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HARVEST ESTIMATES FOR SELECTED
ROADSIDE SPORT FISHERIES IN
HAINES, ALASKA, 1989¹

By

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TABLE OF CONTENTS

| | <u>Page</u> |
|---|-------------|
| LIST OF TABLES | ii |
| LIST OF FIGURES | ii |
| ABSTRACT | 1 |
| INTRODUCTION | 2 |
| METHODS | 4 |
| Study Design | 4 |
| Data Analysis | 5 |
| RESULTS | 8 |
| Chilkoot River Sockeye Salmon Fishery | 8 |
| Angler Effort | 8 |
| Catch and Harvest | 8 |
| Chilkoot River Coho Salmon Fishery | 14 |
| Angler Effort | 14 |
| Catch and Harvest | 14 |
| Chilkat River Coho Salmon Fishery | 14 |
| Angler Effort | 14 |
| Catch and Harvest | 14 |
| Other Fisheries | 14 |
| DISCUSSION | 19 |
| ACKNOWLEDGEMENTS | 20 |
| LITERATURE CITED | 20 |

LIST OF TABLES

| <u>Table</u> | | <u>Page</u> |
|--------------|---|-------------|
| 1. | Estimated effort, harvest, and harvest per angler-hour of sockeye salmon within the Chilkoot River near Haines, 1984-1989 | 9 |
| 2. | Estimated angler effort and harvest statistics for the Haines roadside creel survey by sampling period and area during 1989 . . . | 10 |
| 3. | Mean harvest per unit effort estimates for sockeye salmon and coho salmon by sampling period in the Chilkoot River roadside fishery during 1989 | 15 |
| 4. | Estimated effort, harvest, and harvest per angler-hour of coho salmon within the Chilkoot River near Haines, 1984-1989 | 16 |
| 5. | Estimated effort, harvest, and harvest per angler-hour of coho salmon within the Chilkat River near Haines, 1984-1989 | 17 |
| 6. | Mean harvest per unit effort estimates for coho salmon by sampling period in the Chilkat River roadside sport fishery during 1989 . . | 18 |

LIST OF FIGURES

| <u>Figure</u> | | <u>Page</u> |
|---------------|--|-------------|
| 1. | The Haines roadside sport fishing area | 3 |

ABSTRACT

Roving count and interview creel surveys were conducted to estimate effort, catch, and harvest in freshwater and saltwater shoreline fisheries along the Chilkoot River, Chilkat River, and Lutak Inlet roadside near Haines during 1989. Anglers expended 32,737 (standard error = 1,480) hours of effort to catch 990 (standard error = 240) sockeye salmon *Oncorhynchus nerka* and 955 (standard error = 227) coho salmon *O. kisutch*, and to harvest 914 (standard error = 226) sockeye and 863 (standard error = 223) coho salmon.

KEY WORDS: Creel survey, angler effort, angler catch and harvest, catch per unit effort, harvest per unit effort, sockeye salmon, *Oncorhynchus nerka*, coho salmon, *Oncorhynchus kisutch*, southeast Alaska, Haines, Chilkat River, Chilkoot River, Lutak Inlet, Alaska Department of Fish and Game.

INTRODUCTION

Over 25% of the freshwater sport fishing effort in southeast Alaska occurred in the Haines-Skagway area during 1988 (Mills 1989). Fishing by anglers in the Chilkat and Chilkoot river and lake systems near Haines comprised most of that effort (Figure 1). Sport fishing effort on these two systems has nearly doubled since 1981. Increased tourism and the proximity of the area to Whitehorse, Yukon Territory, Canada, has led to heavy use by non-resident anglers. In addition, commercial fishing pressure on sockeye salmon *Oncorhynchus nerka* and coho salmon *O. kisutch* returning to the Chilkat and Chilkoot systems has intensified.

The Alaska Department of Fish and Game (ADF&G) has conducted creel surveys on the Chilkat and Chilkoot river systems since 1984 to monitor trends in angler use, catch rates, and harvest of coho and sockeye. Since estimates of escapement to the Chilkoot River are based on weir counts, estimates of harvests above the weir are used to adjust the projected escapement to the spawning grounds. Adequate coho salmon escapements have been ensured by monitoring the harvest through the creel survey, and issuing emergency closures of the sport fishery, if necessary. Creel survey data from both the Chilkat and Chilkoot rivers have also been used by the ADF&G to comment on regulatory changes proposed to the Alaska Board of Fisheries.

Lutak Inlet extends north of Haines and is bordered by the Lutak Road. Shore anglers fish the inlet for Dolly Varden *Salvelinus malma* and pink salmon *O. gorbuscha*, from Tanani Bay to the mouth of the Chilkoot River. Because the road parallels the open inlet, anglers can be counted and interviewed wherever they are encountered along the road.

The Chilkoot River is located 13 km north of Haines at the end of Lutak Road. The river itself is only 2.4 km (1.5 miles) in length, and anglers concentrate at a few pools scattered along it. Since a road parallels the river, almost all anglers can be contacted.

Road access to the Chilkat River occurs at the end of Sawmill Road, at km 4.8 (3 miles) on the Kellsall logging road (Kellsall Landing), and from the Haines Highway along highway km 4.8 to 38.4 (miles 3 to 24) paralleling the river. Anglers fishing for chum salmon *O. keta*, and coho salmon concentrate along the major parking areas along the highway. Whenever the creel technician encountered a parked vehicle, he or she can search the surrounding area for anglers. Almost all anglers in this section of the river can be counted and interviewed. ADF&G added the Kellsall Landing to the creel program in 1988, in response to complaints that anglers were taking too many coho salmon from that area.

The 1989 sport fishing regulations permitted anglers to harvest six sockeye salmon and two coho salmon per day on the Chilkoot River. Anglers were permitted six coho salmon per day on the Chilkat River.

