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EVALUATION OF THE RECREATIONAL FISHERY FOR CUTTHROAT TROUT IN CHILKAT LAKE, ALASKA, 1989[1]

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ABSTRACT

A roving count type creel survey was conducted at Chilkat Lake northwest of Haines in 1989 to estimate the angler effort, catch, and harvest of cutthroat trout *Oncorhynchus clarki*, and the size composition of the cutthroat trout in the angler harvest. Approximately 2,538 rod hours of effort (standard error = 233) were expended to catch 1,296 (standard error = 315) and harvest 1,052 cutthroat trout (standard error = 293) between May 20 and October 8, 1989. Chartered anglers accounted for 43 percent of the effort and 63 percent of the cutthroat trout harvest at the lake. A total of 135 cutthroat trout were sampled to estimate mean length (371 millimeters, standard error = 52.3 millimeters) and mean weight (555 grams, standard error = 247.5 grams). The mean condition factor of the trout sampled was 1.02 (standard error = 0.10).

KEY WORDS: Southeast Alaska, Haines, Chilkat Lake, cutthroat trout, *Oncorhynchus clarki*, Dolly Varden char, *Salvelinus malma*, condition factor, creel survey, chartered anglers, angler effort, angler catch and harvest, catch per unit effort, harvest per unit effort.

INTRODUCTION

Trophy class cutthroat trout *Oncorhynchus clarki* three pounds and larger are rare in lakes that are accessible to anadromous fish in southeast Alaska. Notable exceptions include Reflection Lake near Ketchikan, and Chilkat Lake near Haines.

Chilkat Lake is located 29 km northwest of Haines (Figure 1). The lake is 10 km long, has a surface area of 984 ha, a surface elevation of approximately 53 m, and a maximum depth of 57 m (Barto and Koenings 1989). It has substantial littoral areas, yet the depth increases abruptly along the western perimeter of the lake. The lake supports significant runs of coho *O. kisutch*, and sockeye salmon *O.nerka*. The Alaska Department of Fish and Game (ADF&G), Commercial Fisheries Division has operated a weir on the lake outlet since 1975, primarily to count sockeye salmon. Mean escapements of coho and sockeye salmon into Chilkat Lake are 808 and 78,720, respectively.

Chilkat Lake is a popular spot for recreational cabins. Local residents have noted a large increase in cabin construction along the lake shore in recent years. A sport fishing charter business has also operated a lodge located on Chilkat Lake since 1986. Access to the lake is limited to river boat or float plane. The Alaska Department of Natural Resources, Division of Forestry is planning to build a road near the lake to facilitate timber harvest along the Chilkat Ridge (ADNR 1984).

Harvest information for Chilkat Lake available before this study is limited to data collected by the Statewide Harvest Survey program (Mills 1987, 1988, 1989). These surveys indicate that angler effort has increased from 33 angler days in 1984 to 2,083 angler days in 1987 (Table 1). Harvest estimates range from 17 cutthroat trout in 1985 to 645 in 1986. The surveys do not provide estimates of the release rate or the size composition of this harvest. Sport fishing regulations in 1989 permitted anglers to harvest five cutthroat trout per day, of which one could be over 16 inches.

This project was designed to monitor the cutthroat trout fishery in this area. The objectives of this project were to:

1. estimate the total recreational fishing effort for and harvest of cutthroat trout on Chilkat Lake and Outlet, from May 22 to October 8, 1989;

2. estimate the chartered recreational effort for and harvest of cutthroat trout on Chilkat Lake and Outlet, from May 22 to October 8, 1989; and

3. estimate the size composition of cutthroat trout harvested by the recreational fishery at Chilkat Lake, from May 22 to October 8, 1989.

METHODS

Creel Survey

The Chilkat Lake fishery was sampled using a roving type creel survey design. Chilkat Lake was divided into two areas for purposes of the survey (Figure 2), Chilkat Lake proper and the Chilkat Lake outlet stream below the ADF&G weir. The weir was located 0.8 km (0.5 mile) above the confluence with the Tsirku River.

