

# **Angler Effort and Catch in the 1996 Lower Fraser River Sport Fishery**

A.R. Walter, V. Palermo, K.J. Scott, and A.S. Thompson

Fisheries and Oceans Canada  
Science Branch, Pacific Region  
610 Derwent Way, Annacis Island  
New Westminster, British Columbia  
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## ABSTRACT

Walter, A.R., V. Palermo, K.J. Scott, and A.S. Thompson. 1998. Angler effort and catch in the 1996 lower Fraser River sport fishery. *Can. Manuscr. Rep. Fish. Aquat. Sci.* 2470: 26 p.

The lower Fraser River mainstem recreational fishery was assessed from 1985 to 1988 and again in 1995, using an access point/overflight survey design. From June 6 to August 31, 1996, another recreational fishery survey was conducted on the lower Fraser River using the same study design, but with a new data entry and analysis program. The survey focused on angler effort and the harvest and release of chinook (*Oncorhynchus tshawytscha*) and sockeye (*O. nerka*) salmon.

Over the course of the survey, 25 overflights and 4,752 angler interviews were conducted. Angler effort was estimated at 212,205 hours. Total harvests of chinook (adults and jacks combined) and sockeye were estimated at 3,262 and 9,371, respectively. Chinook and sockeye released were estimated at 154 and 8,369, respectively.

The 1996 early season (June and July) chinook catch was down considerably from 1995, due to high water levels. Total August catch for chinook increased from 1995 to 1996, possibly due to a greater abundance of chinook in the lower Fraser River during this month. Catch rates for sockeye increased dramatically from 1995 to 1996. Due to high water levels, angler effort in June and July was down compared to 1995. In August, as the water levels dropped and the sockeye fishery opened, angler effort increased considerably, to almost double the 1995 effort.

**Key Words:** lower Fraser River, sport fishery, chinook salmon, sockeye salmon, angler effort, catch, harvest, release.

## RÉSUMÉ

Walter, A.R., V. Palermo, K.J. Scott, and A.S. Thompson. 1998. Angler effort and catch in the 1996 lower Fraser River sport fishery. Can. Manuscr. Rep. Fish. Aquat. Sci. 2470: 26 p.

La pêche sportive dans le bras principal du cours inférieur du Fraser a fait l'objet d'une évaluation de 1985 à 1988, puis de nouveau en 1995, par une méthode combinant les points d'accès et le survol aérien. Du 6 juin au 31 août 1996, un autre relevé de la pêche sportive a été effectué sur le cours inférieur du Fraser par la même méthode, mais avec un nouveau système d'entrée et d'analyse des données. L'accent était mis sur l'effort de pêche à la ligne et sur la capture avec graciation du quinnat (*Oncorhynchus tshawytscha*) et du saumon rouge (*O. nerka*).

Dans le cours du relevé, 25 survols ont été effectués, et 4 752 entrevues avec des pêcheurs ont été réalisées. L'effort de pêche a été estimé à 212 205 heures. Les captures totales de quinnats (adultes et jacks combinés) et de saumons rouges ont été estimées respectivement à 3 262 et 9 371. On estime à 154 et 8 369 respectivement le nombre de quinnats et de saumons rouges graciés.

Au début de la saison 1996 (juin et juillet), les prises de quinnats étaient fortement en baisse par rapport à 1995, ce qui était dû au niveau élevé des eaux. Les prises totales de quinnat en août ont augmenté entre 1995 et 1996, ce qui peut être attribuable à la plus grande abondance du quinnat dans le cours inférieur du Fraser au cours de ce mois. Les taux de capture du saumon rouge ont grimpé de façon spectaculaire entre 1995 et 1996. À cause du niveau élevé des eaux, l'effort de pêche sportive en juin et juillet était plus bas qu'en 1995. En août, quand les eaux ont baissé et que la pêche du saumon rouge a ouvert, l'effort de pêche a considérablement augmenté, pour atteindre près du double de celui de 1995.

**Mots clés :** cours inférieur du Fraser, pêche sportive, quinnat, saumon rouge, effort de pêche sportive, captures, prélèvements, graciation.

## INTRODUCTION

The Fraser River downstream of Hope supports a year round sport fishery that targets all five salmon species (*Oncorhynchus* spp.), sturgeon (*Acipenser* spp.), and steelhead (*O. mykiss*), rainbow (*O. mykiss*) and cutthroat (*O. clarki*) trout. Previous studies describe the lower Fraser River sport fishery as one of the largest in British Columbia (Mosley MS, 1983; DPA Group MS, 1985; Schubert, 1992b).

The lower Fraser River recreational fishery was studied by creel survey from 1985 to 1988. The study focused on angler effort and catch of salmon and trout in the lower 150 km of the Fraser River, below Hope BC. In 1995, the lower Fraser River recreational fishery was again studied by creel survey. The focus of the 1995 study was expanded to include angler effort and catch of sockeye (*O. nerka*) and pink (*O. gorbuscha*) salmon, which could not be legally taken during the 1985 to 1988 creel surveys (Bratty et al., 1998. in prep.). Assessment of the lower Fraser River recreational fishery continued in 1996, with a creel survey focusing on angler effort and catch of chinook (*O. tshawytscha*) and sockeye salmon. Pink salmon were not assessed, since upstream spawning migration of pinks does not occur in the Fraser River in even numbered years.

This report describes the methods and procedures of the 1996 survey and details the total angler effort, harvest per unit effort (HPUE), release per unit effort (RPUE), and catch per unit effort (CPUE) for the lower Fraser River between the Sumas River and the Agassiz/Rosedale powerline, from June 6 to August 31, 1996. The results are compared with previous lower Fraser River recreational fishery surveys. Finally, recommendations are made for future surveys and management of the recreational fishery on the lower Fraser River.

## STUDY AREA

The Fraser River is the largest river in British Columbia, draining most of the southern half of the province. From its headwa-

ters in the Rocky Mountains, the Fraser River flows 1,350 km through the central interior, entering the Strait of Georgia in the southwestern corner of the province near Vancouver, BC.

The final 150 km stretch of the Fraser River below Hope flows through the alluvial floodplain of the Fraser Valley, bounded to the north by the Coast Mountains and to the south by the Cascade Range (Figure 1). The mean daily discharge for the Fraser River in the Hope area is 2,450 m<sup>3</sup>/s (Water Survey of Canada, 1996). The average width of this section of the Fraser River is 600 meters. Maximum freshet width is 5 km in some areas. The Fraser River is tidal as far upstream as the City of Chilliwack, approximately 90 km from the river's outlet.

Schubert (1992b) separated the lower Fraser River into four study regions (Figure 1). The 1996 study focused on the last two regions (Regions 3 and 4) from the outlet of the Sumas River to the Agassiz/Rosedale powerline, which crosses the Fraser River near the upstream end of Ferry Island. This section of the Fraser River was chosen as the study area for the 1995 Fraser River sport fishery survey and has historically accounted for the highest harvest of chinook salmon in the lower Fraser River (Schubert, 1992b).

Region 3 extended from the outlet of the Sumas River to the outlet of the Harrison River (Figure 1). The region is characterized by many treed islands and mid-channel bars that become exposed as the water level of the Fraser River drops. Angler effort was concentrated at the Sumas River outlet, Bowmans bar and Wellington bar. Interviews in Region 3 were conducted at the boat launch at Englebrich bar (locally known as Island 22).

Region 4 extended from the outlet of the Harrison River to the Agassiz/Rosedale powerline (Figure 1). This region is similar to Region 3, containing many bars and treed islands. Anglers were concentrated at Pegley bar, Gill bar and the exposed bars offshore from Ferry Island (Figure 1). Interviews in Region 4 were conducted at Gill

