Angler Effort and Catch in the Shuswap River Chinook Salmon Sport Fisheries, 1996

J.D. Kristmanson

Fisheries and Oceans Canada
Pacific Region
100 Annacis Parkway, Unit 3
Delta, British Columbia
V3M 6A2

1999

Canadian Manuscript Report of Fisheries and Aquatic Sciences 2489

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Canadian Manuscript Report of Fisheries and Aquatic Sciences

Manuscript reports contain scientific and technical information that contributes to existing knowledge but which deals with national or regional problems. Distribution is restricted to institutions or individuals located in particular regions of Canada. However, no restriction is placed on subject matter, and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Manuscript reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1-900 in this series were issued as Manuscript Reports (Biological Series) of the Biological Board of Canada, and subsequent to 1937 when the name of the Board was changed by Act of Parliament, as Manuscript Reports (Biological Series) of the Fisheries Research Board of Canada. Numbers 1426 - 1550 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Manuscript Reports. The current series name was changed with report number 1551.

Manuscript reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport manuscrit canadien des sciences halieutiques et aquatiques

Les rapports manuscrits contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui traitent des problèmes nationaux ou régionaux. La distribution en est limitée aux organismes et aux personnes de régions particulières du Canada. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports manuscrits peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports manuscrits sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annual des publications scientifiques et techniques du Ministère.

Les numéros 1 à 900 de cette série ont été publiés à titre de manuscrits (série biologique) de l'Office de biologie du Canada, et après le changement de la désignation de cet organisme par décret du Parlement, en 1937, ont été classés comme manuscrits (série biologique) de l'Office des recherches sur les pêcheries du Canada. Les numéros 901 à 1425 ont été publiés à titre de rapports manuscrits de l'Office des recherches sur les pêcheries du Canada. Les numéros 1426 à 1550 sont parus à titre de rapports manuscrits du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 1551.

Les rapports manuscrits sont produits a l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Manuscript Report of
Fisheries and Aquatic Sciences 2489

1999

Angler Effort and Catch in the Shuswap River Chinook Salmon Sport Fisheries, 1996

by

J.D. Kristmanson

prepared for:

Fisheries and Oceans Canada
Pacific Region
100 Annacis Parkway, Unit 3
Delta, British Columbia
V3M 6A2

Cat. No. Fs 97-4/2489E ISSN 0706-6473

Correct citation for this publication:

Kristmanson, J.D. 1999. Angler effort and catch in the Shuswap River chinook salmon sport fisheries, 1996. Can. Manuscr. Rep. Fish. Aquat. Sci. 2489: 25 p.

CONTENTS

CONTENTS

LIST OF FIGURES

PAGE

Figure

LIST OF TABLES

PAGE

Table

LIST OF APPENDICES

Appendix **PAGE**

ABSTRACT

Kristmanson, J.D. 1999. Angler effort and catch in the Shuswap River chinook salmon sport fisheries, 1996. Can. Manuscr. Rep. Fish. Aquat. Sci. 2489: 25 p.

The middle Shuswap River chinook salmon sport fishery and the lower Shuswap River fishery both experienced an increase in angler interviews and effort over previous years. For the lower Shuswap River, over 2000 angler interviews resulted in an estimated 31,000 angler hours of effort. The harvest of over 1300 adult chinook was the second highest recorded. The harvest per unit effort was also above average at 0.0434 chinook per angler hour. The middle Shuswap River fishery had 950 angler interviews and an estimated 6500 angler hours of effort. The harvest of 231 adult chinook and the harvest rate of 0.0352 chinook per hour were below the historical average however.

The Mabel Lake sport fishery experienced a sharp decline in angler interviews and effort. The chinook harvest and the harvest rate were above average for this fishery however.

RÉSUMÉ

Kristmanson, J.D. 1999. Angler effort and catch in the Shuswap River chinook salmon sport fisheries, 1996. Can. Manuscr. Rep. Fish. Aquat. Sci. 2489: 25 p.

La pêche sportive au saumon quinnat dans les cours moyen et inférieur de la rivière Shuswap a fait l'objet d'un plus grand nombre d'enquêtes auprès des pêcheurs et d'un accroissement de l'effort comparativement aux années antérieures. Dans le cas de la pêche pratiquée dans le cours inférieur de la rivière, on a sondé plus de 2 000 pêcheurs et, selon les résultats obtenus, les heures d'effort de pêche s'élèveraient à près de 31 000. La capture a été d'environ 1 300 quinnats adultes, soit la deuxième pêche la plus importante jamais enregistrée. Les prises par unité d'effort, de 0,0434 quinnat par heure de pêche, étaient également supérieures à la moyenne. Pour ce qui est de la pêche dans le cours moyen de la rivière Shuswap, on a sondé 950 pêcheurs et les résultats montrent un effort d'environ 6 500 heures de pêche. Toutefois, la capture de 231 quinnats adultes et le taux de capture de 0,0352 quinnat par heure étaient inférieurs à la moyenne historique.

L'effort et le nombre d'enquêtes menées auprès des pêcheurs sportifs du lac Mabel ont chuté de façon abrupte. Les prises et le taux de capture de quinnats étaient toutefois supérieurs à la moyenne dans cette pêche.

INTRODUCTION

Poor returns of chinook salmon (*Oncorhynchus tshawytscha*) to the Fraser River system led to the 1980 closure of all river sport fishing for chinook adults. Since then, returns have improved, permitting the reopening of sport fisheries (Schubert 1995). Both the lower and middle Shuswap River fisheries reopened in 1986. The middle Shuswap River fishery was closed again in 1987 and did not reopen until 1991. Mabel Lake reopened in 1990. The Shuswap River fisheries have been surveyed annually, except for 1992, in the lower Shuswap River. The Mabel Lake fishery survey began in 1993. In 1996, sport fisheries in the lower and middle Shuswap River and in Mabel Lake were open and structured studies monitored fishery performance in order to provide the data for future management decisions.

This report describes the study design and documents the results (angler effort, harvest and release by species) of the 1996 studies in the lower and middle Shuswap River and Mabel Lake.