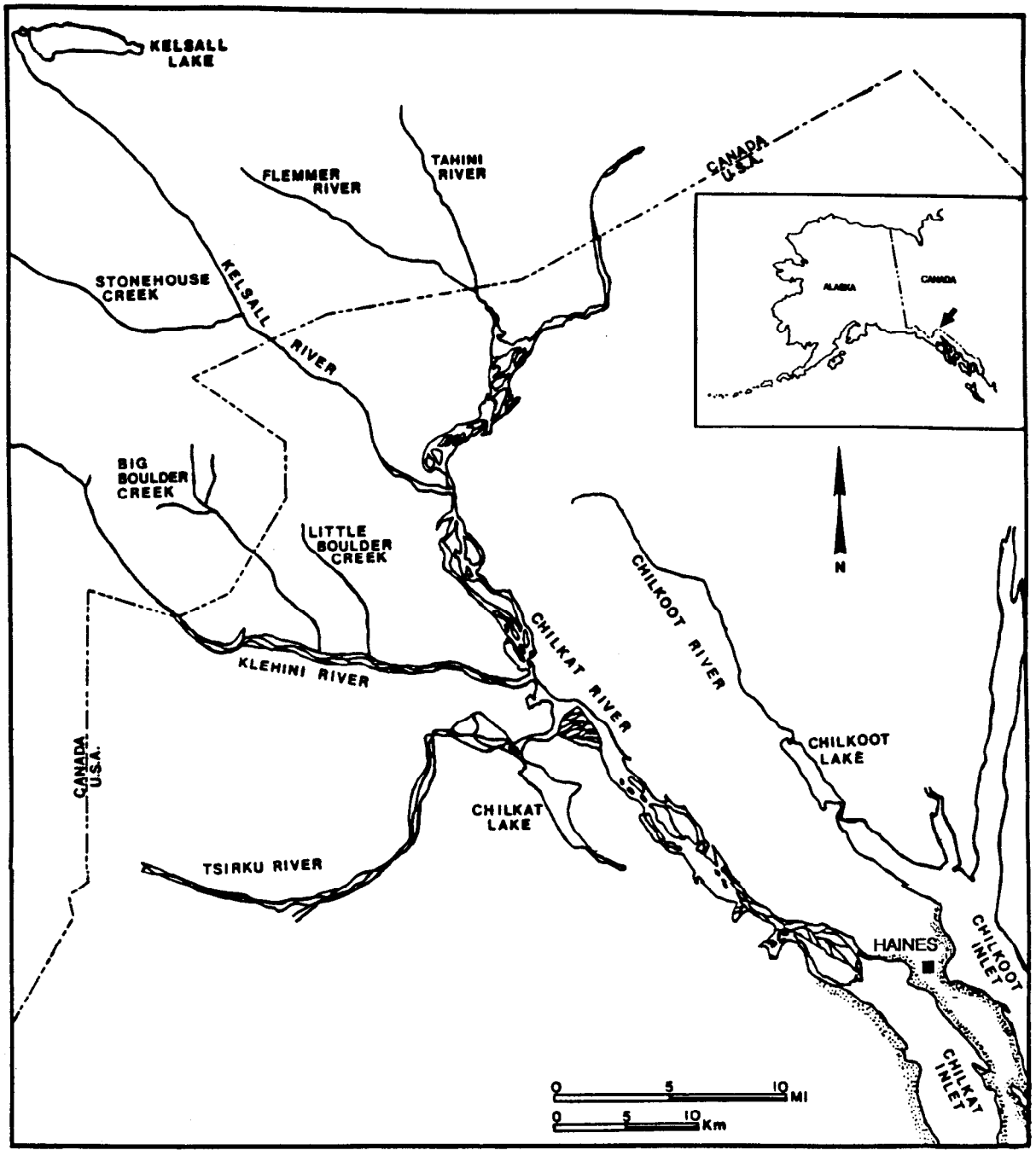

Figure 1. The Chilkat River drainage, showing the location of Chilkat Lake.

Table 1. Recreational effort for and harvest of cutthroat trout, Chilkat Lake, 1984 - 1988.

Year	Angler days	Cutthroat Trout Harvest
1984[a]	33	72
1985[a]	194	17
1986[b]	1,131	645
1987[c]	2,083	272
1988[d]	1,182	473

[a] Mike Mills, ADF&G, Anchorage, Alaska, personal communication
[b] Mills (1987)
[c] Mills (1988)
[d] Mills (1989)