The objectives of this project were to:

1. estimate the number of angler hours of recreational fishing effort expended along the Chilkoot River from May 8 to September 10, 1989;
2. estimate the number of angler hours of recreational fishing effort expended along Chilkoot and Chilkat Rivers from September 11 to November 5, 1989;

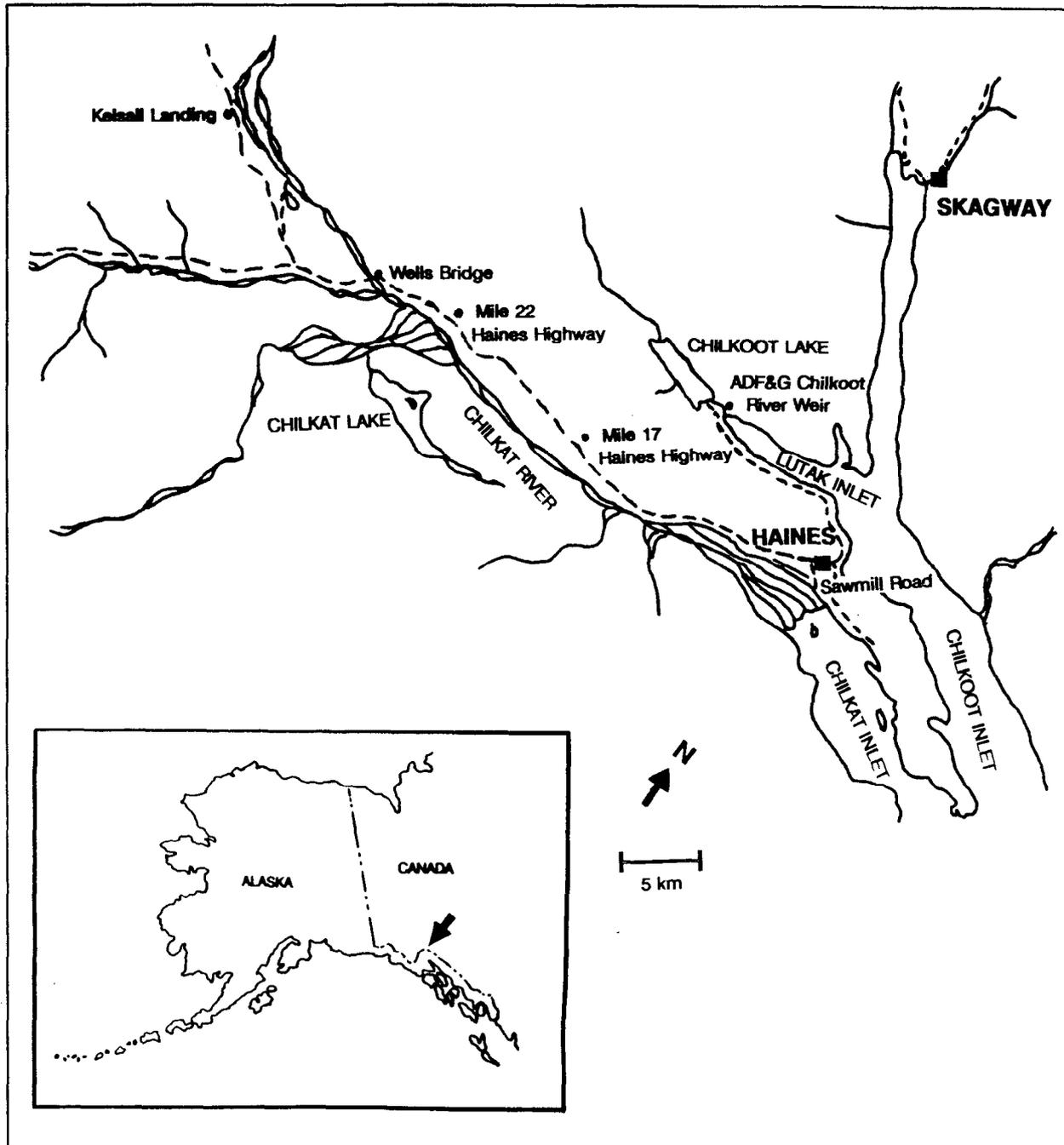


Figure 1. The Haines roadside sport fishing area.

3. estimate the number of sockeye salmon caught and harvested by the recreational fishery along the Chilkoot River from May 8 to September 10, 1989; and
4. estimate the number of coho salmon caught and harvested by the recreational fisheries along the Chilkoot and Chilkat rivers from September 11 to November 5, 1989.

METHODS

Study Design

A roving count and interview creel survey was used to sample the roadside fisheries. The Chilkoot River was divided into two areas for purposes of the survey: above and below the ADF&G weir, located 0.8 km (0.5 mile) above the mouth of the river. The Chilkat River was divided into four survey areas: Sawmill Road to 17 mile Haines Highway; 17 mile to 22 mile; Well's Bridge (24 mile); and the Kelsall Landing. In addition, anglers fishing in saltwater along Lutak Inlet were interviewed.

The sampling season was divided into thirteen, biweekly sampling periods that began on May 8 and ended on November 5. Chilkoot River and Lutak Inlet were sampled every sampling period from May 8 to November 5. The Chilkat River was sampled every other sampling period from September 11 to November 5.

Within each biweekly period, the days were further stratified as weekdays (Monday-Friday) or weekend-holidays (Saturday, Sunday, and all U.S. and Canadian legal holidays).

Each sampling day was subdivided into five equal sampling periods during the first five biweekly periods (May 8 - August 27, 1989). After August 27, the sampling day was subdivided into four equal sampling periods. The sampling day started at approximately 0600, and ended at the nearest 15 minute increment to the average civil twilight within each biweekly period.

Sample periods were selected at random within each seasonal stratum from the total number of available sample periods within either the weekday or weekend-holiday stratum. Sample period selection was constrained such that at least two contiguous weekdays were not sampled within each week; and no more than two sample periods were scheduled in any one day.

From May 8 through September 10, the interviews and counts for each sample period started either upstream of the ADF&G weir on the Chilkoot River or at Lutak Inlet, selected at random. From September 11 through November 5, the interviews and counts started upstream of the ADF&G weir or at Kelsall Landing if the Chilkat River was sampled, and upstream of the ADF&G weir or at Lutak Inlet if it was not sampled. Angler counts took no longer than one-half hour within any one of the seven sites. Anglers were interviewed to determine the number of hours fished by angler, the number of fish kept by species, the number of fish released by species (snagged fish not included), and whether the fishing trip was complete.