STUDY AREA

The Shuswap River originates in the Monashee mountains of south-central British Columbia and flows northwest for almost 200 km, entering Mara Lake east of Salmon Arm. This system, which includes three major lakes, drains a watershed of approximately 5000 square km and has a mean daily discharge of 88 cms.

The 1996 sport fisheries were opened in the lower Shuswap River between the highway bridge at Grinrod and Mabel Lake, in Mabel Lake north of a boundary sign located 4 km south of the lake outlet and in the middle Shuswap River between Mabel Lake and the Wilsey Dam (Figure 2). All of these fisheries were assessed in 1996.

Fishing effort in the lower Shuswap River is heaviest in the upper river and more scattered in the lower section where the river is relatively slow and deep. Closing the highway bridge at Grinrod essentially moves the upstream open area to Enderby as there are no effective angling sites between Grinrod and Enderby (Schubert pers. comm.) Angler access is by road (Highway 97A and Mabel Lake Road) and by boat. In many areas access is restricted by private property or the distance from the road; consequently, angler effort is concentrated near road access points. Angling occurs 24-hours per day, with pronounced peaks in the early morning and evening. This fishery mainly harvests the lower Shuswap chinook stock.

Fishing effort in Mabel Lake is concentrated near the lake outlet. Fishing occurs entirely from boats, with most of the boats within 1 km of the lake outlet. Most of the boats enter the lake at boat launch ramps at the lake outlet and at the resort north of the outlet; a small number originate from cabins along the lake shore. This fishery harvests the lower Shuswap chinook stock, which hold in the lake before dropping back into the river.

In the upper part of the middle Shuswap River, fishing effort is concentrated where anglers access the river by road and by boat. Anglers avoid the lower 13 km section where the gradient is low and the river meanders across the floodplain. Angling occurs 24 hours per day. The middle Shuswap chinook stock, the only stock harvested in this fishery, migrates to the river through the lower Shuswap River and Mabel Lake. Their migration is largely complete before the annual fisheries open in these downstream areas.

METHODS

STUDY DESIGN

Lower Shuswap River

The lower Shuswap River chinook fishery was assessed from August 15 to September 12, 1996 using a hybrid design which included access point and roving creel elements. Two surveyors worked either a morning or afternoon eight hour shift (5:00 am to 1:00 pm; 1:00 pm to 9:00 pm) which encompassed all daylight hours and permitted the surveyors to contact the early morning anglers expected in this fishery. One surveyor conducted the access point survey and the other conducted the roving survey. The study period was stratified into weekday and weekend/holiday day types. Survey effort covered all weekend/holidays and three weekdays per week.

The access point surveyor was stationed at Chuck's Pool (the area of maximum expected angler effort). The surveyor moved between Chuck's and Ballpark pools during a given shift and attempted to interview and record all anglers present. Hourly rod counts were conducted and anglers were interviewed as they left the site. The interviews recorded trip length (to time of interview and expected additional fishing time), target species, number and species harvested and released, marks on harvested fish (maxillary or fin clip), gear type and annual chinook adult harvest to date. If the angler had fished the lower Shuswap river within two weeks, trip duration and harvest were recorded for the most recent trip. When possible, the harvest was inspected to confirm species and mark identification. An interview form was completed for each angler; however, if the angler was unresponsive or if response reliability was questionable, the form was voided. At the end of each shift, all the remaining anglers were interviewed.

The roving surveyor travelled a predetermined route by vehicle, with a randomly selected start point and direction of travel. The surveyor's rate of travel was standardized to ensure that a complete circuit encompassed 6.5 hours. Anglers were approached on foot and interviewed as above. In addition to the interviews, the surveyor counted all rods fishing in the study area during one of the two periods of expected maximum daily effort (beginning at 6:30 am or 6:30 pm - depending on the shift). Because the study area was large (70 km), the count required about 1.5 hours. No interviews were conducted during the rod count.