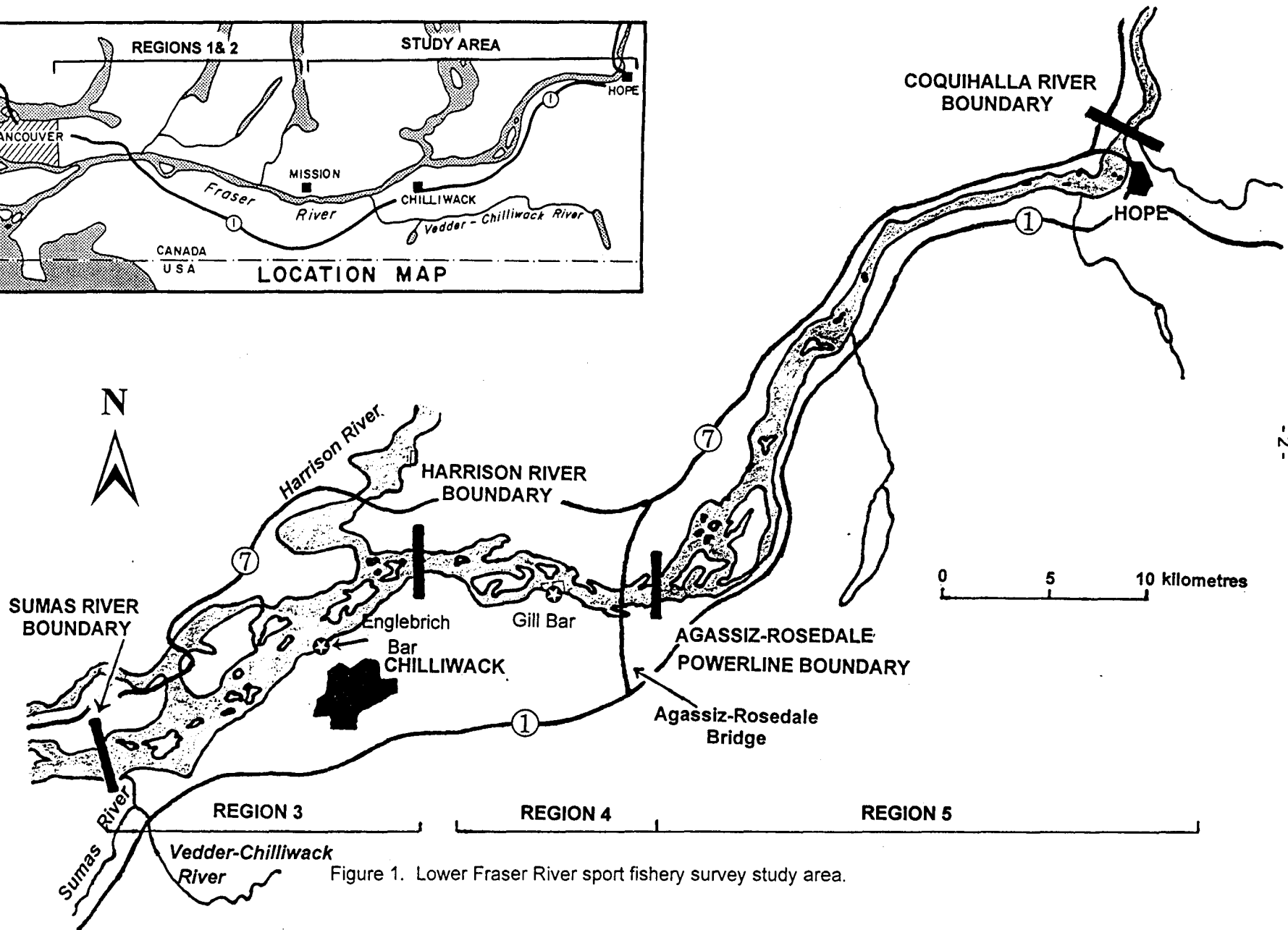
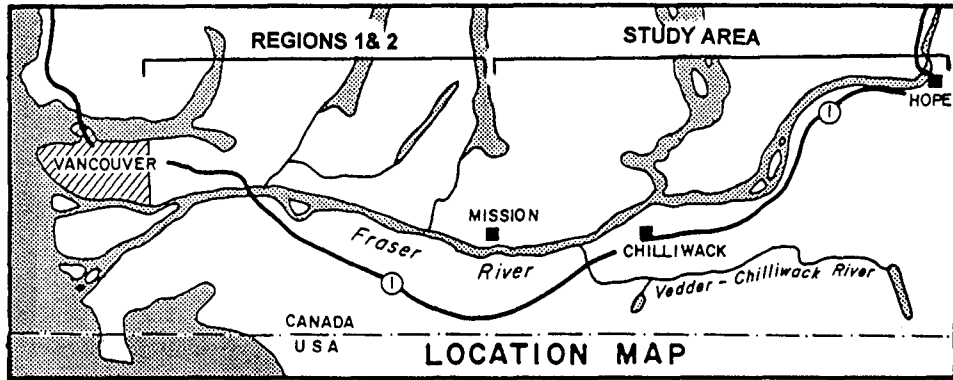


Figure 1. Lower Fraser River sport fishery survey study area.

Pegley bar, Gill bar and the exposed bars offshore from Ferry Island (Figure 1). Interviews in Region 4 were conducted at Gill bar. The 1985-1995 studies extended Region 4 to the outlet of the Coquihalla River (Bratty et al., 1998. in prep.). Due to budget constraints, the 1996 survey did not include the section of the Fraser River from the Agassiz/Rosedale powerline to the Coquihalla River. In 1996, this section of river was designated as Region 5 (Figure 1).

### FISHERY REGULATIONS

The 1996 lower Fraser River sport fishery was managed by daily and annual catch limits, fish size restrictions, and fishing time restrictions (Table 1). During the survey, the daily catch limit for chinook was 4 per day, 1 of which could be over 50 cm. The annual catch limit of chinook adults (over 62 cm) was 10. The sockeye sport fishery opened on August 10 and remained open for the duration of the survey. The daily catch limit of sockeye was 2 per day 30 cm or over. There was no annual catch limit for sockeye. The aggregate limit of salmon was 4 per day.

### METHODS

#### STUDY DESIGN

The lower Fraser River sport fishery was assessed from June 6 to August 31, 1996. The study design, which was similar to that of the 1995 lower Fraser River sport fishery survey, used a combined access point and overflight survey (DPA Group MS, 1985a; Bratty et al., 1998. in prep.). The access point survey allowed for a high proportion of complete trip interviews, while the overflight survey effectively covered the whole study area.

The access point/overflight survey design was based on the assumption that either interview sites were representative of the entire study area, or the proportion of angler effort at the interview sites was large enough to make HPUE estimates insensitive to effort occurring at non-interview sites. These assumptions were not believed to be violated in the 1996 survey because of the

high concentration of angler effort at the interview sites, in proportion to the rest of the survey area. Anglers tended to concentrate at 3 or 4 major bars and did not tend to move between bars. During the 1995 lower Fraser River sport fishery survey it was also concluded that these assumptions were probably not violated (Bratty et al., 1998. in prep.).

A total of 4,752 angler interviews and 25 overflights were conducted between June 6 and August 31 in the 1996 lower Fraser River sport fishery survey (Table 2).

#### Access Point Methods

One interviewer was stationed in each region, at a site chosen for maximum expected angling effort. Interviews were conducted from June 6 to August 31, 1996, and were stratified by month into weekday and weekend (including holiday) day types. Interviews took place on all weekend days and holidays and on an average of three weekdays per week at each region. Interview days were divided into morning and afternoon shifts lasting from 7:00 a.m. to 3:00 p.m. and from 2:00 p.m. to 10:00 p.m.. Shifts were scheduled to allow at least two morning shifts and two afternoon shifts on both weekends and weekdays at each site. This fulfilled the minimum monthly site effort requirement (Bratty et al., 1998. in prep.).

Each shift started with interviewers requesting anglers to take part in the survey at the end of their fishing trip. Hourly rod counts were then conducted to build effort profiles and all anglers exiting the site were interviewed. At the end of each shift an incomplete interview was conducted on all anglers that were still fishing at the interview site. Total complete and incomplete interviews were then tallied for the day on an angler count summary form. Interview questions included: number of anglers in the party, completed or intended length of fishing trip, time blocks fished, target species, fishing gear used, total kept marked or unmarked species and total released species. With the anglers' permission, any kept fish were inspected by the interviewer to verify species and mark identification.

Table 1. Fraser River (Mission to Hope) nontidal fishery regulations for chinook and sockeye during the 1996 lower Fraser River sport fishery survey.

Location	Species	Openings	Daily Catch Limits	Annual Catch Limits
Mission Br. to Powerline above Agassiz/Rosedale Br.	Chinook	June 1- Sept 3	4 per day 30 cm or over 1 of which may be >50 cm.	10 Adults >62 cm
	Sockeye	Aug 10-Sept 3	2 per day 30 cm or over	-
Powerline to Alexander Br.	Chinook	June 1 -Dec 3	4 per day 30 cm or over 1 of which may be >50 cm.	10 Adults >62cm
	Sockeye	Aug 10-Sept 3	2 per day 30 cm or over	-

**Overflight Methods**

An average of two overflights per week (one on weekdays and one on weekends) was scheduled for the duration of the survey. All overflights covered Regions 3 and 4. At least once a month Regions 2 and 5 were also included to observe distribution of effort outside the study area.

Overflights were conducted primarily with a Cessna 182 traveling 30 m above the water, at an average speed of 130 kph. All surveys began at 11:30 a.m. and lasted between 1 and 2 hours, depending on the number of regions flown and the amount of angler effort observed.

When conducting overflights, two observers were positioned on the same side of the plane. Rod counts and flight times over high effort bars were recorded on a study area map of the lower Fraser River. These maps were then compiled to build angler effort profiles and to provide mean daily rod counts for the study area, as well as for specific bars and regions.

**DATA MANAGEMENT**

Historical data management and analytic procedures are thoroughly outlined in Schubert (1992a, 1992b) and Schubert and Whyte (1992). The methodology is reprinted below with relevant modifications.

The use of historical data management programs became increasingly problematic during the 1995 creel survey program, resulting in high rates of input errors and frustration for the data entry staff (R. Diewert, pers. comm.). A review of these programs in 1996 found that the data management and analysis functions were performed by a collection of DOS executable files, with little or no accompanying documentation. In some cases it was impossible to discern what language was used to write the programs, and because the source code was non-existent, it was impossible to perform improvement modifications. For these reasons, we decided that the entire data management and analysis functions would be re-written for the 1996 creel program. This was undertaken with the following specific objectives in mind: 1) the programs would be fully documented with annotated source code and documentation to ease subsequent modification and development; 2) the source language would be a modern generation language, capable of relational database support and running in a Microsoft Windows environment both in 16 and 32 bit versions, taking full advantage of the modern graphical interface design; 3) there would be support for upgrading the database structures to Access and/or Oracle tables when and if necessary; and 4) the system would be modular, allowing greater flexibility for modifications.