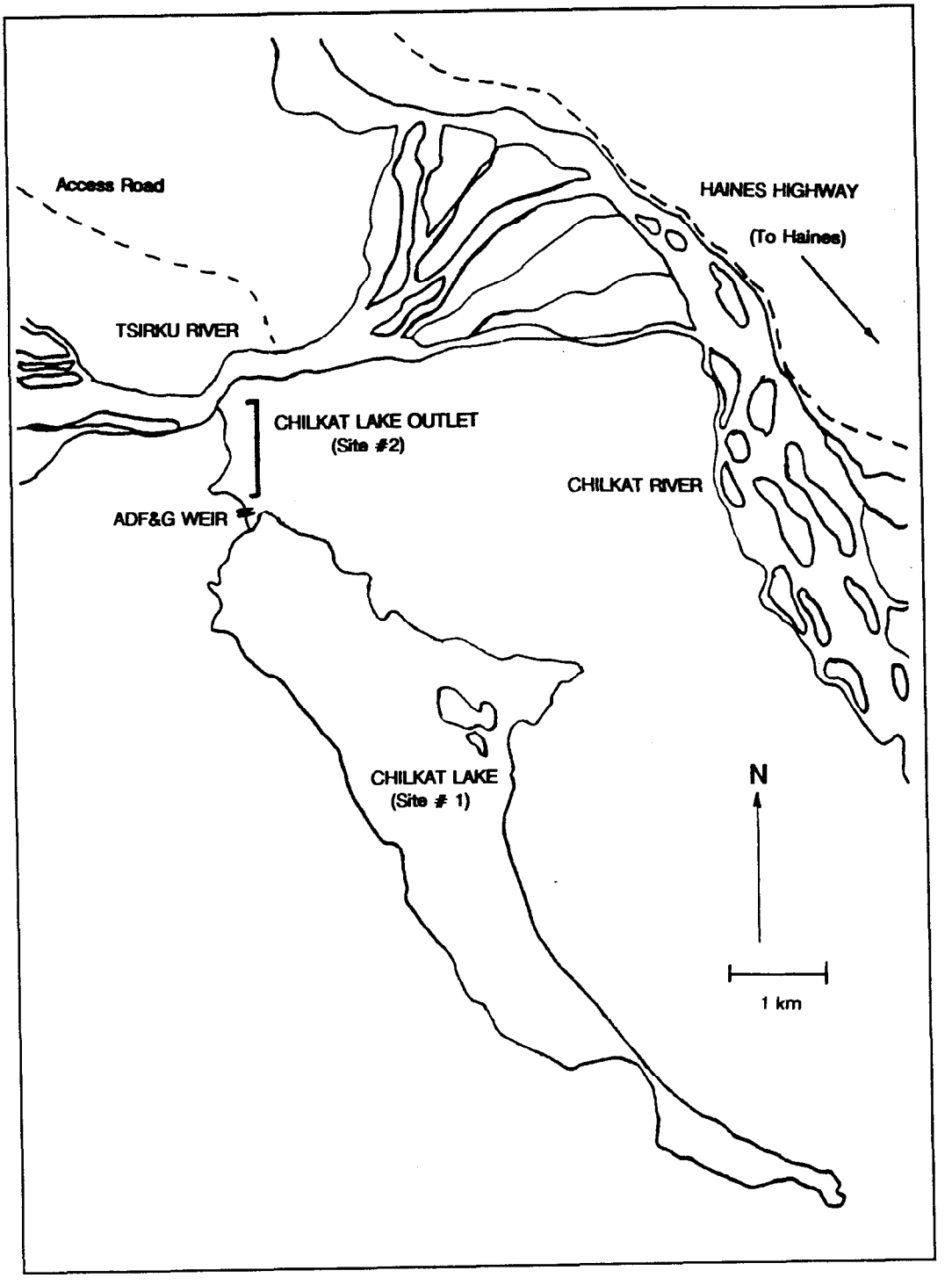

Figure 2. Sampling sites at Chilkat Lake, 1989.

The sampling season was divided into ten, two-week seasonal strata between May 22 and October 8, 1989. Each seasonal stratum the days was stratified into 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 seven seasonal strata (May 22 - August 27, 1989). After August 27, the sampling day was subdivided into four equal sampling periods. The sampling day began at approximately 0600 and ended at the nearest 15 minute increment to the average civil twilight within each biweekly period.

Sample periods were randomly selected within each seasonal stratum from the total number of available periods within either the weekday or weekend-holiday stratum. Sample selection was constrained such that at least two contiguous weekdays were not sampled within each week, and no more than three sample periods were scheduled in any one day (two sample periods were randomly selected within each day sampled prior to July 3, and three were selected thereafter).

For each sample period selected, the interviews started at either Chilkat Lake (Site 1) or at the Chilkat Lake outlet below the ADF&G weir (Site 2), selected at random. Counts of anglers were conducted either before or after the interview, also selected at random. Angler counts took no longer than one-half hour within either site.

Anglers were asked how many hours they fished, how many fish were caught and kept by species, how many fish were caught and released by species (snagged fish not included), whether the fishing trip was completed, and whether the fishing trip was chartered (any boat originating from a registered freshwater guide, whether guided or not, was considered a charter for the purposes of this survey).

For our effort, catch, and harvest estimates to be unbiased, the the following assumptions were necessary:

1. Anglers must accurately report their hours of fishing effort and the number of species kept and released;

2. No significant fishing effort occurred between civil twilight and 0600 hours;

3. Incomplete trip angler interviews provided an unbiased estimate of completed-trip HPUE and CPUE;

4. Anglers were interviewed in proportion to their abundance in each sampling period, and interviewed anglers were representative of the total angler population; and

5. Harvest, catch, and effort by individual anglers were normally distributed random variables; this assumption was necessary for the 95% confidence intervals to be unbiased.

Angler effort and harvest, and associated variances and confidence interval (CI) limits were estimated for the 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 (i.e., above and below the weir). 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):

$\hat{E}_h$ = estimated angler-hours expended in stratum *h* of the fishery;

$$= R_h \bar{x}_h ; \quad (1)$$

h = subscript denoting the stratum;

R_h = total number of hours (available for sampling) in stratum *h*;

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

$$= \frac{\sum_{i=1}^{d_h} x_{hi}}{d_h} ; \quad (2)$$

i = subscript denoting count sample within stratum *h*;

d_h = number of samples (i.e., counts) completed in stratum *h*;

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

$\hat{V}_h[\hat{E}_h]$ = the variance estimate for the estimate of $\hat{E}_h$;

$$= \left(1 - \frac{d_h}{D_h}\right) R_h^2 \left(\frac{s_h^2}{d_h}\right) ; \quad (3)$$

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

D_h = the number of possible count samples.