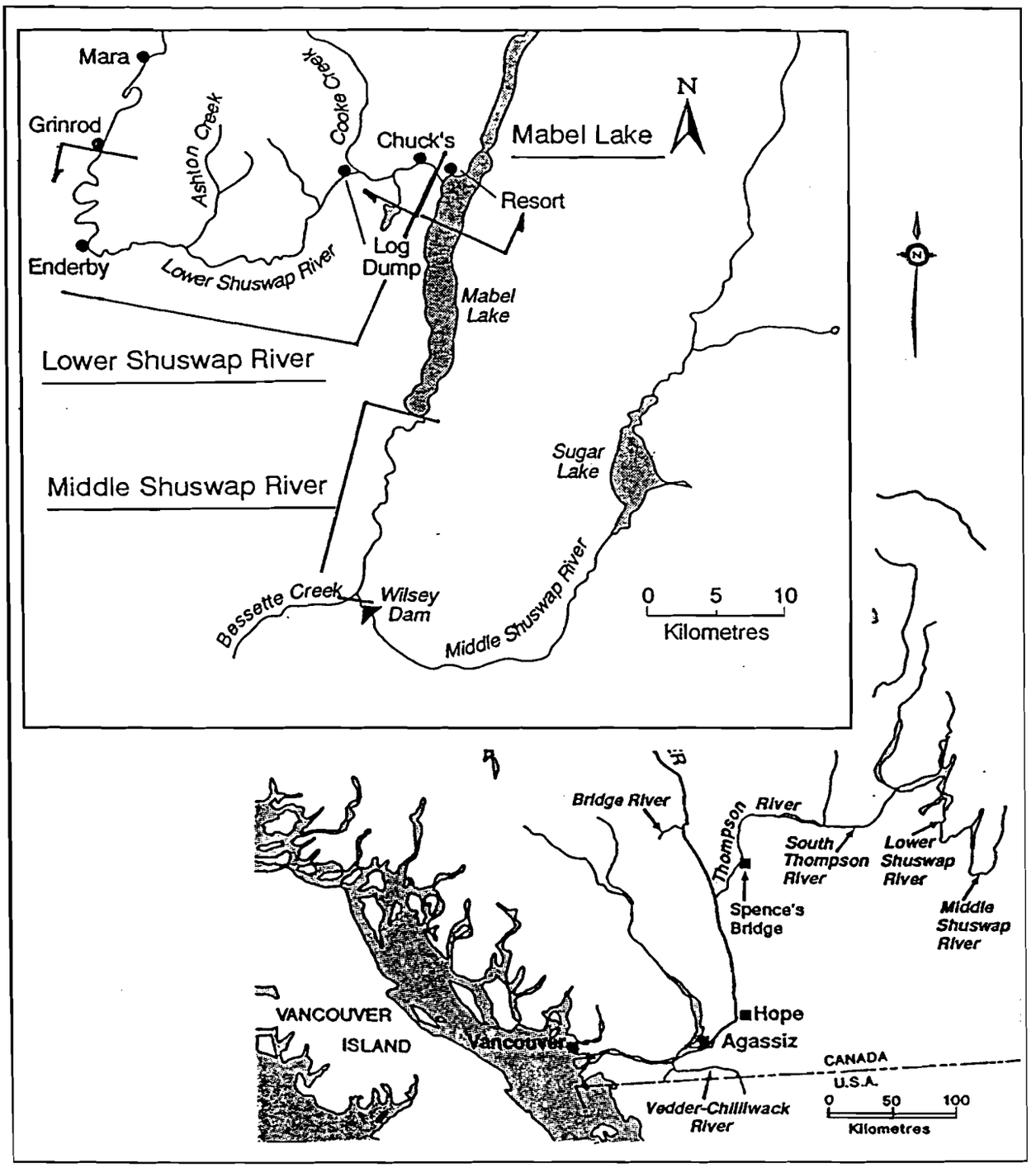


Figure 1.Study area location map.

Mabel Lake

The Mabel Lake fishery was assessed using an access point study design from August 15 to September 12, 1996. The surveyor worked the same shifts described above.

The surveyor was stationed at the boat launch ramp at the outlet of Mabel Lake. During the survey, the surveyor interviewed anglers at both the outlet ramp and at the resort. The survey procedures were similar to those described for the lower Shuswap River except the hourly boat counts, conducted by the surveyor at the resort, were considered complete counts for the entire fishery.

Middle Shuswap River

The middle Shuswap River chinook fishery was assessed using a hybrid design with access point and roving survey elements from July 25 to August 11, 1996. Two surveyors worked either a morning or afternoon eight hour shift (5:00 am to 1:00 pm; 1:00 pm to 9:00 pm) which encompassed all daylight hours and permitted the surveyors to contact the early morning anglers expected in this fishery. The access point surveyor was stationed at the Canyon Pool (the area of maximum expected angler effort). One surveyor conducted the access point survey and the other conducted the roving survey. The study period was stratified into weekday and weekend/holiday day types. Survey effort covered all weekend/holidays and three weekdays per week. The access point and roving survey procedures were identical to those described above, except the instantaneous rod count occurred daily at 6:00 am or 7:00 pm.

DATA MANAGEMENT

Data storage and analysis were performed on a computer. A custom designed data entry program generated ASCII files which were then imported into an analysis program.

DATA ANALYSIS

Lower Shuswap River

Angler Effort: Angler effort profiles were generated from hourly rod counts at Chuck's and Log Dump pools, with effort outside the survey shifts reconstructed from the interview data. Mean sample day angler effort (hours) for each day type stratum was the ratio of the mean rod count and the proportion of daily effort occurring during the rod count time block. Total angler effort was the product of the mean daily angler effort and the number of days in the stratum. The mathematical relationships are reported below.

1) Estimated total rods fishing ($\hat{R}_{hij}$), by hour and day type (weekday or weekend):

$$\hat{R}_{hj} = \sum_i N_h / n_{hij} \sum_k r_{hijk}$$

2) Estimated proportion of the daily angler effort occurring during the instantaneous rod count time block $(\bar{p}_{hj^*})$, by day type:

$$\bar{P}_{hj^*} = \frac{\hat{R}_{hj^*}}{\sum_j \hat{R}_{hj}}$$

3) Estimated mean rod count during the instantaneous rod count time block $(\bar{y}_{hj^*})$, by day type:

$$\bar{y}_{hj^*} = \sum_k \frac{y_{hj^*k}}{n_{hj^*}}$$

4) Estimated angler effort (E_h), by day type, in hours:

$$E_h = N_h \frac{\bar{y}_{hj^*}}{\bar{p}_{hj^*}}$$

5) Estimated study period angler effort (E), in hours:

$$E = \sum_h E_h$$

where:

N_h	=	total study period days of day type h (weekday or weekend);
n_{hij}	=	number of interview sample days on day type h at site i during hour j;
r_{hijk}	=	rod count on day type h at site i at hour j on day k;
$\hat{R}_{hj^*}$	=	estimated total effort (hours) on day type h during the instantaneous rod count time block (j^*);
y_{hj^*k}	=	instantaneous rod count on day type h on day k;
n_{hj^*}	=	number of instantaneous rod counts on day type h.

Catch Per Unit Effort: CPUE was calculated by day type for each species and mark group using a total ratio estimator (Von Geldern, Jr. and Thomlinson 1973; Malvestuto 1983). Estimates were derived from interview data which was weighted to account for the hourly proportion of anglers leaving the site without an interview. CPUE was calculated separately for harvested (HPUE) and released (RPUE) fish; however, RPUE was not calculated by mark type because angler mark recognition was unreliable. The mathematical relationships are reported below:

6) Estimated study period catch to time of interview at the survey sites ($\hat{X}_h$), by day type:

$$\hat{X}_h = \sum_i \sum_l \frac{1}{a_{hil}} \sum_f \sum_q \sum_u \frac{x_{hilfqu}}{a_{hilfq}}$$

7) Estimated study period angler hours to time of interview at the survey sites ($\hat{T}_h$), by day type:

$$\hat{T}_h = \sum_i \sum_l \frac{1}{a_{hil}} \sum_f \sum_q \sum_u \frac{t_{hilfqu}}{a_{hilfq}}$$

8) Estimated catch per angler hour at the survey sites ($\bar{c}_h$), by day type:

$$\bar{c}_h = \frac{\hat{X}_h}{\hat{T}_h}$$

where:

a_{hil} = proportion of the study period stints of type l for site i on day type h which were surveyed;

a_{hilfq} = proportion of anglers leaving in time block q on stint f of stint type l at site i on day type h who were interviewed;

x_{hilfqu} = catch to time of interview by angler u leaving in time block q on stint f of stint type l at site i on day type h;

t_{hilfqu} = hours fished to time of interview by angler u leaving in time block q on stint f of stint type l at site i on day type h.