The Delphi development system by Borland met all these criteria and was therefore used to develop the database management system for the 1996 creel program. The Delphi language is based on PASCAL rather than C, offering greatly improved annotated code and reduced cryptic language structures. Three other major features of this system made it very attractive for this project: 1) the Delphi system enables rapid development by tightly integrating the design process with the use of intelligent components, in fact, the entire data entry section was completed and debugged to beta stage within two months; 2) the system produces a native code compiled executable that runs much faster than an interpretative system such as Microsoft's Visual Basic, and 3) Delphi can also compile .OBJ files for integration with C++ and other development systems and exists in two flavours. Delphi 1.0 will compile a 16-bit executable for use on older computers running Windows version 3.x. The 16-bit executable will also run on modern computers with the Windows 95 operating system. Delphi 2.0 produces 32-bit executables which will run on Windows 95 and Windows NT operating systems, virtually without changes in source code. We have produced both 16 and 32 bit versions of the program, with the more extensive analysis components in the 32 bit version, to take advantage of the execution speed increase and memory space increase afforded under the 32 bit version. The 16 bit version is primarily used as a vehicle for data entry and editing functions on machines running Windows versions 3.x. Currently, the program consists of approximately 4200 lines of code and compiles into an executable file of .6 MB in size.

Delphi also supports modern relational database design, using the Borland Database Engine. Although we originally designed the database using Microsoft Access tables interfaced through an ODBC connection with Delphi, we discovered that using Paradox table formats directly through the BDE proved to be much faster, more efficient, and less prone to error. We were also able to copy the data tables to ASCII, Oracle, and Access formats without difficulty, demonstrating the

flexibility of the Delphi/Paradox/BDE combination.

The program is modular in design and presents the user with selection choices for the category of data to input, edit, or analyse. For each main data category, (interview data, overflight data, effort verification) the program displays visually clear and intelligent forms to aid the entry of the data. Specific mandatory fields are checked for completeness and the entered data is verified for allowable ranges. These design criteria and procedures were proven to be effective in a post-season review of all the data, which indicated data entry error rates of less than .5%.

The creel database has a modern relational design consisting of related data tables that can be grouped by two main functions: support tables and data tables. The following are support tables: 1) the Bar Table consists of uniquely identified river bars and their location by regional association, and is used extensively to identify sampling locations and locations of overflight observations; 2) the Species Table uniquely identifies the species of fish likely to be observed in the survey, and is extensively used to organise information on the basis of unique species groupings; 3) the Periods Table is used to track stint information later used in analysis, and 4) the Region Table lists the unique regions and their identifiers.

Data tables include: 1) the Angler Interview Table set, a group of tables linked together by a unique interview number, which is also linked to an interview sheet for subsequent editing and data verification. The tables in this set are a) the Angler Interview data table, b) the Catch/Release data table, c) the Gear Used table, and d) the Hours Fished by the Angler table. The other data tables are: 2) the Overflight Table, where the information from the unique overflights is recorded, and 3) the Rod count table, where the observed rod counts, later used for effort verification, are recorded by hour. A complete description of these tables, their relationships and the computer programs are documented in Palermo (in prep.).

For 1997, we expect to improve the design of the program in several areas. A new module for printing out the raw data will be completed, and some of the data entry functions will be made more efficient. The analysis section will be expanded to include data graphing capabilities and some non-parametric statistical functions. The entire program will be made more general to set up and use. With this modification it can easily be adapted to other creel survey programs using a similar survey design.

**DATA ANALYSIS**

Before the analysis algorithms were performed, data were stratified according to region, site, month, day type (weekday or weekend/holiday), day, hour, and stint. Days were divided into three stints: the period of overlap between a.m. and p.m. shifts, and the a.m. and p.m. shifts outside the overlap period. Stratification allowed the appropriate weighting of interview and overflight data.

**Angler Effort**

Angler effort profiles were generated from hourly rod counts at the survey sites. Effort information from outside the survey shifts (prior to 07:00 and after 22:00) was reconstructed from the interview data and used to adjust the daily angler effort profile. Hourly effort was also weighted to compensate for the sampling imbalances resulting from overlapping survey shifts. Mean sample day effort for each stratum (region, month and day type) was the ratio of the mean overflight rod count to the proportion of daily effort occurring during the overflight 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, with variance calculations detailed in Schubert and Whyte (1992).

- 1) Estimated total rods fishing by hour (*j*) and day type (*h*):
 
$$\hat{R}_{hj} = \sum_i N_h / n_{hij} \sum_k r_{hijk}$$
- 2) Estimated proportion of the daily angler effort occurring during the

instantaneous rod count time block, 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, by day type:

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

- 4) Estimated angler effort 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 count time (*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 region and day type for each species and mark group, using a total ratio estimator (Von Geldern, Jr. and Thomlinson, 1973; Malvestuto, 1983), i.e., the total estimated catch was divided by the total estimated effort (to time of interview). Estimates were derived from interview data weighted in two ways: 1) by the proportion of stints that were surveyed, and 2) 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 considered unreliable. The mathematical relationships are reported below.

- 6) Estimated monthly catch to time of interview at the survey sites by region and 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 monthly angler hours to time of interview at the survey sites by region and 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 by region and day type:

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

where:

- $a_{hil}$  = proportion of monthly 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  $l$  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  $h$ .

However, 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:

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

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

where:

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

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

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

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

If  $(\bar{c}_c - \bar{c}_t) \pm (t\text{-table}, 0.95) Var(\bar{c}_c - \bar{c}_t)$  did not include zero, the difference was significant. In that case, incomplete trip interviews were excluded from the analysis for that site. In the 1996 survey, less than 8% of all interviews were incomplete; all of these were excluded from analysis.

### Harvest and Release

Monthly regional harvest and release, estimated by species and mark group, was the sum of the weekday and weekend/holiday strata estimates. For each stratum, harvest and release was the product of stratum effort and the corresponding value of HPUE or RPUE.

- 10) Total study period catch (C):

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

### Angler Characteristics

Several unweighted angler attributes were also summarised by site and month (Appendix 1). These were: party size, mean angler day length, preferred species, gear type, mean angler day length, and harvest on the angler's most recent trip. Study period mean angler day length was calculated from site-specific data from complete trip interviews only.

## Angler Response Verification

The ability of anglers to recall total trip length was evaluated throughout the study. The survey technician recorded the actual time the angler began fishing and, upon the angler's return, a normal interview was conducted and the angler's estimate of time fished was recorded. By comparing the actual time fished, as measured by the survey technician with the estimated amount of time fished, as perceived by the angler, an indication of the accuracy of angler responses regarding time fished was obtained. The ability of anglers to recall subsequent trip length was also recorded, but was not evaluated as only complete trip interviews were used for effort and catch estimates.

## RESULTS

The 1996 lower Fraser River sport fishery survey was conducted between June 6 and August 31. Catches during the three month study included chinook and sockeye salmon, as well as sturgeon and several trout species. Survey effort, total angler effort, CPUE, HPUE and RPUE estimates by species and total catch and release by species are detailed below.

### SURVEY EFFORT

The study period included 60 weekdays and 27 weekend/holiday days, of which 57% and 100% were sampled, respectively. The number of interviews per month increased from June (1,109), to August (2,404). Sixty-five percent of the interviews were conducted at Englebrich bar in Region 3, with the remaining 35% conducted at Gill bar in Region 4.

An average of 8 overflights was conducted each month (9 in August) over Regions 3 and 4. Mean daily rod counts for Regions 3 and 4 ranged from 60 to 223 on weekdays and 166 to 261 on weekends and holidays (Appendix 2). The peak rod count for the study area (375) occurred on June 29. On average, 69% of the anglers in the study area were observed in Region 3, with the remaining 31% observed in Region 4.

## ANGLER EFFORT

### Daily Profile

Anglers fished during the daylight hours with peaks in effort generally occurring between 8:00 a.m. and 10:00 a.m. (Figures 2a and 2b, Appendix 3). Other peaks occurred at noon and between 4:00 p.m. and 7:00 p.m.. Daily effort profiles were rarely bimodal. Angling effort during evening hours (between 8:00 p.m. and 10:00 p.m.) dropped monthly from June to August.

### Total Angler Effort

Total estimated angler effort from June through August was 212,205 hours or 38,235 days. Angling effort was greater in Region 3 (66% of total effort) than in Region 4 and monthly angling effort increased steadily from June (43,687 hours) to August (103,949 hours). Sixty-two percent of the angling effort took place on weekdays. Angler effort totals by month and region are presented in Table 2 and Appendices 4a,b, and c.

## CATCH PER UNIT EFFORT

CPUE and HPUE for adult and chinook jack and sockeye are presented in Figure 3 and Appendix 5. Peak and average CPUEs are described below by month, region and day type. The proportion of harvested fish to total catch is also described, along with the average angler success rate (proportion of anglers harvesting at least one fish per trip).