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:

$\hat{T}_h$ = estimated total catch or harvest per unit effort for stratum *h* of the fishery;

$$= \frac{\sum_{j=1}^{n_h} \left(\sum_{k=1}^{o_j} c_{hjk} \right)}{\sum_{j=1}^{n_h} \left(\sum_{k=1}^{o_j} e_{hjk} \right)} ; \quad (5)$$

j = subscript denoting the individual interview sample within stratum *h*;

k = subscript denoting the angler interviewed in sample *j*;

n_h = 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);

$$\approx \left\{\frac{\bar{\bar{c}}_h}{\bar{\bar{e}}_h}\right\}^2 \left\{\frac{s^2_{(c)h}}{\bar{\bar{c}}^2_h} + \frac{s^2_{(e)h}}{\bar{\bar{e}}^2_h} - \frac{2\,\mathrm{cov}_{(c,e)h}}{\bar{\bar{c}}_h\,\bar{\bar{e}}_h}\right\}; \tag{6}$$

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

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

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

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

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

$$= \frac{\sum_{k=1}^{o_j} c_{hjk}}{o_j}; \tag{9}$$

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

$$= \frac{\sum_{k=1}^{o_j} e_{hjk}}{o_j}; \tag{10}$$

$s^2_{(c)h}$ = variance estimate associated with estimating the catch or harvest component of CPUE or HPUE in stratum h;

$$= \left\{\left[1-\frac{n_h}{N_h}\right]\left[\frac{s^2_{(c)_b h}}{n_h}\right]\right\} + \left\{\left[\frac{n_h}{N_h}\right]\left[\frac{\sum_{j=1}^{n_h} \frac{s^2_{(c)_w hj}}{o_j}}{n_h^2}\right]\right\}; \tag{11}$$

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

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

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

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

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

$s^2_{(e)h}$ = 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);

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

$$= \left\{\left[1 - \frac{n_h}{N_h}\right]\left[\frac{cov_{(c,e)_b h}}{n_h}\right]\right\} + \left\{\left[\frac{n_h}{N_h}\right]\left[\frac{\sum_{j=1}^{n_h} \frac{cov_{(c,e)_w hj}}{o_j}}{n_h^2}\right]\right\}; \tag{14}$$

$cov_{(c,e)_b h}$ = the between sample covariance component between catch (or harvest) and effort in stratum h;

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

$cov_{(c,e)_w hj}$ = the within sample covariance component for CPUE or HPUE in sample j in stratum h;

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

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:

$\hat{C}_h$ = estimated catch or harvest in stratum h;

$$= \hat{E}_h \hat{T}_h; \tag{17}$$

$\hat{V}_h[\hat{C}_h]$ = estimated variance of $\hat{C}_h$ in stratum h, 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 the following equations:

$\hat{Y}$ = total estimated effort, catch, or harvest, were Y equals the parameter of interest (e.g., E, C, or H for effort, catch, or harvest);

$$= \sum_{h=1}^{q} \hat{Y}_h; \quad (19)$$

q = number of strata to be combined;

$\hat{Y}_h$ = estimate for the parameter of interest in stratum h;

$\hat{V}[\hat{Y}]$ = estimated variance of $\hat{Y}$, assuming independence of the stratum estimates;

$$= \sum_{h=1}^{q} \hat{V}_h[\hat{Y}_h]; \quad (20)$$

$\hat{V}_h[\hat{Y}_h]$ = variance estimate for the parameter of interest in stratum h.

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

$\hat{T}$ = combined CPUE or HPUE estimate over selected strata;

$$= \frac{\sum_{h=1}^{q} \hat{C}_h}{\sum_{h=1}^{q} \hat{E}_h}; \quad (21)$$

$\hat{V}[\hat{T}]$ = estimated variance of $\hat{T}$, 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);

$$\approx \left\{\frac{\hat{C}}{\hat{E}}\right\}^2 \left\{\left[\frac{\hat{V}[\hat{C}]}{\hat{C}^2}\right] + \left[\frac{\hat{V}[\hat{E}]}{\hat{E}^2}\right] - \left[\frac{2\, cov_{(C,E)}}{\hat{C}\,\hat{E}}\right]\right\}; \quad (22)$$

$$cov_{(C,E)} = \sum_{h=1}^{q} cov_{(c,e)h}. \quad (23)$$

Approximate 95% confidence intervals were obtained for stratum and total angler

effort, catch, and harvest estimates as follows, by assuming normality (Cochran 1977):

$$95\%CI=\hat{Z} \pm 1.96\sqrt{\hat{V}[\hat{Z}]}; \quad (24)$$

Where Z represents the appropriate estimates for either angler effort, catch, or harvest as desired.

Age, Weight, and Length of Cutthroat Trout

All cutthroat trout observed in the angler harvest were sampled to determine length (snout to fork of tail, nearest mm), weight (nearest 10 g), and sex. Age was estimated by examination of sagittal otoliths. Otoliths were stored dry in separate containers, and soaked in a 50% glycerine/50% water solution for approximately 48 hours before aging. Each otolith was lightly hand ground using 220 grain wet/dry sandpaper and examined in a watch glass on a dark background with reflected light, using a stereoscopic microscope with a ten power ocular and a one-power objective. Age was estimated by counting the number of hyaline zones (annular growth checks).

Mean length and weight with the associated standard errors were estimated using standard statistical procedures (Sokal and Rohlf 1981, Boxes 4.2 and 7.1, pages 56 and 139). Note, that equal sample weights were given to each fish sampled even though sampling intensities were different from stratum to stratum (e.g., greater for weekend-holidays versus weekdays). That is we treated our stratified multi-stage sample as if it were a simple random sample. Accordingly, we assumed that the length or weight composition of the harvest did not vary from stratum to stratum. Parameters in the length-weight relationship were estimated using Lotus 1-2-3, and notched box plots were developed using the SYGRAPH statistical package.