Before calculating CPUE, the raw interview data were tested for significant differences in CPUE between all interviews and complete trip interviews. The test used, from Cochran (1977), was:

9) Estimated variance of the difference between two ratios (Var$(\bar{c}_c - \bar{c}_t)$:

where:

$$Var(\bar{c}_c - \bar{c}_t) = Var(\bar{c}_c) + Var(\bar{c}_t)$$

Var$(\bar{c}_c)$ = variance of CPUE from complete trip interviews:

$$\frac{1}{n(n-1)\bar{t}^2}(\sum x_u^2 - 2\bar{c}_c \sum x_u t_u + \bar{c}_u^2 \sum t_u^2)$$

Var$(\bar{c}_t)$ = variance of CPUE from all interviews, calculated as above.

$\bar{t}$ = mean time to interview.

If $(\bar{c}_c - \bar{c}_t) \pm$ (t-table, 0.95) (Var$(\bar{c}_c - \bar{c}_t)$) did not include zero, the difference was significant. In that case, incomplete trip interviews were excluded from the analysis for that site. If a significant difference in CPUE was noted between sites, then equations 6, 7 and 8 were replaced with the following:

10) Estimated total catch to time of interview$(\hat{X}_{hi})$, by site and day type:

$$\hat{X}_{hi} = \sum_l \frac{1}{a_{hil}} \sum_f \sum_q \sum_u \frac{x_{hilfqu}}{a_{hilfq}}$$

11) Estimated total angler hours to time of interview$(\hat{T}_{hi})$, by site and day type:

$$\hat{T}_{hi} = \sum_l \frac{1}{a_{hil}} \sum_f \sum_q \sum_u \frac{t_{hilfqu}}{a_{hilfq}}$$

12) Estimated catch per angler hour$(\bar{c}_{hi})$, by site and day type:

$$\bar{c}_{hi} = \frac{\hat{X}_{hi}}{\hat{T}_{hi}}$$

13) Estimated mean catch per angler hour at all sites (weighted by site angler effort) ($\bar{c}_h$), by day type:

$$\bar{c}_h = \frac{\sum_i \bar{c}_{hi} E_{hi}}{\sum_i E_{hi}}$$

where:

$$E_{hi} = N \frac{\bar{y}_{hij\bullet}}{\bar{P}_{hj\bullet}}$$

$=$ estimated total angler effort at site i on day type h;

$\bar{y}_{hij\bullet}$ $=$ mean rod count at site i on day type h during the instantaneous rod count time block

Harvest and Release: Study period harvest and release, estimated by species and mark group, was the sum of the weekday and week-end/holiday strata estimates. For each stratum, harvest and release was the product of stratum effort and the corresponding value of HPUE or RPUE.

14) Total study period catch (C):

$$C = \sum_h \bar{c}_h E_h$$

Angler Characteristics: The following unweighed angler attributes were summarized by week: party size, mean angler day length (from complete trip, incomplete trip and all interviews), preferred species, gear type, mean angler day length and harvest on the angler's most recent trip, and chinook harvest to date.

RESULTS

LOWER SHUSWAP RIVER

Survey effort

The open season was 28 days long; 9 weekend/holiday days and 19 weekdays. Five of the weekend days (55.5%) and 5.5 of the weekdays (28.9%) were sampled. A total of 796 anglers were interviewed; 449 anglers were interviewed during the access survey and 347 anglers were interviewed during the roving survey (Table 1).

Angler effort

The diel angler effort profile of the access point survey was bimodal with the biggest effort peak at 9:00 pm (13%) on weekdays and at 8:00 am (12%) on weekends (Figure 2).

Table 1. Interview number, angler effort, estimated harvest and release for the 1996 lower Shuswap River chinook sport fishery.

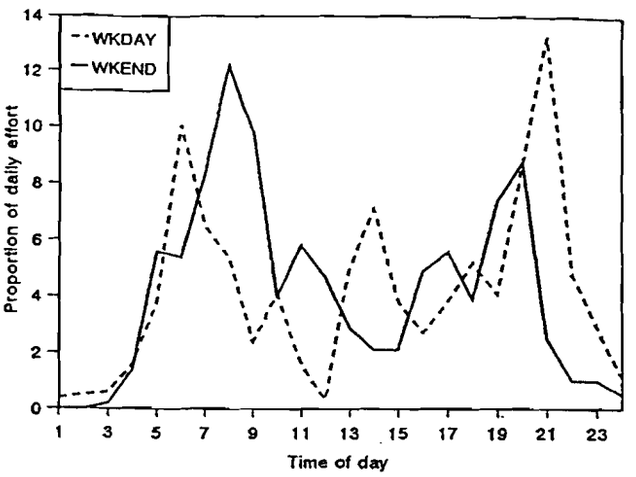
	Chuck's			Roving			
	weekday	weekend	total	weekday	weekend	total	Total
Interview	263	186	449	181	166	347	796
Effort (hr)							
observed	672	531	1203	457.5	550.5	1008	1211
estimated	4256	1834	6090	1729	1216	2945	9035
Harvest							
chinook	361	66	427	125	46	171	598
salmon	6	5	11				11
Release							
chinook	108	0	108				108

Estimated angler effort totalled 9035 hours; 6090 hours for the access survey and 2945 for the roving survey (Table 1). About 66% (5985 hours) of the effort occurred on weekdays. Average daily effort was slightly higher on weekends (339 angler hours per weekend day) than on weekdays (315 angler hours per day).