Data Analysis

Angler effort and harvest, and associated variances and confidence intervals (CI) were estimated for the roadside creel survey using the following procedures. A stratified random estimator was used to estimate effort in angler-hours. As noted above each stratum was defined by the unique combinations of biweekly sampling period, type of day (i.e., weekday or weekend-holiday), and sampling area. The average angler count within each sampling stratum was multiplied by the total number of available sampling hours for each stratum. The effort estimates and the associated variance estimates were obtained according to the following equations (essentially following the approach of Von Geldern and Tomlinson 1973):

$$\begin{aligned} \hat{E}_h &= \text{estimated angler-hours expended in stratum } h \text{ of the fishery;} \\ &= R_h \bar{x}_h; \end{aligned} \tag{1}$$

$$R_h = \text{total number of hours (available for sampling) in stratum } h;$$

$$\bar{x}_h = \text{mean number of anglers fishing over all samples in stratum } h;$$

$$= \frac{\sum_{i=1}^{d_h} x_{hi}}{d_h}; \tag{2}$$

$$d_h = \text{number of samples (i.e., counts) completed in stratum } h;$$

$$x_{hi} = \text{number of anglers counted in sample } i \text{ for stratum } h;$$

$$\begin{aligned} \hat{V}_h[\hat{E}_h] &= \text{the variance estimate for the estimate of } \hat{E}_h; \\ &= R_h^2 \left(\frac{s_h^2}{d_h} \right); \end{aligned} \tag{3}$$

$$s_h^2 = \frac{\sum_{i=1}^{d_h} (x_{hi} - \bar{x}_h)^2}{d_h - 1}. \tag{4}$$

Angler catch and harvest rates along with their variances were estimated from interview data using a stratified multi-stage random estimator, according to the following equations:

$$\begin{aligned} \hat{T}_h &= \text{estimated total catch or harvest per unit effort for stratum } h \\ &\quad \text{of the fishery;} \\ &= \frac{\sum_{j=1}^{n_h} \left(\sum_{k=1}^{o_j} c_{hjk} \right)}{\sum_{j=1}^{n_h} \left(\sum_{k=1}^{o_j} e_{hjk} \right)}; \end{aligned} \tag{5}$$

$$n_h = \text{number of interview samples collected within stratum } h;$$

- o_j = number of anglers interviewed within sample j ;
 c_{hjk} = catch or harvest of angler k interviewed within sample j in stratum h ;
 e_{hjk} = effort expended by angler k interviewed within sample j in stratum h ;
 $\hat{V}_h[\hat{T}_h]$ = estimated variance of the catch per unit effort (CPUE) or harvest per unit effort (HPUE) for stratum h , which is obtained by the approximation formula for the variance of the ratio of random variables (Jessen 1978, equation 5.8, page 128, omitting the finite population correction factor);

$$\approx \left\{ \frac{\bar{c}_h}{\bar{e}_h} \right\}^2 \left\{ \frac{s_{(c)h}^2}{\bar{c}_h^2} + \frac{s_{(e)h}^2}{\bar{e}_h^2} - \frac{2 \text{COV}_{(c,e)h}}{\bar{c}_h \bar{e}_h} \right\}; \quad (6)$$

- \bar{c}_h = mean of mean catch or harvest per angler for stratum h ;

$$= \frac{\sum_{j=1}^{n_h} \bar{c}_{hj}}{n_h}; \quad (7)$$

- \bar{e}_h = mean of mean effort per angler for stratum h ;

$$= \frac{\sum_{j=1}^{n_h} \bar{e}_{hj}}{n_h}; \quad (8)$$

- \bar{c}_{hj} = mean catch or harvest per angler for sample j in stratum h ;

$$= \frac{\sum_{k=1}^{o_j} c_{hjk}}{o_j}; \quad (9)$$

- \bar{e}_{hj} = mean effort per angler for sample j in stratum h ;

$$= \frac{\sum_{k=1}^{o_j} e_{hjk}}{o_j}; \quad (10)$$

- $s_{(c)h}^2$ = variance estimate associated with estimating the catch or harvest component of CPUE or HPUE in stratum h obtained from the usual two-stage variance equation (as adapted from equation 10.15 from Cochran 1977, page 278);

$$= \left\{ \left[1 - \frac{n_h}{N_h} \right] \left[\frac{s_{(c)h}^2}{n_h} \right] \right\} + \left\{ \left[\frac{n_h}{N_h} \right] \left[\frac{\sum_{j=1}^{n_h} \frac{s_{(c)hj}^2}{o_j}}{n_h^2} \right] \right\}; \quad (11)$$

- N_h = total possible number of interview samples within stratum h ;

$s_{(c)_h}^2$ = the between sample variance component for the variance estimate of catch or harvest in stratum h ;

$$= \frac{\sum_{j=1}^{n_h} (\bar{c}_{hj} - \bar{c}_h)^2}{n_h - 1}; \quad (12)$$

$s_{(c)_whj}^2$ = the within sample variance component for the variance estimate of catch or harvest in sample j in stratum h ;

$$= \frac{\sum_{k=1}^{o_j} (c_{hjk} - \bar{c}_{hj})^2}{o_j - 1}; \quad (13)$$

$s_{(e)_h}^2$ = variance estimate associated with estimating the effort component of CPUE or HPUE in stratum h , which is calculated by substituting the corresponding effort statistics into equations (11) - (13);

$\text{COV}_{(c,e)_h}$ = covariance estimate between the catch (or harvest) and effort components of the CPUE or HPUE in stratum h ;

$$= \left\{ \left[1 - \frac{n_h}{N_h} \right] \left[\frac{\text{COV}_{(c,e)_bh}}{n_h} \right] \right\} + \left\{ \left[\frac{n_h}{N_h} \right] \left[\frac{\sum_{j=1}^{n_h} \frac{\text{COV}_{(c,e)_whj}}{o_j}}{n_h^2} \right] \right\}; \quad (14)$$

$\text{COV}_{(c,e)_bh}$ = the between sample covariance component between catch (or harvest) and effort in stratum h ;

$$= \frac{\sum_{j=1}^{n_h} [(\bar{c}_{hj} - \bar{c}_h)(\bar{e}_{hj} - \bar{e}_h)]}{n_h - 1}; \quad (15)$$

$\text{COV}_{(c,e)_whj}$ = the within sample covariance component for CPUE or HPUE in sample j in stratum h ;

$$= \frac{\sum_{k=1}^{o_j} [(c_{hjk} - \bar{c}_{hj})(e_{hjk} - \bar{e}_{hj})]}{o_j - 1}. \quad (16)$$

Estimates of angler catch or harvest and their variances were obtained by combining the estimated stratum estimates of effort and catch (or harvest) rates, as follows:

$$\begin{aligned} \hat{C}_h &= \text{estimated catch or harvest in stratum } h; \\ &= \hat{E}_h \hat{T}_h; \end{aligned} \quad (17)$$

$$\hat{V}_h[\hat{C}_h] = \text{estimated variance of } \hat{C}_h \text{ in stratum } h, \text{ assuming independence of the estimates of effort and CPUE or HPUE, obtained by using the formula proposed by Goodman (1960) for the estimation of the variance of a product of two random independent variables;} \\ = \hat{E}_h^2 \hat{V}_h[\hat{T}_h] + \hat{T}_h^2 \hat{V}_h[\hat{E}_h] - \hat{V}_h[\hat{E}_h] \hat{V}_h[\hat{T}_h]. \quad (18)$$

Total angler effort, catch, or harvest across all strata (or select combinations of strata) were obtained by summing the individual stratum estimates. Similarly, estimates of the across strata variances were obtained by summing, assuming independence of the individual stratum estimates (see Kish 1965, equation 1.8.7, page 61).