CPUE, HPUE and RPUE of all other species caught in the study area during the survey are detailed in Appendix 5. Following chinook and sockeye, sturgeon and trout species were the main targets and had average CPUEs from June to August of 0.0009 and 0.0005, respectively.

Chinook adult and jack CPUE, expressed as the number of fish caught per hour, averaged 0.0151 and 0.0010, respectively, in June and August. CPUE peaked in July (0.0204) for adult chinook and in August

(0.0018) for chinook jacks. Most of the catch was harvested, with HPUEs averaging 0.0144 and 0.0007, respectively, for chinook adults and jacks. In Region 3, CPUE was highest for adult chinook during July (0.0231), and for chinook jacks during August (0.0033).

Average weekend and weekday CPUE for adult chinook from June to August were 0.0137 and 0.0160, respectively. Average weekend and weekday CPUE for chinook jacks from June to August were both 0.0010. The peak weekend CPUE for adult chinooks occurred in Region 3 during July (0.0218). The peak weekday monthly CPUE for adults occurred in Region 3 during June (0.0253). Both peak weekend and weekday monthly CPUE for chinook jacks occurred in Region 3 during August (0.0028 and 0.0036, respectively).

In June, 10% of the anglers harvested at least one adult chinook. In July, the success rate rose to 13% and, in August, dropped to 5%. The highest success rate was among Region 3 anglers in July (14%). The average proportion of anglers harvesting at least one chinook jack ranged from 0% in July to 1% in August.

Sockeye CPUE during the August opening was 0.1679 for the entire study area. On average, 54% of the sockeye caught in August were harvested (August HPUE was 0.0900). Sockeye CPUE for the entire study area was almost twice as high on weekdays (0.1965) as on weekends (0.1068). In Region 4, sockeye weekday and weekend CPUE was highest in August, at 0.2914 and 0.1101, respectively.

On average, 23% of the anglers within the study area harvested at least one sockeye per trip during the August opening. Region 4 had a success rate of 25%, compared to 21% in Region 3; the difference between these rates was not significant.

#### **TOTAL CATCH**

A total catch of 3,208 adult chinook, 208 chinook jacks and 17,740 sockeye, representing 98% of the total sport catch, was

estimated for the study area from June to August. Monthly harvest and release totals for all species are detailed in Table 2. Harvest and release totals by month and region are detailed in Appendices 4a, b, and c.

Chinook were caught throughout the study period, with their catch peaking in July (41% of total catch) for adults, and in August (90% of total catch) for jacks. Over 85% of adult chinook and 95% of jacks were caught in Region 3. A total of 95% of the combined chinook catch was harvested.

Seventy percent of the sockeye caught were in Region 4 during the August sockeye opening. Less than 1% of the total harvest (illegal) and 3% of the total release for the entire study period occurred between June and July (before the sockeye opening).

#### **MARKED CATCH**

Less than 1% of the fish examined during the study were marked with an adipose fin clip or any other mark. Marked fish estimates are presented in Table 3. Interview staff did not consider angler mark recognition reliable and hence, these numbers are probably underestimates.

#### **ANGLER CHARACTERISTICS**

Weekly and site-specific angler characteristics are detailed in Appendix 1. Anglers changed their gear and fishing location, as well as target species, in accordance with changes in river conditions, species composition, species abundance and fishery openings.

The majority of anglers in the 1996 lower Fraser River sport fishery fished from shore or from mid-channel gravel bars, as they became exposed. During high water in June, anglers fished from boats offshore from submerged bars. Some angling by boat also occurred at the mouths of the Sumas and Harrison Rivers. Anglers were rarely spotted "in transit" to other bars and generally fished in only one spot per trip.

During June and July, when chinook were the most abundant salmon species in

Table 2. Harvest, release and angler effort by species and month in the 1996 lower Fraser River sport fishery, Regions 3 and 4.

	JUNE	JULY	AUGUST	TOTAL
# of Interviews	1,109	1,239	2,404	4,752
# of Overflights	8	8	9	25
<b>ANGLER EFFORT</b>				
Estimated Effort (hours)	43,687	64,569	103,949	212,205
Estimated Effort (days)	7,519	10,121	20,873	38,235
Average Angler Day (hours)	6	6	5	6
<b>ESTIMATED HARVEST</b>				
Chinook	744	1,240	1,077	3,061
Jack Chinook	0	21	180	201
Sockeye	0	12	9,359	9,371
Pink	0	0	0	0
Coho	0	0	0	0
Chum	0	0	0	0
Steelhead	0	0	0	0
Trout	0	0	15	15
Sturgeon	0	0	0	0
Other	0	0	0	0
<b>ESTIMATED RELEASE</b>				
Chinook	27	77	43	147
Jack Chinook	0	0	7	7
Sockeye	18	257	8,094	8,369
Pink	0	0	0	0
Coho	0	0	0	0
Chum	0	0	0	0
Steelhead	0	0	0	0
Trout	34	15	38	87
Sturgeon	36	23	138	197
Other	34	20	15	69

the lower Fraser River, anglers fished with rods set in holders driven into the gravel. In August, as sockeye entered the system, those anglers targeting sockeye generally spin casted or drift fished.

Ninety-nine percent of the anglers interviewed were targeting either adult chinook or sockeye salmon. During June and July, when the lower Fraser River was closed to sockeye, and adult chinook were abundant, 98% of the anglers targeted adult chinook. In August, as sockeye entered the system and

the sockeye fishery opened, interest in chinook dropped, with only 28% of anglers targeting chinook, as opposed to 72% targeting sockeye. The difference in target species between regions also changed as sockeye entered the system. In Region 4, chinook and sockeye were targeted evenly, with 55% targeting sockeye, whereas in Region 3 most anglers targeted sockeye (88%).

Ninety-eight percent of anglers used lures as their gear type, with the remainder using either bait (when targeting sturgeon) or

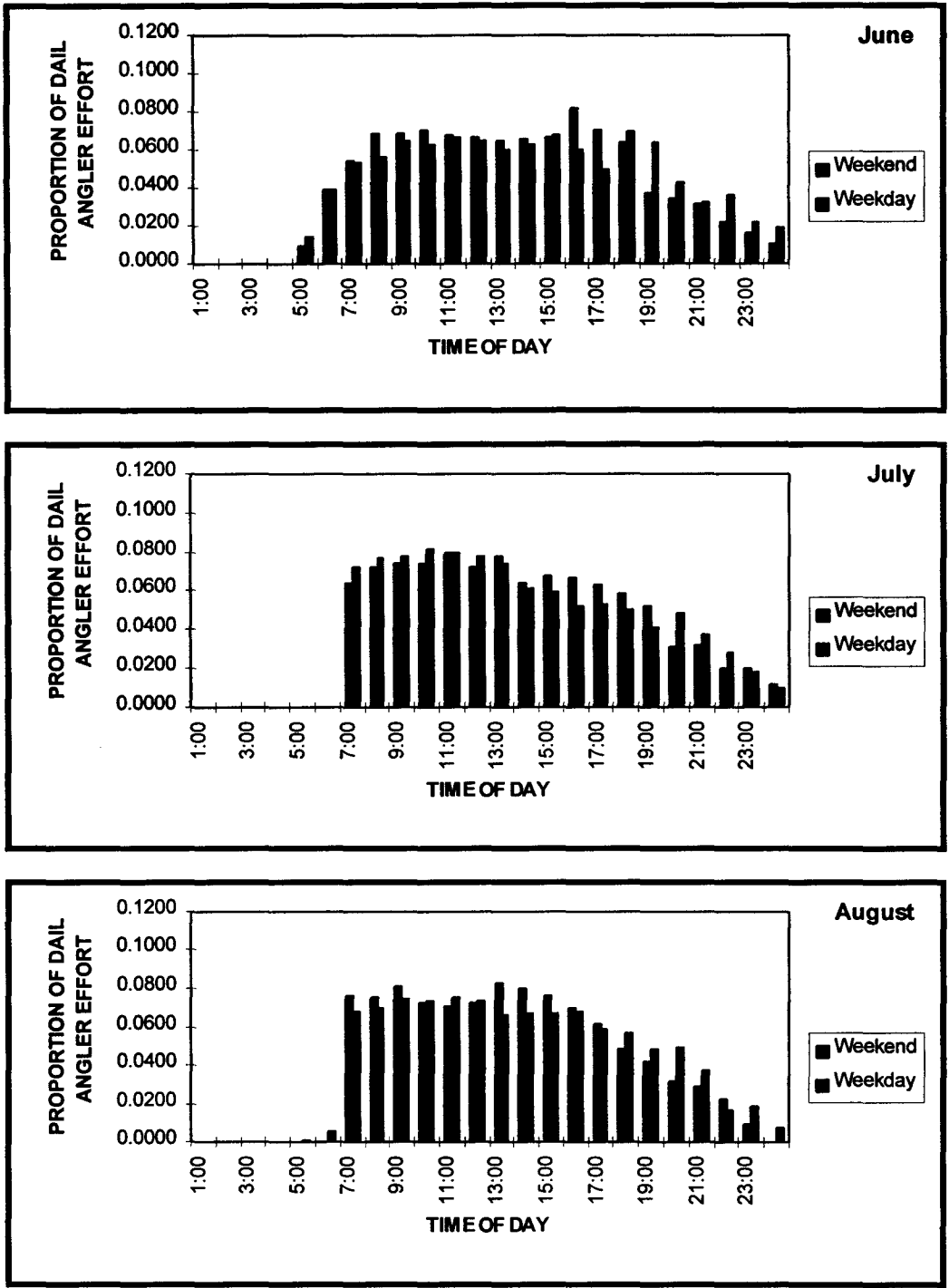


Figure 2a. Hourly effort profiles by month and day type in the 1996 lower Fraser River sport fishery, Region 3.