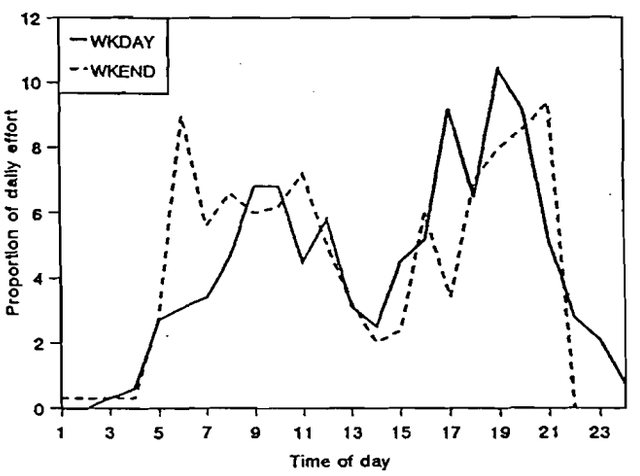
Catch per unit effort

Chinook adult catch per unit effort (CPUE), expressed as fish per hour, was 0.0781. Harvest per unit effort (HPUE) and release per unit effort (RPUE) were 0.0662 and 0.0119, respectively.

Lower Shuswap River



Mabel Lake



Middle Shuswap River

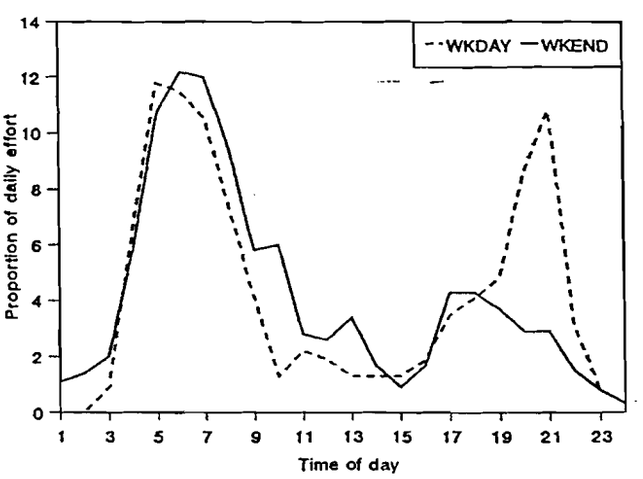


Figure 2. Diel effort profiles for the 1996 Shuswap River system chinook sport fisheries

Chuck's Pool HPUE was higher (0.0701) than the roving HPUE (0.0581). Chinook adult HPUE from completed trips (0.0940) and all trips (0.0860) was not significantly different ($p>0.05$); consequently all interviews were used in the analysis.

Catch

Harvest was estimated at 598 chinook adults. Three chinook adults in the observed harvest were marked with an adipose fin clip. Released fish were estimated at 108 chinook adults. An estimated 11 unidentified salmonids were harvested and none were released.

Angler Attributes

Angler trip lengths averaged 2.6 hours for the access survey and 2.8 hours for the roving survey (Table 5, Appendix 1 and 2). Anglers fished for chinook (94.8% access, 100% roving) and any salmonid (5.2% access). Bait was the most commonly used technique (59.6% access, 66.2% roving) followed by lures (23.3% access, 15.9% roving) and baited lures (15.8% access, 17% roving). Less than 1% used flies.

Weekly changes among anglers in the seasonal harvest of lower Shuswap River chinook are shown in Appendix 1 and 2. In the first week of the fishery, between 78% (roving survey) and 88% (Chuck's Pool) of the anglers had not harvested a chinook. By the last week of the fishery, 88% of the anglers at Chuck's Pool and 85% of the roving survey anglers still had not harvested a chinook. No angler harvested more than three fish and less than 1% harvested more than one chinook. Between 88% (roving survey) and 64% (Chuck's Pool) of the interviewed anglers had fished for lower Shuswap River chinook within two weeks of the interview. Effort data was not recorded usefully so no HPUE can be calculated.

MABEL LAKE

Survey effort

The fishing season was open for 28 days, of which ten were sampled. Four of the nine weekend/holiday days (44.4%) and 5.5 of the 19 weekdays (28.9%) were sampled. A total of 365 anglers were interviewed (Table 2).

Angler effort

Fishing effort was strongly bimodal (Figure 2). Angler numbers showed a marked decrease between 12:00 noon and 4:00 pm. A higher percentage of weekday anglers fished in the evenings than in the mornings.

Angler effort was estimated at 7619 hours of which about 52% (3949 hours) occurred on weekend/holidays (Table 2). Average daily angler effort was higher on weekends (439 hours/day) than on weekdays (193 hours/day).

Catch per unit effort

Chinook adult CPUE was 0.0171 fish per angler hour. HPUE and RPUE were 0.0163 and 0.0008 respectively. Including the unidentified salmonid catch increases the HPUE of the fishery to 0.0291 fish per hour. Total CPUE (chinook and unidentified salmonids combined) was 0.0348 fish per hour. Completed trip HPUE (0.0360) and all trip HPUE (0.0330) was not significantly different ($p>0.05$); consequently all interviews were used in the analysis.

Table 2. Interview number, angler effort, estimated harvest and release for the 1996 Mabel Lake chinook sport fishery.

	weekday	weekend	total
Interviews	154	211	365
Effort (hr)			
observed	579.5	877.5	1457
estimated	3670	3949	7619
Harvest			
chinook	70	54	124
salmon	57	41	98
Release			
chinook	6	0	6
salmon	19	18	37

Catch

An estimated 124 chinook adults were harvested with a further 6 released (Table 2). None of the catch was marked and no other species were reported. Given the species diversity reported in previous studies (Schubert 1995), this result is highly unusual.

Angler Attributes

Angler trip length averaged 3.9 hours (Table 5 and Appendix 3). Anglers attempted to harvest chinook (84.6%) or any salmonid (15.6%). Lures were the preferred technique (96%); less than 2% used each of bait or baited lures. None used flies.