CPUE or HPUE estimates across all strata (or select combinations of strata) were obtained by the following approximate procedures:

$$\hat{T} = \text{combined CPUE or HPUE estimate over selected strata;} \\ = \frac{\sum_{h=1}^g \hat{C}_h}{\sum_{h=1}^g \hat{E}_h}; \quad (19)$$

$$\hat{V}[\hat{T}] = \text{estimated variance of } \hat{T}, \text{ which is obtained by the approximation formula for the variance of the ratio of random variables (Jessen 1978, equation 5.8, page 128, omitting the finite population correction factor);} \\ = \left\{ \frac{\hat{C}}{\hat{E}} \right\}^2 \left\{ \left[\frac{\hat{V}[\hat{C}]}{\hat{C}^2} \right] + \left[\frac{\hat{V}[\hat{E}]}{\hat{E}^2} \right] - \left[\frac{2 \text{COV}_{(C,E)}}{\hat{C}\hat{E}} \right] \right\}; \quad (20)$$

$$\text{COV}_{(C,E)} = \sum_{h=1}^g \text{COV}_{(C,E)h}. \quad (21)$$

Approximate 95% confidence intervals were obtained for stratum and total angler effort, catch, and harvest estimates as follows, by assuming normality.

RESULTS

Chilkoot River Sockeye Salmon Fishery

Angler Effort:

Anglers expended an estimated 25,235 hours of effort (SE = 1,323) in this fishery during the May 8 to September 10, 1989 time period (Table 1). Approximately 68% of this effort occurred downstream of the ADF&G weir. The majority (69%) of the effort occurred after July 16 (Table 2).

Catch and Harvest:

Anglers caught an estimated 988 (SE = 240) sockeye salmon between May 8 and September 10, 1989 along the Chilkoot River (Table 2). Most (914, SE = 226) of

Table 1. Estimated effort, harvest, and harvest per angler-hour of sockeye salmon within the Chilkoot River near Haines, 1984-1989.

| Year | Survey Dates | Effort | | Harvest | | Harvest per Hour |
|-------------------|--------------|---------------------|--------------------|------------------|------------------|------------------|
| | | Hours | SE ^a | Sockeye Salmon | SE ^a | |
| 1984 | 7/06-8/31 | 21,625 ^b | -- ^c | 962 ^d | -- ^c | .04 |
| 1985 ^e | 7/15-9/1 | 19,576 | -- ^c | 1,206 | -- ^c | .06 |
| 1986 ^f | 7/14-8/31 | 21,694 | -- ^c | 2,873 | -- ^c | .13 |
| 1987 ^g | 7/13-9/7 | 20,289 | -- ^c | 1,007 | -- ^c | .05 |
| 1988 ^h | 6/20-9/11 | 18,681 | 1,172 | 609 | 350 | .03 |
| 1984-1988 Mean | | 20,373 | 1,331 ⁱ | 1,306 | 888 ⁱ | .07 |
| 1989 | 5/08-9/10 | 25,235 | 1,323 | 914 | 226 | .04 |

^a Estimated in individual years as the square root of variances summed across sampling areas. This estimate may be biased because sampling at each site is not independent.

^b Lee Neimark, Alaska Department of Fish & Game, Division of Sport Fish, Douglas, Alaska, unpublished data.

^c Estimate of variance not provided.

^d Neimark 1985.

^e Mecum and Suchanek 1986.

^f Mecum and Suchanek 1987.

^g Bingham et al. 1988.

^h Suchanek and Bingham 1989.

ⁱ Estimated as the sample standard deviation of the 1984-1988 annual means.

Table 2. Estimated angler effort and harvest statistics for the Haines roadside creel survey by sampling period and area during 1989.