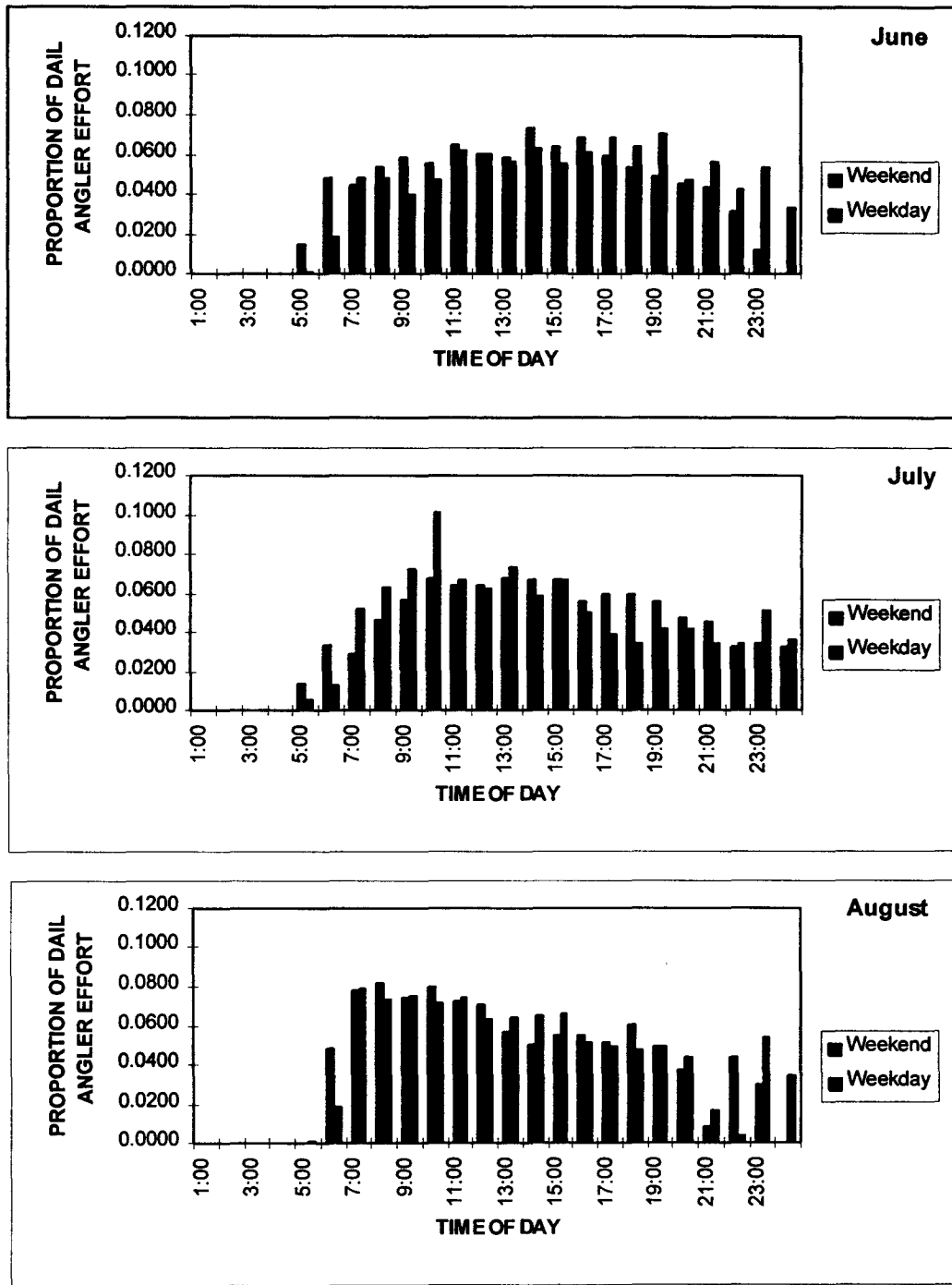


Figure 2b. Hourly effort profiles by month and day type in the 1996 lower Fraser River sport fishery, Region 4.

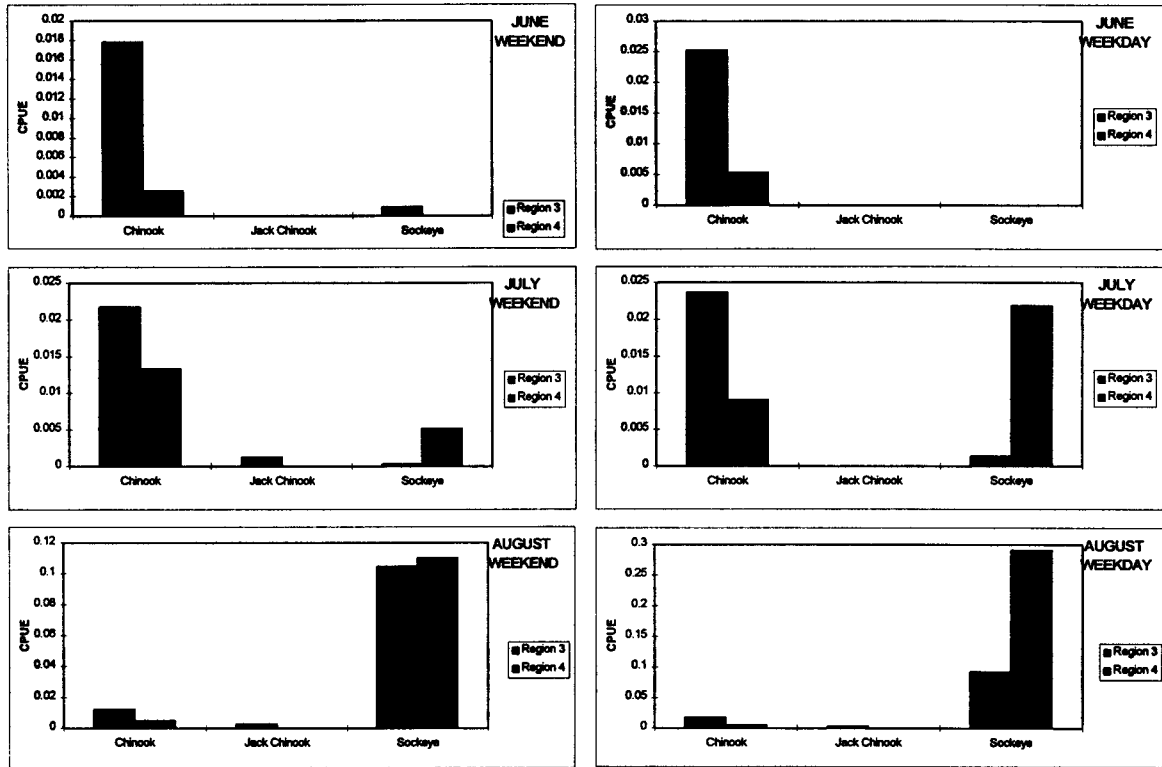


Figure 3. CPUE by species, month, day type and region in the 1996 lower Fraser River sport fishery.

bait and lure combinations. Less than 1% (only 4) of the anglers fly fished.

Mean angler trip length over the study period was 5.55 hours. Trips were longest in July (6.38 hours) and shortest in August (4.98 hours). Average trip lengths were always shorter in Region 4 than in Region 3.

Table 3. Estimated marks by species and month in the 1996 lower Fraser River sport fishery, Regions 3 and 4.

	June	July	August	Total
Chinook	12	0	0	12
Jack Chinook	0	0	0	0
Sockeye	0	0	0	0
Pink	0	0	0	0
Coho	0	0	0	0
Chum	0	0	0	0
Steelhead	0	0	0	0
Trout	0	0	0	0
Sturgeon	0	0	0	0
Other	0	0	0	0

### ANGLER RESPONSE VERIFICATION

Anglers were able to recall trip length accurately during the 1996 lower Fraser River sport fishery survey. Most anglers were able to estimate their trip length to within 0.5 hours of its actual length (Figure 4). Only 2 anglers deviated by more than one hour and only one angler deviated by more than two hours.

### DISCUSSION

As previously explained, Region 4 boundaries were reduced in the 1996 lower Fraser River sport fishery survey. Due to these modifications, any comparisons with previous fisheries will focus on Region 3 only unless specifically stated otherwise.