Eighty-six percent of the interviewed anglers had fished on Mabel Lake within two weeks of the interview (Appendix 3). Weekly changes among anglers in the seasonal harvest of Mabel Lake chinook are shown in Appendix 3. In the first week of the fishery, 100% of the anglers had not harvested a chinook. By the last week of the fishery, 90% of the anglers had still not harvested a chinook. No angler harvested three or more and only 0.3% harvested more than one chinook. Effort data were not collected usefully so no HPUE can be calculated.

Table 3. Angler number by location for the middle Shuswap River chinook sport fishery, roving survey.

Site	Angler Number	Percent
Bailey Bridge	10	3.9
Rip Rap	21	8.2
Honey Hole	21	8.2
Meat Hole	75	29.4
Iron Pin	24	9.4
Deer Pool	52	20.4
Bessette Ck	52	20.4

MIDDLE SHUSWAP RIVER

Survey effort

The fishing season on the middle Shuswap River was open for 17 days. All of the weekend/holiday days (6.5 days) and 6 of the 10.5 weekdays (57.1%) were sampled. A total of 546 angler interviews were conducted; 214 at the Canyon Pool and 332 in the roving survey (Table 4). Weekend interviews accounted for 76.7% (419) of the total.

Angler effort

The diel angler effort profile was bimodal on weekdays with peaks at 6:00 am and 9:00 pm. Weekend effort peaked at 7:00 am and declined for the rest of the day. Three locations on the river accounted for about 70% of the angling effort observed in the instantaneous counts of

the roving creel. Most of the effort was concentrated at the Meat Hole (29%) while the Deer Pool and Bessette Creek locations had about 20% each (Table 3).

The total effort was estimated at 3,731 hours; 58% (2169 hours) of which occurred on weekends (Table 4). Angler effort was more intense on weekend days (337 hours/day) than on weekdays (149 hours/day).

Catch per unit effort

Chinook adult CPUE was 0.0482; HPUE and RPUE were 0.0348 and 0.0134 respectively. The HPUE estimated from the roving survey was considerably higher (0.0530) than the Canyon Pool HPUE (0.0187). Chinook adult HPUE estimated from complete trip (0.0260) and all interviews (0.0190) was not significantly different ($p>0.05$); consequently all interviews were used in the analysis.

Table 4. Interview number, angler effort, estimated harvest and release for the 1996 middle Shuswap River chinook sport fishery.

	Canyon			**Roving**			**Total**
	weekday	weekend	total	weekday	weekend	total	
Interviews	93	121	214	34	298	332	546
Effort (hr)							
observed	333.5	454.5	788	92.5	841.5	934	1722
estimated	1223	752	1975	339	1417	1756	3731
Harvest							
chinook	18	19	37	11	82	93	130
rainbow	4	0	4				4
salmon					5	5	5
Release							
chinook	4	3	7	18	25	43	50
chinook, jack	0	2	2				2
rainbow	4	0	4				4

Catch

Harvest was estimated at 130 adult chinook salmon (Table 4). Three of the harvested chinook were observed to have an adipose fin clip. Four rainbow trout and 5 unidentified salmonids were also harvested. An estimated 50 chinook adults, 2 chinook jacks and 4 rainbow trout were released.

Angler Attributes

Average angler trip length varied from 2.9 hours for the roving creel to 3.8 hours for the access point survey at Canyon Pool (Table 5, Appendix 4 and 5). Anglers pursued chinook exclusively at the Canyon Pool. Anglers in the roving survey attempted to harvest chinook mainly (99.4%) and rainbow trout (0.6%). Bait (54%) and baited lures (38%) were the most commonly used gear types at Canyon Pool. Anglers in the roving survey preferred baited lures (54%) and bait (37%). Less than 2% used flies and about 7% used lures (Table 5).

Table 5. Angler characteristics in the 1996 Shuswap River chinook sport fisheries.

	Lower Shuswap River		**Mabel Lk**	**Middle Shuswap River**	
	Chuck's	Roving		Canyon	Roving
Angler Day (hr)	2.6	2.8	3.9	3.8	2.9
Target species (%)					
chinook	94.8	100	84.6	100	99.4
salmon	5.2		15.6		
rainbow					0.6
Gear (%)					
bait	59.6	66.2	1.6	54.2	37.4
lure	23.3	15.9	95.9	7.0	7.1
baited lure	15.8	17.0	1.9	37.8	53.8
fly	0.8	0.9	0	0.5	1.6

DISCUSSION

The lower Shuswap River survey had the highest number of angler interviews (796) followed by middle Shuswap River (546) and Mabel Lake (365). Survey intensity was highest

for the middle Shuswap River creel with 100% of the weekend days and 57% of the weekdays sampled. Mabel Lake (29% weekdays and 44% weekend/holidays sampled) and lower Shuswap River (29% weekdays and 55% weekend/holidays sampled) were not as thoroughly surveyed. The season for lower Shuswap and Mabel Lake was 11 days longer (28 days total) than the middle Shuswap River season (17 days).

Effort tended to be higher on the weekend/holidays than the weekdays for lower Shuswap River roving survey, the middle Shuswap River and Mabel Lake fisheries. This trend was reversed for Chuck's Pool on the lower Shuswap River fishery in which the weekday effort and catch were higher than the weekend/holiday period. In all surveys, more angling effort per day was expended during weekend days than during weekdays. The lower Shuswap River fishery had the highest estimated effort level followed by Mabel Lake then the middle Shuswap River fishery. Estimated daily effort also revealed that more effort was expended in the lower Shuswap (322 hours per day) compared to Mabel Lake (272 hours) or middle Shuswap (207 hours).