| Lutak Inlet | MAY08 | MAY22 | JUN05 | JUN19 | JUL03 | JUL17 | JUL31 | AUG14 | AUG28 | SEP11 | SEP25 | OCT09 | OCT23 | Total |
|-------------------------------|-------|-------|--------|---------|--------|--------|---------|---------|---------|--------|--------|-------|-------|-----------|
| | MAY21 | JUN04 | JUN18 | JUL02 | JUL16 | JUL30 | AUG13 | AUG27 | SEP10 | SEP24 | OCT08 | OCT22 | NOV05 | |
| Number of Count Samples | 16 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 14 | 14 | 14 | 14 | 160 |
| Number of Interview Samples | 16 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 14 | 14 | 14 | 14 | 160 |
| Number of Possible Samples | 224 | 238 | 238 | 238 | 238 | 224 | 210 | 210 | 196 | 182 | 168 | 154 | 140 | 2,660 |
| Number of Anglers Interviewed | 4 | 1 | 5 | 9 | 12 | 14 | 42 | 19 | 7 | 0 | 4 | 2 | 0 | 119 |
| Rod-hours effort | 45 | 0 | 60 | 406 | 228 | 189 | 897 | 267 | 49 | 0 | 0 | 0 | 0 | 2,141 |
| Var. Rod-hours effort | 654 | 0 | 1,767 | 61,852 | 5,929 | 5,561 | 122,321 | 7,653 | 547 | 0 | 0 | 0 | 0 | 206,284 |
| Pink Kept | 0 | 0 | 0 | 0 | 0 | 16 | 280 | 47 | 0 | -- | 0 | 0 | -- | 343 |
| Var. Pink Kept | 0 | 0 | 0 | 0 | 0 | 53 | 17,273 | 1,836 | 0 | -- | 0 | 0 | -- | 19,161 |
| Pink Released | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | -- | 0 | 0 | -- | 24 |
| Var. Pink Released | 0 | 0 | 0 | 0 | 0 | 0 | 207 | 0 | 0 | -- | 0 | 0 | -- | 207 |
| Dolly Varden Kept | 0 | 0 | 0 | 33 | 174 | 55 | 57 | 0 | 0 | -- | 0 | 0 | -- | 319 |
| Var. Dolly Varden Kept | 0 | 0 | 0 | 606 | 6,050 | 747 | 988 | 0 | 0 | -- | 0 | 0 | -- | 8,390 |
| Dolly Varden Released | 0 | 0 | 0 | 299 | 0 | 16 | 96 | 0 | 0 | -- | 0 | 0 | -- | 411 |
| Var. Dolly Varden Released | 0 | 0 | 0 | 27,824 | 0 | 109 | 3,400 | 0 | 0 | -- | 0 | 0 | -- | 31,333 |
| | | | | | | | | | | | | | | |
| Chilkoot River below weir | MAY08 | MAY22 | JUN05 | JUN19 | JUL03 | JUL17 | JUL31 | AUG14 | AUG28 | SEP11 | SEP25 | OCT09 | OCT23 | Total |
| | MAY21 | JUN04 | JUN18 | JUL02 | JUL16 | JUL30 | AUG13 | AUG27 | SEP10 | SEP24 | OCT08 | OCT22 | NOV05 | |
| Number of Count Samples | 16 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 14 | 14 | 14 | 14 | 160 |
| Number of Interview Samples | 16 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 14 | 14 | 14 | 14 | 160 |
| Number of Possible Samples | 224 | 238 | 238 | 238 | 238 | 224 | 210 | 210 | 196 | 182 | 168 | 154 | 140 | 2,660 |
| Number of Anglers Interviewed | 5 | 1 | 36 | 146 | 68 | 86 | 169 | 248 | 178 | 43 | 129 | 29 | 6 | 1,144 |
| Rod-hours effort | 41 | 31 | 573 | 3,261 | 1,584 | 1,878 | 3,177 | 3,608 | 3,033 | 573 | 908 | 225 | 67 | 18,960 |
| Var. Rod-hours effort | 1,458 | 914 | 14,657 | 452,598 | 97,010 | 94,844 | 233,789 | 131,104 | 313,720 | 37,593 | 33,142 | 2,959 | 801 | 1,414,589 |
| Coho Kept | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 107 | 16 | 12 | 135 |
| Var. Coho Kept | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,703 | 76 | 28 | 1,807 |
| Coho Released | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 35 |
| Var. Coho Released | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 430 | 0 | 430 |
| Sockeye Kept | 0 | 0 | 56 | 194 | 22 | 95 | 215 | 275 | 0 | 0 | 0 | 0 | 0 | 858 |
| Var. Sockeye Kept | 0 | 0 | 547 | 34,035 | 185 | 2,753 | 4,825 | 8,211 | 0 | 0 | 0 | 0 | 0 | 50,556 |
| Sockeye Released | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| Var. Sockeye Released | 0 | 0 | 0 | 0 | 152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 152 |
| Pink Kept | 0 | 0 | 0 | 0 | 0 | 0 | 332 | 1,068 | 2,499 | 87 | 0 | 0 | 0 | 3,986 |
| Var. Pink Kept | 0 | 0 | 0 | 0 | 0 | 0 | 9,626 | 107,071 | 301,079 | 2,222 | 0 | 0 | 0 | 419,997 |
| Pink Released | 0 | 0 | 0 | 0 | 0 | 5 | 169 | 954 | 3,010 | 752 | 9 | 0 | 0 | 4,899 |
| Var. Pink Released | 0 | 0 | 0 | 0 | 0 | 29 | 7,704 | 42,423 | 449,069 | 75,259 | 323 | 0 | 0 | 574,806 |
| Dolly Varden Kept | 12 | 0 | 103 | 81 | 269 | 126 | 50 | 129 | 25 | 9 | 6 | 0 | 0 | 810 |
| Var. Dolly Varden Kept | 119 | 0 | 5,322 | 1,805 | 14,353 | 7,721 | 387 | 1,817 | 182 | 59 | 28 | 0 | 0 | 31,793 |
| Dolly Varden Released | 0 | 0 | 7 | 35 | 412 | 78 | 93 | 13 | 0 | 7 | 9 | 0 | 0 | 654 |
| Var. Dolly Varden Released | 0 | 0 | 44 | 712 | 36,228 | 3,408 | 988 | 62 | 0 | 46 | 1,055 | 0 | 0 | 42,543 |

-(Continued)-

Table 2. (page 2 of 4)

| Chilkoot River above weir | MAY08 MAY21 | MAY22 JUN04 | JUN05 JUN18 | JUN19 JUL02 | JUL03 JUL16 | JUL17 JUL30 | JUL31 AUG13 | AUG14 AUG27 | AUG28 SEP10 | SEP11 SEP24 | SEP25 OCT08 | OCT09 OCT22 | OCT23 NOV05 | Total |
|-------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------|
| Number of Count Samples | 16 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 14 | 14 | 14 | 14 | 160 |
| Number of Interview Samples | 16 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 14 | 14 | 14 | 14 | 160 |
| Number of Possible Samples | 224 | 238 | 238 | 238 | 238 | 224 | 210 | 210 | 196 | 182 | 168 | 154 | 140 | 2,660 |
| Number of Anglers Interviewed | 4 | 4 | 9 | 52 | 54 | 81 | 79 | 81 | 21 | 38 | 120 | 28 | 2 | 573 |
| Rod-hours effort | 69 | 133 | 167 | 992 | 1,070 | 2,056 | 1,699 | 1,419 | 444 | 449 | 988 | 276 | 11 | 9,772 |
| Var. Rod-hours effort | 1,029 | 5,653 | 2,314 | 57,583 | 39,374 | 84,676 | 137,453 | 70,940 | 10,686 | 12,616 | 22,904 | 7,727 | 88 | 453,042 |
| Coho Kept | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 53 | 48 | 11 | 124 |
| Var. Coho Kept | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 71 | 1,078 | 234 | 89 | 1,472 |
| Coho Released | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Var. Coho Released | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sockeye Kept | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 17 | 0 | 0 | 0 | 0 | 56 |
| Var. Sockeye Kept | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 276 | 82 | 0 | 0 | 0 | 0 | 358 |
| Sockeye Released | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 0 | 0 | 2 | 0 | 0 | 54 |
| Var. Sockeye Released | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6,735 | 0 | 0 | 6 | 0 | 0 | 6,741 |
| Pink Kept | 0 | 0 | 0 | 0 | 0 | 10 | 83 | 57 | 0 | 0 | 0 | 0 | 0 | 149 |
| Var. Pink Kept | 0 | 0 | 0 | 0 | 0 | 45 | 935 | 524 | 0 | 0 | 0 | 0 | 0 | 1,504 |
| Pink Released | 0 | 0 | 0 | 0 | 0 | 0 | 181 | 26 | 50 | 13 | 2 | 0 | 0 | 271 |
| Var. Pink Released | 0 | 0 | 0 | 0 | 0 | 0 | 6,513 | 1,684 | 745 | 76 | 3 | 0 | 0 | 9,019 |
| Dolly Varden Kept | 7 | 0 | 0 | 60 | 193 | 998 | 475 | 741 | 308 | 365 | 61 | 62 | 0 | 3,270 |
| Var. Dolly Varden Kept | 15 | 0 | 0 | 507 | 3,186 | 81,743 | 64,709 | 169,101 | 21,948 | 14,553 | 585 | 1,772 | 0 | 358,120 |
| Dolly Varden Released | 0 | 0 | 0 | 9 | 162 | 189 | 224 | 31 | 17 | 24 | 13 | 3 | 0 | 672 |
| Var. Dolly Varden Released | 0 | 0 | 0 | 4,359 | 2,537 | 4,993 | 9,622 | 400 | 83 | 164 | 225 | 3 | 0 | 22,386 |
| | | | | | | | | | | | | | | |
| Chilkat River 3-17 Mile | MAY08 MAY21 | MAY22 JUN04 | JUN05 JUN18 | JUN19 JUL02 | JUL03 JUL16 | JUL17 JUL30 | JUL31 AUG13 | AUG14 AUG27 | AUG28 SEP10 | SEP11 SEP24 | SEP25 OCT08 | OCT09 OCT22 | OCT23 NOV05 | Total |
| Number of Count Samples | | | | | | | | | | 7 | 7 | 8 | 8 | 30 |
| Number of Interview Samples | | | | | | | | | | 7 | 7 | 8 | 8 | 30 |
| Number of Possible Samples | | | | | | | | | | 182 | 168 | 154 | 140 | 644 |
| Number of Anglers Interviewed | | | | | | | | | | 23 | 29 | 7 | 1 | 60 |
| Rod-hours effort | | | | | | | | | | 351 | 684 | 219 | 11 | 1,265 |
| Var. Rod-hours effort | | | | | | | | | | 25,675 | 43,804 | 16,558 | 99 | 86,137 |
| Coho Kept | | | | | | | | | | 55 | 51 | 0 | 0 | 106 |
| Var. Coho Kept | | | | | | | | | | 6,246 | 381 | 0 | 0 | 6,626 |
| Coho Released | | | | | | | | | | 25 | 0 | 0 | 0 | 25 |
| Var. Coho Released | | | | | | | | | | 1,586 | 0 | 0 | 0 | 1,586 |
| Chum Kept | | | | | | | | | | 46 | 25 | 0 | 0 | 71 |
| Var. Chum Kept | | | | | | | | | | 762 | 256 | 0 | 0 | 919 |
| Chum Released | | | | | | | | | | 0 | 0 | 0 | 0 | 0 |
| Var. Chum Released | | | | | | | | | | 0 | 0 | 0 | 0 | 0 |