### MIGRATION TIMING ABUNDANCE

In the 1996 lower Fraser River sport fishery survey, monthly and regional catch

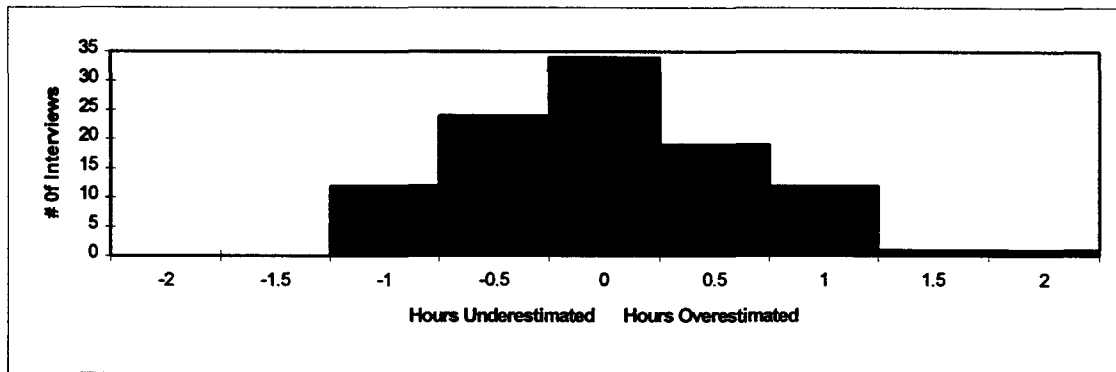


Figure 4. Differences, in half-hour increments, between actual time fished and angler estimates of time fished in the 1996 lower Fraser River sport fishery.

patterns, along with effort, were associated with salmon migration timing and abundance. For example, upper Fraser River chinook stocks were migrating through the lower Fraser River between June and August (Figure 5), corresponding with a high total catch of chinook (i.e., chinook accounted for 80% of the total catch in July). Test fishery results indicated a larger August run of chinook in 1996 (Figure 5) than in 1995 (Bratty et al., 1998, in prep.). This may partially explain the higher chinook catches in August 1996, compared with August 1995 (850 and 160 adults, respectively). In August, sockeye accounted for 92% of the total catch, coinciding with the peak sockeye migration through the lower Fraser River. The survey did not extend into September, and so missed the start of the Harrison River chinook spawning migration. This resulted in low catch totals for chinook jacks in this survey.

Changes in species abundance also affected angling effort and distribution on the lower Fraser River. In June and July, approximately 80% of the effort within the study area was concentrated in Region 3, which contained prime chinook angling sites (i.e., Wellington bar, which became exposed in early July). In August, as sockeye entered the lower Fraser River, effort began to shift to Region 4 (approximately 50% of total effort for August) and sites known to produce high numbers of sockeye salmon, such as Gill bar.

## ENVIRONMENTAL CONDITIONS

Interannual variation in environmental conditions can also impact the effectiveness of a fishery. Schubert and Whyte (1992) have shown that river level can affect both angler effort and success. High river levels flood the most effective fishing sites, making them inaccessible to anglers. Also, the proportion of a run that is vulnerable to a fishery is affected by the river discharge, since river discharge affects migration timing. Although the 1996 chinook fishery opened in June, water levels were still high (Figure 5), flooding many of the traditional fishing bars (i.e., Wellington and Bowmans).

Anglers targeting chinook in June were forced to fish by boat and this may have caused reduced angler effort (35,052 hours in Region 3 in June 1996 compared to 42,752 hours in June 1995).

High water may also have made chinook less vulnerable to anglers. Angler effectiveness, measured in harvest per trip (HPT), was much lower in June 1996 (0.1197) than in June 1995 (0.2424). Chinook HPUEs for June and July 1996 (0.0206 and 0.0216) were also significantly lower than in 1995 (0.0379 and 0.0285). Analysis of the proportion of anglers harvesting at least one chinook also showed that anglers were much more successful in June and July of 1995, as compared to 1996. For example, peak success rates per trip for adult

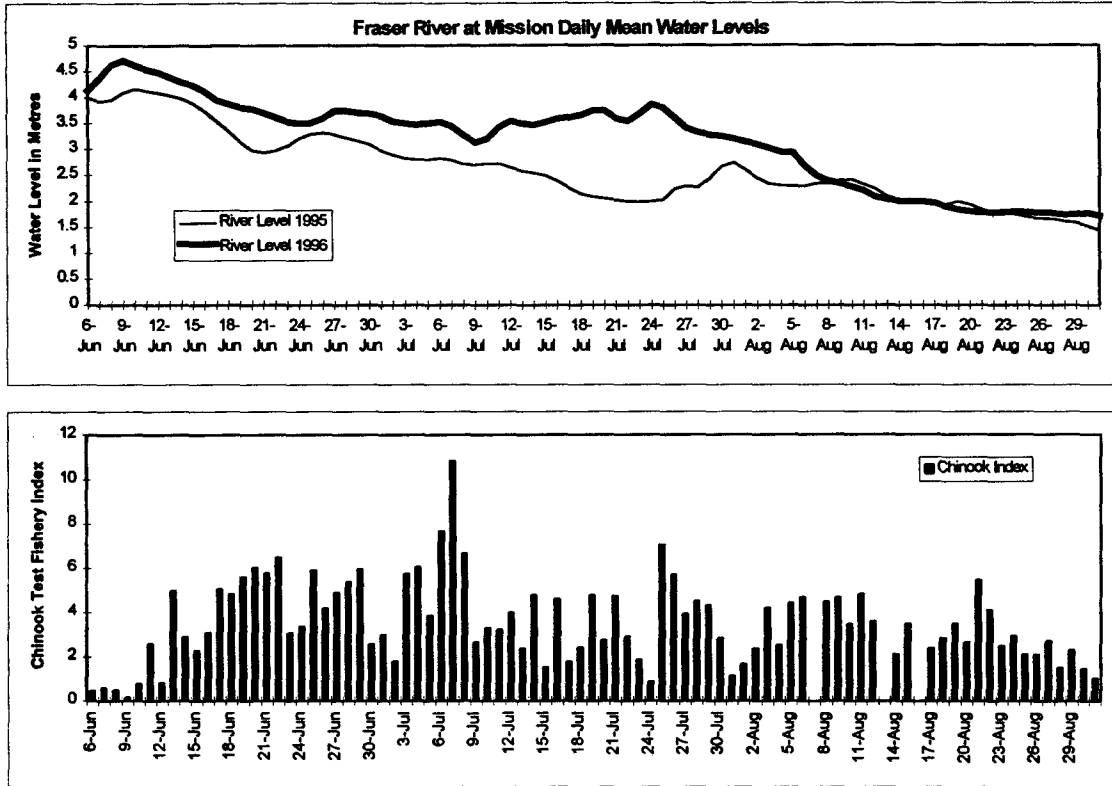


Figure 5. 1995 and 1996 river levels and 1996 chinook test fishery index.

chinook during July 1996(14%) were much lower than in 1995 (24%).

Therefore, although the test fishery indicated that the peak run of chinook began moving through the lower Fraser River in the middle of June (Figure 5), high water made it logistically harder to catch chinook. This factor resulted in low catches for chinook in June and July 1996 (741 and 1,163 adult chinook), compared with 1995 (1,789 and 2,479 adult chinook, respectively).

In contrast, August water levels were low enough to expose prime fishing bars during peak sockeye migration (Figure 5). The combination of ideal environmental conditions and peak sockeye migration resulted in an effective sockeye fishery. Average HPT rates for August 1996 were 0.4484 with 25% of the anglers in Region 4 harvesting at least one sockeye per trip.

### FISHERY REGULATIONS

Angler effort was also affected by

openings and closures in the fishery. For example, overflight rod counts doubled when the sockeye fishery opened (177 rods counted on Sunday, August 4, before the sockeye fishery, compared to 327 rods on Saturday, August 10, during the sockeye fishery). Schubert (1992a) noted increased angler effort at the initiation of special fisheries as well.

Timing of the sockeye fishery had an affect on the sockeye RPUE. During August, RPUE estimates were almost as high as HPUE for sockeye salmon (.0779 and .0900, respectively). This can be explained by the late opening of the sockeye fishery (August 10), relative to the abundance of sockeye earlier in the month. Anglers who kept fishing after they had reached their catch limit also may have influenced the high sockeye RPUE.

### ANGLER RESPONSE VERIFICATION

Discussion will only include the ability of anglers to recall total trip length, since in-

complete trip interviews were not used to estimate effort. Results indicated anglers recalled the length of their trips quite accurately. Our findings were similar to the 1995 Fraser River sport fishery survey, where the average and maximum deviations were 0.5 hour and 1.5 hours, respectively (Bratty et al., 1998. in prep.). Similar observations were noted by Schubert (1992a), McEachron et al. (1986) and Phippen and Bergersen (1991).

#### **PROPORTION OF ANGLERS AT SURVEY SITES AND SURVEY EFFICIENCY**

The proportion of anglers at survey sites was assessed to satisfy the assumption that either interview sites were representative of the entire study area, or the proportion of angler effort occurring at the interview sites was sufficient to make HPUE estimates insensitive to effort occurring at non-interview sites (Schubert 1992a, 1995). It has been suggested that if the survey sites account for a large proportion (>50%) of the total angler effort, the difference between survey sites and the remainder of the fishery would have to be large to appreciably affect effort estimates (Schubert, 1995). Bratty et al. (1998. in prep.) found that effort at survey sites was high in June and July (68% and 56% of total effort, respectively). In August, as the angler effort dispersed, effort at survey sites dropped to 42% of the total effort. As a result, Bratty et al. (1998. in prep.) concluded that more error may be associated with the August estimate, than within the June and July estimates. Similar conclusions may be drawn for the 1996 survey, as the methodology, study design, and bars surveyed were similar to the 1995 lower Fraser River sport fishery survey.