Condition factors were estimated according to the following equations:

$\bar{K}$ = mean condition factor for fish sampled from the sampled harvest;

$$= \frac{\sum_{p=1}^{s} K_p}{s}; \quad (25)$$

p = subscript denoting the fish sampled;

s = number of fish sampled from the harvest;

$$K_p = \frac{10^5 W_p}{L_p^3}; \quad (26)$$

W_p = weight (g) of fish p;

L_p = length (mm) of fish p.

Variances and standard errors were estimated approximately by treating each individual fish's condition factor (K_p) as an individual attribute, and then

following the procedures outlined by Sokal and Rohlf (1981, Boxes 4.2 and 7.1, pages 56 and 139).

Note, that each individual fish's condition factor was weighted equally in equation (25), above, regardless of differing sampling intensity during weekend-holidays versus weekdays throughout the survey. Accordingly, we assumed that condition factor of fish harvested during weekdays did not differ from fish harvested during weekend-holidays.

RESULTS

Creel Survey

An estimated 2,538 angler hours of effort (SE = 233) were expended in this fishery between May 22 and October 8, 1989 (Table 2). Approximately 82% of this effort occurred on Chilkat Lake (Area 1). Chartered anglers were responsible for an estimated 1,089 angler hours of effort (SE = 149), (Table 3) representing 43% the total effort. Most (55%) of the effort occurred between July 17 and August 27.

All the cutthroat trout were caught in Area 1 (Chilkat Lake). An estimated 1,296 cutthroat trout were caught (SE = 315) and 1,052 (81%) were harvested (SE = 293) during the survey period (Table 2). An estimated 809 cutthroat trout were caught (SE = 194) and 662 were harvested (SE = 180) by chartered anglers (Table 3). Catch per unit effort (CPUE) of cutthroat trout peaked in early July and again in early September (Table 4). The seasonal CPUE was higher for chartered anglers (0.74 cutthroat per hour) than for non-chartered anglers (0.51 cutthroat per hour).

Age, Weight, and Length of Cutthroat Trout

A total of 135 cutthroat trout were sampled from the angler catch during the reporting period. The mean length for all fish sampled was 371 mm (14.6 inches), (SE = 52), ranging from 230 mm (9.1 inches) to 510 mm (20.1 inches). Weights were available for 128 of these fish. Weights averaged 555 g (1.2 lbs) (SE = 248) and ranged from 120 g (0.4 lbs) to 1600 g (3.5 lbs). The mean condition factor for cutthroat trout was 1.02 (SE = 0.10) with a range from 0.77 to 1.28. A total of 129 cutthroat trout were aged from otoliths. Mean length, weight, and condition factor of the fish sampled by age group is presented in Table 5. Ages ranged from 4 to 9 years with the most common age (7 years) comprising 36% of the total. Lengths at age for the cutthroat trout sampled are presented as notched box plots in Figure 3. The median length at each age is represented by a horizontal line within the box, and the top and bottom of the box represent the upper and lower quartiles of the data for that age. Vertical lines from each box extend to the upper and lower adjacent values ($\pm 1.5 \times IQR$), where IQR is the interquartile range; values outside the upper and lower adjacent values are plotted as individual points. The tops and bottoms of the notches are at $M \pm 1.57(IQR/\sqrt{n})$, were M is the median and n is the number of observations, and estimate 95% confidence intervals assuming a normal distribution of values about the median. Cutthroat trout greater than 406 mm (16 inches) in length are generally aged eight or more years.

Table 2. Total angler effort and harvest statistics for the Chilkat Lake and outlet cutthroat creel survey by sampling period and area during 1989.

	May 22 June 4	June 5 June 18	June 19 July 2	July 3 July 16	July 17 July 30	July 31 Aug 13	Aug 14 Aug 27	Aug 28 Sept 10	Sept 11 Sept 24	Sept 25 Oct 8	Total
CHILKAT LAKE											
Number of Count Samples	18	20	20	27	30	30	30	27	30	30	262
Number of Interview Samples	18	20	20	27	30	30	30	27	30	30	262
Number of Possible Samples	238	238	238	238	224	210	210	196	182	168	2,142
Number of Anglers Interviewed	11	9	14	18	35	94	44	11	19	13	268
Angler hours effort	137	116	146	171	261	686	329	100	93	52	2,093
Variance	1,277	2,672	3,410	3,367	6,886	17,560	6,154	1,830	1,000	379	44,535
Cutthroat Kept	12	43	119	177	138	370	88	85	13	6	1,052
Variance	48	539	3,925	5,194	2,540	8,775	756	1,652	52	7	23,489
Cutthroat Released	36	0	0	0	10	18	107	62	3	8	244
Variance	481	0	0	0	60	962	3,165	903	6	20	5,596
Dolly Varden Kept	0	33	72	0	44	0	14	0	3	26	191
Variance	0	397	1,524	0	910	0	209	0	5	201	3,246
Dolly Varden Released	12	0	0	0	52	0	7	0	6	27	105
Variance	37	0	0	0	2,891	0	52	0	24	192	3,196
CHILKAT OUTLET											
Number of Count Samples	18	20	20	27	30	30	30	27	30	30	262
Number of Interview Samples	18	20	20	27	30	30	30	27	30	30	262
Number of Possible Samples	238	238	238	238	224	210	210	196	182	168	2,142
Number of Anglers Interviewed	0	0	2	8	8	6	1	8	6	19	58
Angler hours effort	0	0	30	71	67	53	5	70	39	111	445
Variance	0	0	377	2,322	2,035	721	21	1,443	417	2,261	9,595
Cutthroat Kept	---	---	0	0	0	0	0	0	0	0	0
Variance	---	---	0	0	0	0	0	0	0	0	0
Cutthroat Released	---	---	0	0	0	0	0	0	0	0	0
Variance	---	---	0	0	0	0	0	0	0	0	0
Dolly Varden Kept	---	---	0	0	0	0	0	0	0	4	4
Variance	---	---	0	0	0	0	0	0	0	7	7
Dolly Varden Released	---	---	40	0	0	0	0	0	0	0	40
Variance	---	---	733	0	0	0	0	0	0	0	733