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Table 2. (page 3 of 4)

| Chilkat River 17-22 Mile | MAY08 MAY21 | MAY22 JUN04 | JUN05 JUN18 | JUN19 JUL02 | JUL03 JUL16 | JUL17 JUL30 | JUL31 AUG13 | AUG14 AUG27 | AUG28 SEP10 | SEP11 SEP24 | SEP25 OCT08 | OCT09 OCT22 | OCT23 NOV05 | Total |
|--------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------|
| Number of Count Samples | | | | | | | | | | 7 | 7 | 8 | 8 | 30 |
| Number of Interview Samples | | | | | | | | | | 7 | 7 | 8 | 8 | 30 |
| Number of Possible Samples | | | | | | | | | | 182 | 168 | 154 | 140 | 644 |
| Number of Anglers Interviewed | | | | | | | | | | 0 | 0 | 2 | 0 | 2 |
| Rod-hours effort | | | | | | | | | | 0 | 0 | 28 | 0 | 28 |
| Var. Rod-hours effort | | | | | | | | | | 0 | 0 | 704 | 0 | 704 |
| Coho Kept | | | | | | | | | | -- | -- | 15 | -- | 15 |
| Var. Coho Kept | | | | | | | | | | -- | -- | 209 | -- | 209 |
| Coho Released | | | | | | | | | | -- | -- | 0 | -- | 0 |
| Var. Coho Released | | | | | | | | | | -- | -- | 0 | -- | 0 |
| Chum Kept | | | | | | | | | | -- | -- | 0 | -- | 0 |
| Var. Chum Kept | | | | | | | | | | -- | -- | 0 | -- | 0 |
| Chum Released | | | | | | | | | | -- | -- | 0 | -- | 0 |
| Var. Chum Released | | | | | | | | | | -- | -- | 0 | -- | 0 |
| | | | | | | | | | | | | | | |
| Chilkat River - Wells Bridge Area | MAY08 MAY21 | MAY22 JUN04 | JUN05 JUN18 | JUN19 JUL02 | JUL03 JUL16 | JUL17 JUL30 | JUL31 AUG13 | AUG14 AUG27 | AUG28 SEP10 | SEP11 SEP24 | SEP25 OCT08 | OCT09 OCT22 | OCT23 NOV05 | Total |
| Number of Count Samples | | | | | | | | | | 7 | 7 | 8 | 8 | 30 |
| Number of Interview Samples | | | | | | | | | | 7 | 7 | 8 | 8 | 30 |
| Number of Possible Samples | | | | | | | | | | 182 | 168 | 154 | 140 | 644 |
| Number of Anglers Interviewed | | | | | | | | | | 4 | 5 | 4 | 0 | 13 |
| Rod-hours effort | | | | | | | | | | 53 | 80 | 0 | 0 | 133 |
| Var. Rod-hours effort | | | | | | | | | | 2,624 | 6,240 | 0 | 0 | 8,864 |
| Coho Kept | | | | | | | | | | 0 | 0 | 0 | -- | 0 |
| Var. Coho Kept | | | | | | | | | | 0 | 0 | 0 | -- | 0 |
| Coho Released | | | | | | | | | | 0 | 0 | 0 | -- | 0 |
| Var. Coho Released | | | | | | | | | | 0 | 0 | 0 | -- | 0 |
| Chum Kept | | | | | | | | | | 0 | 32 | 0 | -- | 32 |
| Var. Chum Kept | | | | | | | | | | 0 | 998 | 0 | -- | 998 |
| Chum Released | | | | | | | | | | 0 | 0 | 0 | -- | 0 |
| Var. Chum Released | | | | | | | | | | 0 | 0 | 0 | -- | 0 |