Survey efficiency (the proportion of effort that was interviewed) has averaged between 9% and 11% in previous lower Fraser River sport fishery surveys, comparing favourably to surveys in different systems (Bratty et al., 1998. in prep.). Since the study design and methodology were consistent with the 1995 survey, survey efficiency was not evaluated in the 1996 lower Fraser River sport fishery survey.

#### **EFFORT DISTRIBUTION**

Examining effort distribution was not a primary objective of the 1996 survey. Nonetheless, angler distribution was monitored from overflights conducted one weekend a month. Due to budget constraints, overflights outside the study area were limited to Region 2 (Port Mann Bridge to Sumas River) and Region 5 (Agassiz/Rosedale powerline to Coquihalla River mouth). It was found that effort was consistently greater inside the study area than outside. For example, in June, the rod count for Region 3 was 285 whereas Region 2 had a total count of 73. Effort tended to disperse during August when the sockeye fishery was open. The August rod count for Region 3 was 139 whereas Region 2 had a total count of 81. Due to changes in region boundaries and in overflight patterns, effort distribution was not extensively compared to previous fisheries. In general, however, Bratty et al. (1998. in prep.) also found the majority of effort taking place within, rather than outside, the study area (upstream of Sumas River).

#### **COMPARISON TO PREVIOUS FISHERIES**

The inclusion of a sockeye fishery for both the 1995 and 1996 seasons invited comparison of the effectiveness of this fishery over the two years. Effectiveness was assessed by comparing CPUE, effort and total catch of sockeye during peak migration in August. Although the study area size was slightly different (i.e., Region 4 ending at Agassiz/Rosedale powerline), the smaller area should still be representative of the system between Sumas River and Hope, making comparisons in CPUE between years valid. Sockeye CPUE for August 1995 in Regions 3 and 4 was 0.0100 (Bratty et al., 1998. in prep.). CPUE for the same regions in 1996 was much higher at 0.1679. HPT results also evaluate a fisheries effectiveness. HPT of sockeye in Regions 3 and 4 in August 1995 was 0.2698, compared to a much higher HPT in 1996 of 0.4484. These findings suggest that the 1996 fishery was more effective at harvesting sockeye than the 1995 fishery, probably as a result of the environmental conditions previously discussed.

Although the study area size was smaller, a much larger angler effort was estimated in August 1996 (103,949 hours) than in 1995 (63,463 hours). The combination of an increase in angler effectiveness (higher CPUE and HPT) and greater angler effort produced higher catch rates in August 1996 (17,453) than in 1995 (6,318).

### RECOMMENDATIONS

Due to increased population levels in the Lower Mainland, there is a common belief that sport fishing effort has substantially increased in the lower Fraser River area. Therefore, we recommend that the survey be extended to cover areas and species currently not covered. Specifically:

1. Extend the survey coverage to include the area below the confluence of the Sumas River to the mouth of the Fraser.
2. Extend the survey coverage to include the months June through November in order to estimate sport catch of chinook, coho, sockeye, pink, and steelhead.
3. Extend the survey coverage to those lower Fraser River tributary fisheries, such as the Chillwack/ Vedder sport fishery, that target coho salmon.

Further recommendations regarding the general evaluation of recreational fisheries are discussed by Schubert (1995).

### SUMMARY

1. The 1996 early season (June and July) chinook catch was down considerably from the 1995 season, due to high water levels in the study area. In June and July 1995, a total of 4,268 chinook were caught in Region 3. In June and July 1996, 1,904 chinook were caught in the same region. In August, catch rates increased compared to 1995, possibly due to a greater abundance of chinook in the lower Fraser River during this month. In August 1995, 160 chinook were caught in Region 3, compared to 850 in caught in 1996.

2. Catch rates have increased dramatically for sockeye salmon since the 1995 survey. The August 1996 catch totals of sockeye salmon (17,453), which were caught in a reduced study area, were still al-most triple those of the 1995 survey (6,318).
3. During June and July, when water levels were high, angler effort was down compared to 1995. Region 3 effort totals for June and July 1995 were 124,322 hours, compared to 85,360 hours in 1996. In August, corresponding with lower water levels and the sockeye opening, effort increased substantially. With a reduced study area, angler effort in August 1996 was still much higher than in 1995 (103,949 hours compared to 63,463 hours).

### ACKNOWLEDGMENTS

Over the course of the study period, interviews were conducted by T. Roy and C. Thornton of Scott Resource Services Inc. M. Thomey of Scott Resource Services Inc. acted as the second counter during overflights provided by Air Southwest based out of Chilliwack. M. Thomey also word-processed the final report. R. Diewert provided valuable insights during the report writing phase of the study. Thanks to the PSARC members who reviewed the original draft of this report.

Special thanks to all anglers who willingly provided both time and information to the 1996 lower Fraser River sport fishery survey.

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**APPENDICES**

Appendix 1. Month-specific interview responses in the 1996 lower Fraser River sport fishery.

		Englebrich Bar				Gill Bar			
		June	July	August	Total	June	July	August	Total
<b>Number of Interviews</b>		914	989	1176	3079	195	250	1228	1673
<b>Mean Angler Day Length</b>									
-All Anglers		5.8	6.4	5.7	6.0	7.3	6.9	4.4	5.1
-Complete Trip Interviews	Number	912	989	1176	3077	129	171	1007	1307
	Hours	5.8	6.4	5.7	6.0	5.7	6	4.1	4.5
-Incomplete Trip Interviews	Number	2	-	-	2	66	79	221	366
	Hours	3.3	-	-	3.3	10.4	8.7	5.9	7.3
<b>Target Species</b>	None	1	-	-	1	2	1	5	8
	Chinook	897	986	520	2403	185	242	143	570
	Coho	-	-	-	-	-	-	-	-
	Chum	-	-	-	-	-	-	-	-
	Pink	-	-	-	-	-	-	-	-
	Sockeye	-	-	647	647	-	3	1077	1080
	Steelhead	-	-	-	-	-	-	-	-
	Trout	10	-	7	17	7	4	3	14
	Sturgeon	5	3	2	10	-	-	-	-
	Jack Chinook	1	-	-	1	-	-	-	-
	Other	-	-	-	-	1	-	-	1
<b>Harvested Catch</b>	Chinook	115	146	109	370	2	13	22	37
	Coho	-	-	-	-	-	-	-	-
	Chum	-	-	-	-	-	-	-	-
	Pink	-	-	-	-	-	-	-	-
	Sockeye	-	1	409	410	-	-	438	438
	Steelhead	-	-	-	-	-	-	-	-
	Trout	-	-	4	4	-	-	-	-
	Sturgeon	-	-	-	-	-	-	-	-
	Jack Chinook	-	1	26	27	-	-	1	1
	Other	-	-	-	-	-	-	-	-
<b>Released Catch</b>	Chinook	3	7	2	12	1	-	3	4
	Coho	-	-	-	-	-	-	-	-
	Chum	-	-	-	-	-	-	-	-
	Pink	-	-	-	-	-	-	-	-
	Sockeye	2	4	228	234	-	12	446	458
	Steelhead	-	-	-	-	-	-	-	-
	Trout	2	1	5	8	1	1	-	2
	Sturgeon	4	2	13	19	-	-	1	1
	Jack Chinook	-	-	1	1	-	-	-	-
	Other	4	-	4	8	-	2	-	2
<b>Gear</b>	Bait	13	3	9	25	7	5	4	16
	Lure	895	986	1161	3042	184	243	1218	1645
	Bait and Lure	5	-	6	11	4	2	3	9
	Fly	1	-	-	1	-	-	3	3
<b>Inspection of Catch</b>	Number	107	137	364	608	1	13	255	269
	Number Correct	107	136	364	607	1	13	255	269

Appendix 2. Daily angler counts (from overflights) in the 1996 lower Fraser River sport fishery.