Table 3. Chartered angler effort and harvest statistics for the Chilkat Lake and outlet cutthroat fishery by sampling period and area during 1989.

	May 22 June 4	June 5 June 18	June 19 July 2	July 3 July 16	July 17 July 30	July 31 Aug 13	Aug 14 Aug 27	Aug 28 Sept 10	Sept 11 Sept 24	Sept 25 Oct 8	Total
CHILKAT LAKE											
Number of Count Samples	18	20	20	27	30	30	30	27	30	30	262
Number of Interview Samples	11	19	16	22	24	17	23	26	24	27	209
Number of Possible Samples	238	238	238	238	224	210	210	196	182	168	2,142
Number of Anglers Interviewed	0	5	3	9	25	32	19	8	0	3	104
Angler hours effort	0	69	36	85	180	225	125	79	0	12	811
Variance	0	1,578	486	2,073	5,211	3,134	1,379	1,433	0	108	15,402
Cutthroat Kept	---	37	48	131	126	181	68	71	---	1	662
Variance	---	652	1,054	7,414	5,318	12,826	2,697	2,282	---	2	32,243
Cutthroat Released	---	0	0	0	0	15	84	44	---	4	147
Variance	---	0	0	0	0	365	4,188	837	---	10	5,400
Dolly Varden Kept	---	28	29	0	47	0	15	0	---	1	120
Variance	---	425	417	0	3,222	0	222	0	---	0	4,286
Dolly Varden Released	---	0	0	0	0	0	8	0	---	11	19
Variance	---	0	0	0	0	0	55	0	---	89	145
CHILKAT OUTLET											
Number of Count Samples	18	20	20	27	30	30	30	27	30	30	262
Number of Interview Samples	18	20	18	27	30	30	30	27	27	26	253
Number of Possible Samples	238	238	238	238	224	210	210	196	182	168	2,142
Number of Anglers Interviewed	0	0	0	8	8	6	1	8	0	3	34
Angler hours effort	0	0	0	71	67	53	5	70	0	12	278
Variance	0	0	0	2,322	2,035	721	21	1,443	0	108	6,649
Cutthroat Kept	---	---	---	0	0	0	0	0	---	0	0
Variance	---	---	---	0	0	0	0	0	---	0	0
Cutthroat Released	---	---	---	0	0	0	0	0	---	0	0
Variance	---	---	---	0	0	0	0	0	---	0	0
Dolly Varden Kept	---	---	---	0	0	0	0	0	---	2	2
Variance	---	---	---	0	0	0	0	0	---	4	4
Dolly Varden Released	---	---	---	0	0	0	0	0	---	0	0
Variance	---	---	---	0	0	0	0	0	---	0	0

Table 4. Mean estimates of catch per unit effort for all anglers and for chartered anglers by sampling period during 1989.

Period	All anglers[a]		Chartered anglers	
	CPUE[b]	SE	CPUE[b]	SE
May 22 - June 4	0.3451	0.1898	.	.
June 5 - June 18	0.3730	0.2591	0.5351	0.4837
June 19 - July 2	0.6780	0.4271	1.3333	1.2217
July 3 - July 16	0.7337	0.3758	0.8374	0.6565
July 17 - July 30	0.4523	0.2029	0.5117	0.3448
July 31 - Aug 13	0.5249	0.1645	0.7033	0.4421
Aug 14 - Aug 27	0.5828	0.2322	1.1721	0.7207
Aug 28 - Sept 10	0.8651	0.4145	0.7667	0.4635
Sept 11 - Sept 24	0.1199	0.0670	.	.
Sept 25 - Oct 8	0.0892	0.0427	0.2121	0.1920
All Periods	0.5109	0.0819	0.7433	0.2050

[a] Includes chartered anglers and anglers who were not chartered.

[b] Cutthroat trout caught per angler hour fished.

Table 5. Mean length, weight, and condition factor of sampled Chilkat Lake cutthroat trout by age group.