Table 6. Angler interview number, estimated effort and chinook harvest over time in the Shuswap River chinook sport fisheries. (Middle Shuswap River = MSR, Lower Shuswap River = LSR)

	Year										
	1996	1994	1993	1992	1991	1990	1989	1988	1987	1986	Mean
MSR											
Interviews	546	295	370	384	560	-	-	-	-	115	345
Effort (hr)	3731	6255	5542	8964	5622	-	-	-	-	1786	5634
Harvest	130	163	459	307	482	-	-	-	-	53	293
Mabel Lk											
Interviews	365	1322	1291								
Effort (hr)	7619	14488	9447								
Harvest	124	468	62								
LSR											
Interviews	796	1288	1528	-	630	1121	1136	660	364	487	902
Effort (hr)	9035	19266	21545	-	28891	28708	19449	14288	6071	6145	18405
Harvest	598	639	785	-	378	1415	120	174	215	237	495
Total Shuswap R. Harvest	852	1270	1306	307	860	1415	120	174	215	290	681

Estimated catch was higher for the lower Shuswap fishery (598 adult chinook) compared to Mabel Lake (124 adult chinook) and the middle Shuswap fishery (130 adult chinook). Total 1996 estimated chinook harvest in the Shuswap River system fisheries was 852. Harvest tended to be higher for weekdays than for weekend/holidays in the lower Shuswap and Mabel Lake fisheries. For the middle Shuswap River, harvest was about equal for the two day types at the Canyon Pool but harvest was much higher for weekend/holidays in the roving survey. Adult chinook harvest per day was highest for the lower Shuswap fisheries (21.3 fish per day). The middle Shuswap River fishery harvested an estimated 7.2 adult chinook per day while the Mabel Lake fishery was lowest at 4.4 chinook per day.

The lower Shuswap River fishery had the highest CPUE with 0.0781 chinook harvested per angler hour. The Mabel Lake fishery catch rate was the lowest at 0.0171 chinook per hour and the middle Shuswap River fishery had a harvest rate of 0.0482 chinook per hour.

Historical Perspective

The lower Shuswap River fishery has consistently been the largest and most successful of the fisheries. While continuing to dominate the other fisheries in this study, the 1996 season had the lowest level of participation and effort recorded since the season was expanded to 28 days in 1990. Only 796 anglers were interviewed which is lower than the average number of interviews (902 interviews, 1986-94) (Table 6). The estimated angling effort was about half the average (9035 vs 18,045 hours). Average angling effort per day was below average as well (322 hours per day vs 945 hours per day).

Table 7. Harvest per unit effort over time in the Shuswap River chinook sport fisheries. (Middle Shuswap River = MSR, Lower Shuswap River = LSR)

	Year										
	1996	1994	1993	1992	1991	1990	1989	1988	1987	1986	Mean
MSR	0.0348	0.0261	0.0828	0.0342	0.0857	-	-	-	-	0.0297	0.0517
Mabel Lk	0.0171	0.0323	0.0066								0.0199
LSR	0.0781	0.0332	0.0364	-	0.0131	0.0493	0.0062	0.0122	0.0354		0.0265

The harvest was slightly above the average (598 vs 495 adult chinook) of the previous eight sampled years. The harvest was lower only in 1991 when about 378 chinook were harvested. Previous years to 1990 had fewer open days in the season and are not directly comparable. Harvest per unit effort was above average (0.0781 vs 0.0265 chinook per angling hour, Table 7).

Schubert (1995) reported that the fishing season has expanded from 5 days in 1986 to 28 days in 1990. The 1996 season was 28 days long. Average effort per day for the 1990-1991 seasons was about 1,020 hours per day and total effort was about 29,000 hours. The 1993-94 seasons resulted in a reduction in angler effort in the lower Shuswap as anglers moved to the Mabel Lake fishery (Schubert 1995).

The 1996 season appears to continue the decline in the lower Shuswap fishery noted for the 1993-94 seasons. There may be an upper limit to the amount of effort which the lower Shuswap fishery can sustain due to crowding at the most favoured fishing sites (Schubert 1995). Fishing effort however did not switch to Mabel Lake as this fishery declined as well from previous years. The lower Shuswap fishery may be oscillating around an optimum fishing effort level.

The 1996 Mabel Lake fishery experienced a decline in effort. The harvest was about average and the harvest rate (0.0171 chinook harvested per angling hour) was about average (0.0199 fish per hour) (Table 7). About half of the catch was unidentified however and if combined with the chinook catch raises the overall CPUE to 0.0348 fish per hour.

The middle Shuswap River fishery experienced an increase in angler interviews (546 compared to a mean of 345) (Table 6). Angler effort was below average (3,731 angler hours vs mean 5,634 angler hours). The estimated harvest of 130 adult chinook was below the five year average of 293 fish. The HPUE (0.0348 chinook per angler hour) was also below average (0.0517 fish per angler hour) (Table 7).

Overall angler effort has decreased from previous years and the average daily effort (207 hours) was below the 1994 season (450 hours). The average effort per day has been steadily declining since 1991, from 800 hours per day to the present (207 hours per day). This trend may represent the results of a lengthening of the open season on a stable pool of anglers (Schubert 1995). The reduction of daily effort may also represent the effects of crowding at the preferred angling sites. Anglers tended to cluster at a small number of access points in both the lower and middle Shuswap River fisheries (Schubert 1995). Angling success, as reflected in HPUE, is quite variable in the middle Shuswap River but can be the highest of all three fisheries. This variability is due to varying environmental conditions in the river which directly influence angling success and may be another factor influencing the average daily effort values as the anglers may vary their fishing effort in response to river conditions.

Acknowledgements

The assistance of K. Wilson in the completion of this report is gratefully acknowledged.

References

Cochrane, W.G. 1977. Sampling techniques, third edition. John Wiley & Sons, New York.

Malevesto, S.P. 1983. Sampling the recreational fishery. Pages 397-419. *In* Fisheries Techniques. Neilsen, L.H. and D.L. Johnson (eds.). American Fisheries Society, Bethesda, Maryland.

Schubert, N.D. 1995. Angler effort and catch in four Fraser River chinook salmon sport fisheries, 1994, and a retrospective on nine years of upper Fraser River sport fishery management and assessment. Can. Manuscr. Rep. Fish. Aquat. Sci. 2275: 93p.

Von Geldern Jr., C.E. and P.K. Tomlinson. 1973. On the analysis of angler catch rate from warmwater reservoirs. Calif. Fish and Game 59(4): 281-292.