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Table 2. (page 4 of 4)

| Chilkat River - Kelsall Landing Area | MAY08 MAY21 | MAY22 JUN04 | JUN05 JUN18 | JUN19 JUL02 | JUL03 JUL16 | JUL17 JUL30 | JUL31 AUG13 | AUG14 AUG27 | AUG28 SEP10 | SEP11 SEP24 | SEP25 OCT08 | OCT09 OCT22 | OCT23 NOV05 | Total |
|---|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|--------|
| Number of Count Samples | | | | | | | | | | 7 | 7 | 8 | 8 | 30 |
| Number of Interview Samples | | | | | | | | | | 7 | 7 | 8 | 8 | 30 |
| Number of Possible Samples | | | | | | | | | | 182 | 168 | 154 | 140 | 644 |
| Number of Anglers Interviewed | | | | | | | | | | 0 | 8 | 13 | 7 | 28 |
| Rod-hours effort | | | | | | | | | | 27 | 152 | 186 | 74 | 438 |
| Var. Rod-hours effort | | | | | | | | | | 656 | 7,824 | 9,970 | 1,687 | 20,137 |
| Coho Kept | | | | | | | | | | -- | 192 | 111 | 180 | 483 |
| Var. Coho Kept | | | | | | | | | | -- | 25,448 | 3,932 | 10,204 | 39,584 |
| Coho Released | | | | | | | | | | -- | 0 | 0 | 9 | 9 |
| Var. Coho Released | | | | | | | | | | -- | 0 | 0 | 32 | 32 |
| Chum Kept | | | | | | | | | | -- | 0 | 0 | 0 | 0 |
| Var. Chum Kept | | | | | | | | | | -- | 0 | 0 | 0 | 0 |
| Chum Released | | | | | | | | | | -- | 0 | 0 | 0 | 0 |
| Var. Chum Released | | | | | | | | | | -- | 0 | 0 | 0 | 0 |

the sockeye salmon that were caught were harvested. Harvest per unit effort (HPUE) of sockeye salmon peaked at 0.098 sockeye salmon per angler hour in early June, with a smaller peak in late August (Table 3). The earlier portion of the sockeye run accounted for 27% of the angler harvest between June 5 and July 2. Most sockeye salmon (58%) were harvested during the later portion of the run, between July 31 and August 27. Most (94%) of the sockeye salmon were harvested below the ADF&G weir.

Chilkoot River Coho Salmon Fishery

Angler Effort:

Anglers expended an estimated 3,497 rod-hours of effort (SE = 343) in this fishery during the September 11 to November 5, 1989 time period (Table 4). The majority (54%) of the effort occurred during one bi-weekly period (September 25 to October 8) which included the Canadian Thanksgiving holiday.

Catch and Harvest:

Anglers caught an estimated 294 (SE = 61) coho salmon between September 11 and November 5, 1989 along the Chilkoot River. Of the coho salmon caught, 259 (SE = 57) were harvested (Table 4). Harvest per unit effort peaked during the latter part of October both above and below the ADF&G weir (0.175, SE = 0.109 and 1.000, SE = 1.267 respectively). Most coho salmon (86%) were caught between September 25 and October 22. An estimated 58% of the catch and 52% of the harvest of coho salmon harvest occurred below the weir.

Chilkat River Coho Salmon Fishery

Angler Effort:

Anglers expended 1,864 (SE = 340) rod-hours of effort along the Chilkat River, between September 11 and November 5, 1989 (Table 5). Most of the effort (68%) was expended below Mile 17 on the Haines Highway. The Kelsall Landing accounted for 23% of the effort on the Chilkat River.

Catch and Harvest:

Anglers caught an estimated 638 (SE = 219) coho salmon along the Chilkat River. Of the coho salmon caught, 604 (SE = 215) were harvested. Most of the coho salmon (80%) were harvested at the Kelsall Landing (Table 5). Harvest per unit effort was highest (2.452, SE = 1.940) at the Kelsall Landing during late October and early November (Table 6).

Other Fisheries

Lutak Inlet was surveyed in 1989, but this fishery targets primarily on Dolly Varden and pink salmon. Anglers expended an estimated 2,141 (SE = 454) hours of effort in this fishery to catch 730 Dolly Varden (SE = 199) and 367 pink salmon (SE = 139) between May 8 and November 5, 1989 (Table 2). Of those caught,

Table 3. Mean harvest per unit effort estimates for sockeye salmon and coho salmon by sampling period in the Chilkoot River roadside fishery during 1989.

| Period | Chilkoot River | | | |
|-------------------------------|-------------------|-------|-------------------|-------|
| | Below Weir | | Above Weir | |
| | HPUE ^a | SE | HPUE ^a | SE |
| <u>Sockeye Salmon</u> | | | | |
| 5/08 - 5/21 | 0 | | 0 | |
| 5/22 - 6/04 | 0 | | 0 | |
| 6/05 - 6/18 | 0.098 | 0.046 | 0 | |
| 6/19 - 7/02 | 0.060 | 0.058 | 0 | |
| 7/03 - 7/16 | 0.014 | 0.009 | 0 | |
| 7/17 - 7/30 | 0.051 | 0.029 | 0 | |
| 7/31 - 8/13 | 0.068 | 0.024 | 0 | |
| 8/14 - 8/27 | 0.076 | 0.026 | 0.028 | 0.013 |
| 8/28 - 9/10 | 0 | | 0.037 | 0.022 |
| Sockeye Salmon All Periods | 0.050 | 0.014 | 0.007 | 0.002 |
| <u>Coho Salmon</u> | | | | |
| 9/11 - 9/24 | 0 | | 0.028 | 0.020 |
| 9/25 - 10/08 | 0.118 | 0.051 | 0.053 | 0.034 |
| 10/09 - 10/22 | 0.071 | 0.042 | 0.175 | 0.079 |
| 10/23 - 11/05 | 0.175 | 0.109 | 1.000 | 1.267 |
| Coho Salmon All Periods | 0.076 | 0.027 | 0.072 | 0.024 |

^a Salmon kept per angler hour

Table 4. Estimated effort, harvest, and harvest per angler-hour of coho salmon within the Chilkoot River near Haines, 1984-1989.

| Year | Survey Dates | Effort | | Harvest | | Harvest per Hour |
|-------------------|--------------|--------------------|--------------------|------------------|------------------|------------------|
| | | Hours | SE ^a | Coho Salmon | SE ^a | |
| 1984 | 9/01-10/30 | 9,437 ^b | -- ^c | 614 ^d | -- ^c | .07 |
| 1985 ^e | 9/02-11/03 | 6,530 | -- ^c | 742 | -- ^c | .11 |
| 1986 ^f | 9/01-10/31 | 10,790 | -- ^c | 708 | -- ^c | .07 |
| 1987 ^g | 9/08-11/01 | 5,209 | -- ^c | 378 | -- ^c | .07 |
| 1988 ^h | 9/12-11/06 | 3,952 | 380 | 395 | 84 | .10 |
| 1984-1988 Mean | | 7,184 | 2,866 ⁱ | 567 | 172 ⁱ | .08 |
| 1989 | 9/11-11/05 | 3,497 | 343 | 259 | 57 | .07 |

^a Estimated in individual years as the square root of variances summed across sampling areas. This estimate may be biased because sampling at each site is not independent.