Age	Mean Length[a]			Mean Weight			Condition Factor		
	N	(mm)	SE	N	(g)	SE	N	$(K)^b$	SE
4	3	261.7	22.5	2	165.0	45.0	2	0.97	0.01
5	10	312.3	39.4	10	313.0	133.4	10	0.97	0.07
6	28	338.9	28.7	27	401.5	114.5	27	1.01	0.09
7	46	366.8	36.2	44	506.5	131.8	44	1.02	0.11
8	30	407.4	29.1	28	706.8	165.3	28	1.03	0.08
9	12	443.5	28.5	12	920.0	253.3	12	1.03	0.14
Aged Total	129	370.6	51.2	123	548.1	233.5	123	1.02	0.10
Sampled Total	135	370.8	52.3	128	554.6	247.5	128	1.02	0.10

[a] Snout to fork of tail

[b] $K = \frac{\text{Weight (g)} \times 10^5}{\text{Length(mm)}^3}$

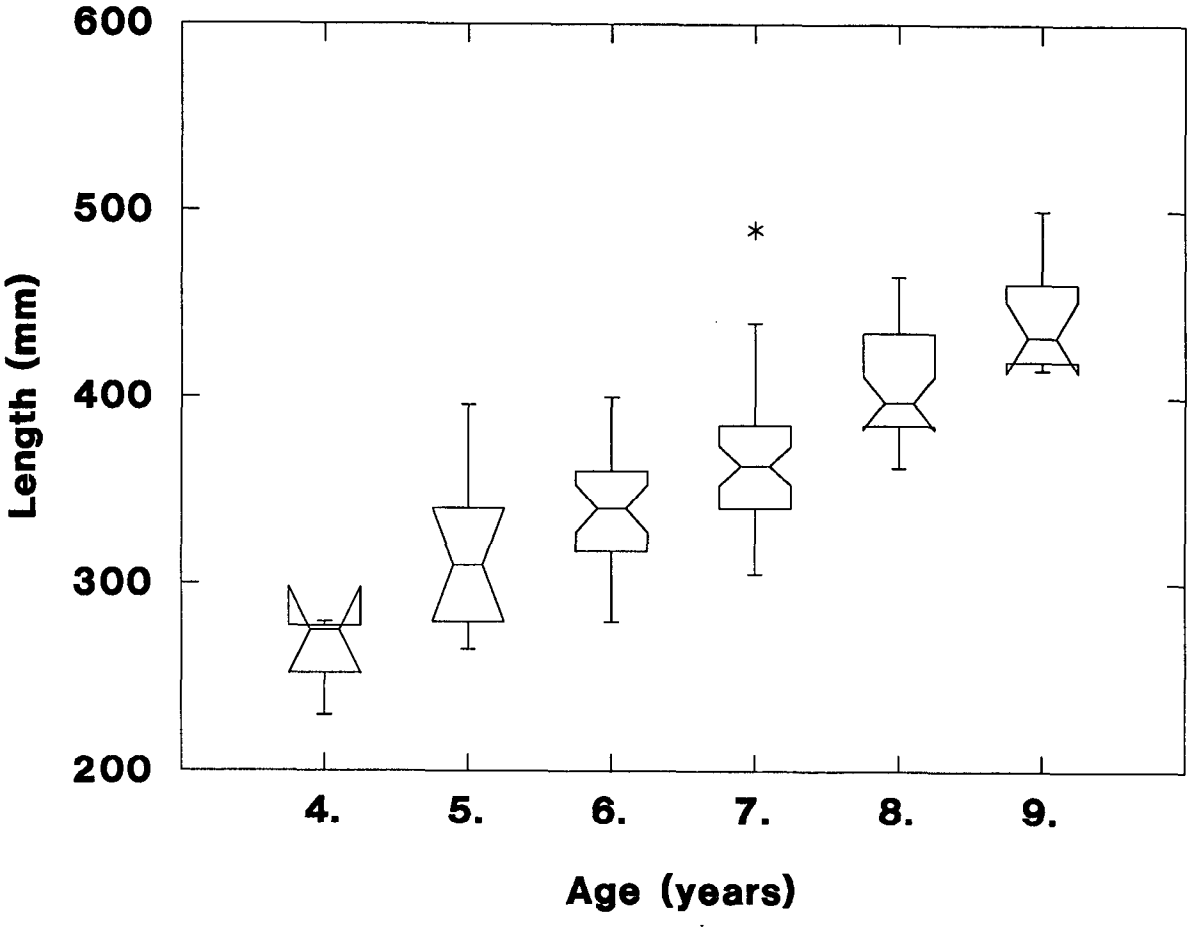

Figure 3. Lengths versus ages of Chilkat Lake Cutthroat trout.

A total of 128 pairs of length and weight were collected from the cutthroat trout sampled at Chilkat Lake. The estimated length-weight parameters for these fish were: a = -12.2435; SE(a) = 0.09597; b = 3.1258; SE(b) = 0.06096; correlation (a,b) = 0.9543 (Figure 4).

DISCUSSION

The estimated harvest of cutthroat trout in Chilkat Lake was higher than anticipated. Postal survey estimates indicate the harvest from Chilkat Lake has ranged from 33 to 645 cutthroat trout from 1984 to 1988 (Table 1). Our estimate of 1,052 cutthroat trout is substantially greater than previous postal survey harvest estimates for this fishery, but 1989 data is not yet available for comparison.