APPENDICES

Appendix 1. Interview responses by week in the lower Shuswap River chinook salmon sport fishery at Chuck's/Ballpark Pool

Week	Aug 15-17	Aug 18-24	Aug 25-31	Sep 1-7	Sep 8-12
Interviews	101	130	94	36	25
Mean Day (hr)					
All Interviews	1.8	2.4	2.9	2.9	3.2
Incomplete					
number	77	92	78	21	16
hours	1.8	2.3	2.8	2.5	2.9
Complete					
number	24	38	16	15	9
hours	1.7	2.6	3.2	3.4	3.7
Mean Anglers Per Party	2.6	2.3	2.7	2.0	1.6
Target Species					
chinook	91	123	91	36	25
salmon	10	7	3		
Harvest					
chinook	11	9	12	6	7
salmon	2				
Release					
chinook	4	0	0	3	0
Catch					
inspection	5	2	4	2	2
correct ID	5	2	4	2	2
Previous Fishing					
yes (%)	14	94	81	33	24
no (%)	87	36	13	3	1
catch (chinook)	3	45	40	41	53
Harvest To Date					
0 chinook	89	121	82	29	18
1 chinook	9	9	12	5	7
2 chinook	1	0	0	2	0

Appendix 2. Interview responses by week in the lower Shuswap River chinook salmon sport fishery in the roving survey.

Week	Aug 15-17	Aug 18-24	Aug 25-31	Sep 1-7	Sep 8-12
Interviews	60	104	91	92	-
Mean Day (hr)					
All interviews	2.5	2.9	3.3	2.7	-
Incomplete					
number	58	79	83	92	-
hours	2.3	2.8	3.2	2.7	-
Complete					
number	2	25	8	0	-
hours	8.0	3.3	4.3		-
Mean Anglers Per Party	1.8	1.6	1.8	1.6	-
Target Species					
chinook	60	104	91	92	-
salmon					
Harvest					
chinook	15	13	10	17	-
salmon					
Release					
chinook	0	0	0	0	-
Catch					
inspection	8	5	4	1	-
correct ID	7	5	4	1	-
Previous Fishing					
yes (%)	30 (50)	99 (95)	87 (96)	91 (99)	-
no (%)	30 (50)	5 (5)	4 (4)	1 (1)	-
catch (chinook)	28	94	98	123	-
Harvest To Date					
0 chinook	47	91	81	75	-
1 chinook	11	13	10	17	-
2 chinook	2	0	0	0	-

Appendix 3. Interview responses by week in the lower Shuswap River chinook salmon sport fishery at Mabel Lake.

Week	Aug 15-17	Aug 18-24	Aug 25-31	Sep 1-7	Sep 8-12
Interviews	46	78	23	163	55
Mean Day (hr)					
All interviews	3.7	3.6	3.2	4.0	5.1
Incomplete					
number	31	25	6	54	8
hours	4.2	3.7	3.0	3.4	2.5
Complete					
number	15	53	17	109	47
hours	2.8	3.6	3.2	4.3	5.6
Mean Anglers Per Party	2.5	2.3	2.3	2.2	2.2
Target Species					
chinook	40	65	18	142	44
salmon	6	13	5	21	11
Harvest					
chinook	0	5	5	8	5
salmon	1	1	2	8	6
Release					
chinook	0	0	1	0	0
salmon	0	0	0	5	11
Catch					
inspection	0	2	1	3	0
correct ID		2	1	3	
Previous Fishing					
yes (%)	32 (69)	49 (63)	18 (78)	148 (91)	55 (100)
no (%)	14 (30)	29 (37)	5 (22)	15 (9)	
catch (chinook)	7	11	2	89	55
Harvest To Date					
0 chinook	45	72	19	148	45
1 chinook	0	5	3	15	5
2 chinook	0	0	0	0	0

Appendix 4. Interview responses by week in the middle Shuswap River chinook salmon sport fishery at the Canyon Pool.

Week	Jul 25-27	Jul 28-Aug 3	Aug 4-10	Aug 11
Interviews	37	89	72	16
Mean Day (hr)				
All interviews	3.0	3.9	3.6	4.9
Incomplete				
number	14	32	27	0
hours	1.7	3.2	2.6	
Complete				
number	23	57	45	16
hours	3.8	4.3	4.2	4.9
Mean Anglers Per Party	1.8	1.7	1.9	1.9
Target Species				
chinook	37	89	72	16
salmon				
Harvest				
chinook	1	5	4	7
rainbow		1		
Release				
chinook	1 (jack)	1	1	1
rainbow		1		
Catch				
inspection	1	8	3	7
correct ID	1	8	3	7
Previous Fishing				
yes (%)	13 (35)	67 (75)	53 (74)	13 (81)
no (%)	24 (65)	22 (25)	19 (26)	1 (6)
catch (chinook)	1	14	23	13
Harvest To Date				
0 chinook	36	84	68	10
1 chinook	1	5	4	5
2 chinook	0	0	0	1

Appendix 5. Interview responses by week in the middle Shuswap River chinook salmon sport fishery for the roving survey.

Week	**Jul 25-27**	**Jul 28-Aug 3**	**Aug 4-Aug 10**	**Aug 11**
Interviews	24	52	68	38
Mean Day (hr)				
All Interviews	2.3	2.9	3.3	3.3
Incomplete				
number	23	43	58	31
hours	2.3	2.7	3.4	3.2
Complete				
number	1	9	10	7
hours	2.0	3.8	2.6	4.0
Mean Anglers Per Party	2.4	2.0	2.4	2.2
Target Species				
chinook	23	52	68	38
rainbow	1			
Harvest				
chinook	3	1	14	22
salmon				
Release				
chinook	0	2	5	9
salmon				
Catch				
inspection	2	1	7	18
correct ID	2	1	7	18
Previous Fishing				
yes (%)	4 (17)	33 (63)	58 (85)	32 (84)
no (%)	20 (83)	19 (36)	10 (15)	5 (13)
catch (chinook)	0	4	46	50
Harvest To Date				
0 chinook	21	51	56	19
1 chinook	3	1	10	16
2 chinook	0	0	2	3