^b Lee Neimark, Alaska Department of Fish & Game, Division of Sport Fish, Douglas, Alaska, unpublished data.

^c Estimate of variance not provided.

^d Neimark 1985.

^e Mecum and Suchanek 1986.

^f Mecum and Suchanek 1987.

^g Bingham et al. 1988.

^h Suchanek and Bingham 1989.

ⁱ Estimated as the sample standard deviation of the 1984-1988 annual means.

Table 5. Estimated effort, harvest, and harvest per angler-hour of coho salmon within the Chilkat River near Haines, 1984-1989.

| Year | Survey Dates | Chilkat River (except Kelsall Landing) | | | | | Kelsall Landing | | | | |
|-------------------|--------------|--|--------------------|------------------|------------------|------------------|-----------------|-----------------|-------------|-----------------|------------------|
| | | Effort | | Harvest | | Harvest per Hour | Effort | | Harvest | | Harvest per Hour |
| | | Hours | SE ^a | Coho Salmon | SE ^a | | Hours | SE ^a | Coho Salmon | SE ^a | |
| 1984 | 9/16-10/30 | 5,817 ^b | -- ^c | 437 ^d | -- ^c | 0.08 | | | | | |
| 1985 ^e | 9/02-11/03 | 4,965 | -- ^c | 777 | -- ^c | 0.16 | | | | | |
| 1986 ^f | 9/01-10/31 | 3,061 | -- ^c | 194 | -- ^c | 0.06 | | | | | |
| 1987 ^g | 9/08-11/01 | 3,217 | -- ^c | 81 | -- ^c | 0.03 | | | | | |
| 1988 ^h | 9/12-11/06 | 2,970 | 415 | 195 | 61 | 0.07 | 717 | 234 | 324 | 184 | 0.50 |
| 1984-1988 Mean | | 4,006 | 1,303 ⁱ | 337 | 278 ⁱ | 0.08 | | | | | |
| 1989 | 9/11-11/05 | 1,426 | 309 | 121 | 83 | 0.08 | 438 | 142 | 483 | 199 | 1.10 |

^a Estimated in individual years as the square root of variances summed across sampling areas. This estimate may be biased because sampling at each site is not independent.

^b Lee Neimark, Alaska Department of Fish & Game, Division of Sport Fish, Douglas, Alaska, unpublished data.

^c Estimate of variance not provided.

^d Neimark 1985.

^e Mecum and Suchanek 1986.

^f Mecum and Suchanek 1987.

^g Bingham et al. 1988.

^h Suchanek and Bingham 1989.

ⁱ Estimated as the sample standard deviation of the 1984-1988 annual means.

Table 6. Mean harvest per unit effort estimates for coho salmon by sampling period in the Chilkat River roadside sport fishery during 1989.

| Period | Airport to 17-Mile | | 17-Mile to 22-Mile | | Wells Bridge | | Kelsall Landing | |
|---------------|-----------------------|-------|-----------------------|-------|-------------------|----|--------------------|-------|
| | HPUE ^a | SE | HPUE ^a | SE | HPUE ^a | SE | HPUE ^a | SE |
| 9/11 - 9/24 | 0.158 | 0.236 | | | 0 | | | |
| 9/25 - 10/08 | 0.074 | 0.037 | | | 0 | | 1.263 | 1.281 |
| 10/09 - 10/22 | 0 | | 0.546 | 0.742 | | | 0.599 | 0.467 |
| 10/23 - 11/05 | 0 | | | | | | 2.452 | 1.940 |
| All Periods | 0.084 | 0.067 | 0.546 | 0.742 | 0 | | 1.104 | 0.579 |

^a Coho salmon kept per angler hour

319 (SE = 92) Dolly Varden and 343 (SE = 138) pink salmon were harvested.

Anglers caught an estimated 5,406 (SE = 674) Dolly Varden and 9,305 (SE = 1003) pink salmon along the Chilkoot River between May 8 and November 5, 1989 (Table 2). Of those caught, 4,080 (SE = 624) Dolly Varden and 4,135 (SE = 649) pink salmon were kept.

Along the Chilkat River, an estimated 103 (SE = 44) chum salmon were caught and harvested between September 11 and November 5, 1989 (Table 2).

DISCUSSION

The estimate of 28,732 (SE = 1,367) hours of total angler effort on the Chilkoot River in 1989 represents an increase of over 25% from 1988 levels (Suchanek and Bingham 1989), and was comparable to the 1984-1988 mean of 27,516 angler-hours. Most (88%) of this effort, and all of the increased effort, occurred during the sockeye salmon fishery. Sockeye salmon HPUE in 1989 was similar to the levels of 1988, but was below the 1984-1988 mean.

Effort during the Chilkoot River coho salmon fishery was similar to that in 1988, but only about half of the 1984-1988 mean (Table 4). The coho salmon seasonal HPUE, however, was comparable to the 1984-1988 mean. The estimated coho salmon escapement of 3,704 fish into the Chilkoot River was the highest since weir records were first maintained in 1976 (Steve Elliott, Alaska Department of Fish and Game, Division of Sport Fish, Douglas, Alaska, personal communication). It is unclear why effort has decreased in this fishery.

The 1989 levels of effort along the lower Chilkat River and at Kelsall Landing were below the levels observed during the 1988 survey (Suchanek and Bingham 1989). The Kelsall Landing site was added to the Chilkat River coho salmon roadside fishery creel program in 1988, and has accounted for a substantial portion of the total harvest in both 1988 and 1989. While harvest rates in the lower river were similar to those observed in 1988, the decrease in effort coincided with the highest (of two) seasonal coho salmon HPUE recorded at Kelsall Landing (Table 5). A lack of chum salmon in the river during 1989 may indirectly explain the reduced levels of effort. The Lynn Canal commercial drift gill net fishery was closed several weeks early during 1989 due to poor returns of chum salmon to the Chilkat River. Although this resulted in increased escapement of coho salmon to the Chilkat system, there were fewer total salmon in the river than usual due to the poor chum run. Anglers fishing along the Chilkat frequently confuse chum and coho salmon, and effort may have been reduced if anglers heard that there were fewer "silvers" around.

Several regulatory proposals have been submitted to the Alaska Board of Fisheries in recent years to close the Kelsall Landing to sport fishing for coho salmon. Local residents believe that this area is site where coho salmon spawn. While we have no evidence indicating that this is true, it is evident that large numbers of coho salmon are harvested at this site. It may be appropriate to regulate the fishery at Kelsall Landing through area closures or bag limit reductions in years when coho salmon returns to the Chilkat River system are weak.

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