The sole charter operator on Chilkat Lake kept a record of the total number of cutthroat trout he and his clients harvested in 1989. His records show that 452 cutthroat trout were harvested during 1989 (Don Krake, Don's Camp, P.O. Box 74, Haines, Ak. 99827, personal communication). This falls within the 95% confidence limits of the estimated harvest (point estimate = 662 cutthroat trout, 95% CI = 303 - 1,022) by chartered anglers.

CPUE for complete trip angler interviews (CPUE = 1.05, SE = 1.42, N = 43) was higher than for incomplete trip angler interviews (CPUE = 0.295, SE = 0.30, N = 283). This difference is significant (independent samples *t*-test, $t = -3.412$, df = 46, $p = 0.001$) and biases our catch and harvest estimates by an unknown amount. We will be continuing cutthroat trout harvest surveys on Chilkat Lake in 1990. Non-chartered anglers will again be surveyed using roving type creel survey methods with an emphasis on interviewing as many completed trip anglers as possible, to reduce the bias incurred in 1989.

Although the harvest of cutthroat trout was higher than anticipated, it is difficult to know what effect this harvest has on the population of cutthroat trout at Chilkat Lake. The population size of cutthroat trout in the lake will be estimated during the summer of 1991. This information will help us to assess the impact of this harvest on the Chilkat Lake cutthroat trout population.

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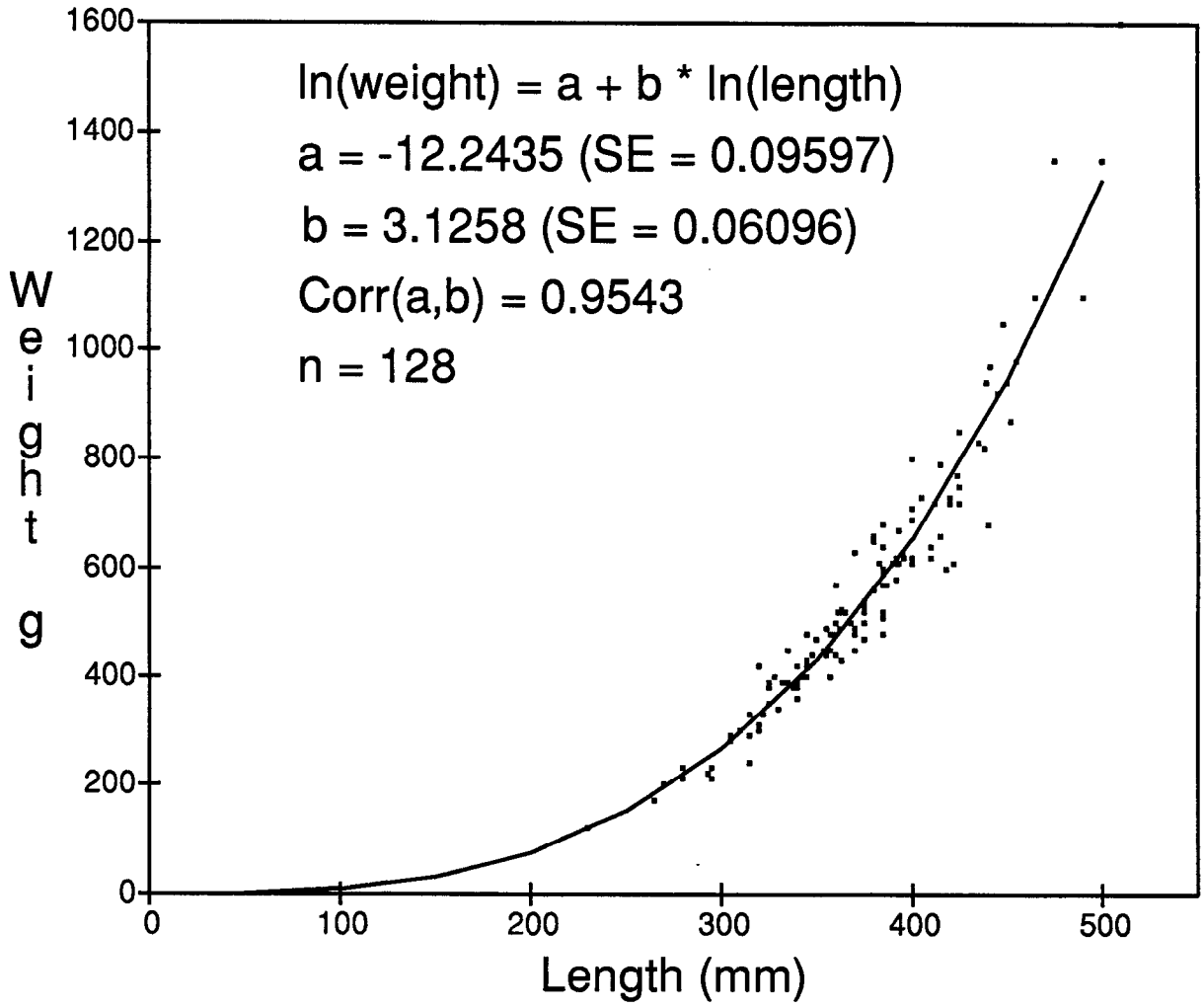

Figure 4. Estimates of parameters in the length-weight relationship for Chilkat Lake cutthroat trout.

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