Month	Date	Day of Week	Wx.	Port Mann Br.- Sumas R.	Sumas R.- Harrison R.	Harrison R.- Agassiz powerline	Agassiz powerline- Coquihalla R.	Total
June	6/5/96	wed	N/A	-	30	4.0	2.0 <sup>c</sup>	36.0
	6/9/96	sun	cloud	-	17	8.5	0.0 <sup>h</sup>	25.5
	6/13/96	thur	sun	-	19.5	3.0	-	22.5
	6/15/96	sat	sun	-	37	9.5	-	46.5
	6/17/96	mon	cloud	-	49.5	5.5	5.0 <sup>h</sup>	60.0
	6/23/96	sun	rain	-	178	39.5	-	217.5
	6/27/96	thur	cloud	-	109.5	18.5	5.0 <sup>h</sup>	133.0
	6/29/96	sat	cloud	73.0	284.5	90.0	35.5 <sup>c</sup>	483.0
	weekday	mean			52.1	7.8	3.0	62.9
		%			82.9%	12.3%	4.8%	
weekend	mean			129.1	36.9	8.9	174.9	
	%			73.8%	21.1%	5.1%		
Month	Date	Day of Week	Wx.	Port Mann Br.- Sumas R.	Sumas R.- Harrison R.	Harrison R.- Agassiz powerline	Agassiz powerline- Coquihalla R.	Total
July	7/3/96	wed	cloud	-	144.5	41.0	3.5 <sup>h</sup>	189.0
	7/7/96	sun	sun	-	179.0	48.5	-	227.5
	7/10/96	wed	sun	-	78.5	0.0	0.0 <sup>h</sup>	78.5
	7/13/96	sat	sun	-	132.5	52.0	9.5 <sup>h</sup>	194.0
	7/18/96	thur	cloud	-	89.5	25.5	6.0 <sup>c</sup>	121.0
	7/20/96	sat	cloud	-	194.5	45.5	12.5 <sup>h</sup>	252.5
	7/22/96	mon	sun	-	169.0	26.5	5.0 <sup>h</sup>	200.5
	7/28/96	sun	sun	23.5	113.0	36.0	20.0 <sup>c</sup>	192.5
	weekday	mean			120.4	23.3	3.6	147.3
		%			81.7%	15.8%	2.5%	
weekend	mean			154.8	45.5	10.5	210.8	
	%			73.4%	21.6%	5.0%		
Month	Date	Day of Week	Wx.	Port Mann Br.- Sumas R.	Sumas R.- Harrison R.	Harrison R.- Agassiz powerline	Agassiz powerline- Coquihalla R.	Total
Aug	8/2/96	fri	cloud	-	60.5	34.5	4.00 <sup>h</sup>	99.0
	8/4/96	sun	cloud	-	122.0	55.0	23.0 <sup>h</sup>	200.0
	8/10/96	sat	sun	-	190.5	136.0	42.0 <sup>c</sup>	368.5
	8/13/96	tue	sun	-	156.5	132.5	27.0 <sup>h</sup>	316.0
	8/17/96	sat	cloud	-	146.0	136.0	52.5 <sup>h</sup>	334.5
	8/19/96	mon	cloud	-	136.0	215.0	46.5 <sup>h</sup>	397.5
	8/24/96	sat	sun	-	198.0	107.0	45.0 <sup>h</sup>	350.0
	8/28/96	wed	cloud	-	112.0	43.0	19.0 <sup>h</sup>	174.0
	8/31/96	sat	cloud	81.0	138.5	74.5	52.5 <sup>c</sup>	346.5
	weekday	mean			116.3	106.3	24.1	246.6
	%			47.1%	43.1%	9.8%		
weekend	mean			159.0	101.7	43.0	303.7	
	%			52.4%	33.5%	14.2%		

<sup>h</sup> Count from Agassiz powerline to top of Wahleach slough only.

<sup>c</sup> Count from Agassiz powerline to Coquihalla river.

- No count was done in the area

Appendix 3. Mean hourly proportion of angler effort in the 1996 lower Fraser River sport fishery by region, month and day type.

Region 3		June		July		August	
Hour		Weekend	Weekday	Weekend	Weekday	Weekend	Weekday
1:00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2:00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3:00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4:00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5:00		0.0099	0.0145	0.0000	0.0002	0.0000	0.0010
6:00		0.0392	0.0387	0.0002	0.0004	0.0001	0.0052
7:00		0.0540	0.0537	0.0642	0.0722	0.0767	0.0677
8:00		0.0687	0.0565	0.0721	0.0767	0.0754	0.0700
9:00		0.0686	0.0645	0.0741	0.0775	0.0811	0.0746
10:00		0.0709	0.0631	0.0741	0.0817	0.0728	0.0738
11:00		0.0677	0.0670	0.0800	0.0795	0.0710	0.0757
12:00		0.0663	0.0652	0.0721	0.0775	0.0728	0.0731
13:00		0.0644	0.0603	0.0780	0.0746	0.0829	0.0662
14:00		0.0656	0.0626	0.0642	0.0618	0.0796	0.0669
15:00		0.0665	0.0680	0.0682	0.0598	0.0759	0.0674
16:00		0.0819	0.0596	0.0667	0.0522	0.0694	0.0675
17:00		0.0709	0.0495	0.0630	0.0534	0.0617	0.0582
18:00		0.0635	0.0695	0.0588	0.0504	0.0485	0.0563
19:00		0.0373	0.0640	0.0519	0.0409	0.0419	0.0481
20:00		0.0341	0.0429	0.0310	0.0489	0.0314	0.0489
21:00		0.0315	0.0322	0.0319	0.0374	0.0292	0.0374
22:00		0.0221	0.0366	0.0199	0.0285	0.0224	0.0165
23:00		0.0160	0.0221	0.0203	0.0184	0.0096	0.0187
24:00		0.0102	0.0189	0.0122	0.0105	0.0000	0.0075

Region 4		June		July		August	
Hour		Weekend	Weekday	Weekend	Weekday	Weekend	Weekday
1:00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2:00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3:00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4:00		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5:00		0.0145	0.0006	0.0144	0.0056	0.0004	0.0006
6:00		0.0484	0.0185	0.0336	0.0130	0.0480	0.0185
7:00		0.0444	0.0482	0.0286	0.0518	0.0784	0.0788
8:00		0.0538	0.0482	0.0464	0.0636	0.0814	0.0731
9:00		0.0585	0.0402	0.0571	0.0726	0.0747	0.0752
10:00		0.0561	0.0473	0.0678	0.1014	0.0802	0.0717
11:00		0.0655	0.0624	0.0643	0.0668	0.0722	0.0745
12:00		0.0608	0.0603	0.0643	0.0622	0.0703	0.0632
13:00		0.0585	0.0568	0.0678	0.0737	0.0568	0.0646
14:00		0.0732	0.0632	0.0669	0.0587	0.0500	0.0654
15:00		0.0642	0.0556	0.0669	0.0668	0.0548	0.0657
16:00		0.0684	0.0615	0.0557	0.0507	0.0548	0.0512
17:00		0.0596	0.0686	0.0600	0.0387	0.0509	0.0497
18:00		0.0544	0.0638	0.0600	0.0346	0.0609	0.0477
19:00		0.0491	0.0709	0.0557	0.0415	0.0494	0.0492
20:00		0.0456	0.0473	0.0471	0.0415	0.0370	0.0436
21:00		0.0439	0.0568	0.0455	0.0346	0.0085	0.0167
22:00		0.0318	0.0426	0.0321	0.0346	0.0435	0.0036
23:00		0.0121	0.0541	0.0343	0.0512	0.0298	0.0535
24:00		0.0000	0.0334	0.0324	0.0359	0.0000	0.0345

Appendix 4a. Angler effort, harvest and release by region in the 1996 lower Fraser River sport fishery, June.

June						
	Region 3	SE	Region 4	SE	Total	SE
# of Interviews	914		195		1109	
# of Overflights	8		8		8	
<b>ANGLER EFFORT</b>						
Estimated Effort (hours)	35052	8732	8635	2764	43687	11496
Estimated Effort (days)	6023		1507		7519	
Average Angler Day (hours)	5.82		5.73		5.81	
<b>ESTIMATED HARVEST</b>						
Chinook	721	258	23	8	744	264
Jack Chinook	-		-		0	
Sockeye	-		-		0	
Pink	-		-		0	
Coho	-		-		0	
Chum	-		-		0	
Steelhead	-		-		0	
Trout	-		-		0	
Sturgeon	-		-		0	
Other	-		-		0	
<b>ESTIMATED RELEASE</b>						
Chinook	20	5	7	2	27	7
Jack Chinook	-				0	
Sockeye	18	4			18	4
Pink	-				0	
Coho	-				0	
Chum	-				0	
Steelhead	-				0	
Trout	18	6	16	4	34	10
Sturgeon	36	8			36	8
Other	34	8			34	8

Appendix 4b. Angler effort, harvest and release by region in the 1996 lower Fraser River sport fishery, July.

July						
	Region 3	SE	Region 4	SE	Total	SE
# of Interviews	989		250		1239	
# of Overflights	8		8		8	
<b>ANGLER EFFORT</b>						
Estimated Effort (hours)	50308	15601	14261	3682	64569	19283
Estimated Effort (days)	7800		2357		10121	
Average Angler Day (hours)	6.45		6.05		6.38	
<b>ESTIMATED HARVEST</b>						
Chinook	1086	482	154	39	1240	521
Jack Chinook	21	6	-		21	6
Sockeye	12	4	-		12	4
Pink	-		-		0	
Coho	-		-		0	
Chum	-		-		0	
Steelhead	-		-		0	
Trout	-		-		0	
Sturgeon	-		-		0	
Other	-		-		0	
<b>ESTIMATED RELEASE</b>						
Chinook	77	31	-		77	31
Jack Chinook	-		-		0	
Sockeye	39	14	218	62	257	76
Pink	-		-		0	
Coho	-		-		0	
Chum	-		-		0	
Steelhead	-		-		0	
Trout	5	2	10	3	15	5
Sturgeon	23	5	-		23	5
Other	-		20	5	20	5

Appendix 4c. Angler effort, harvest and release by region in the 1996 lower Fraser River sport fishery, August.

August						
	Region 3	SE	Region 4	SE	Total	SE
# of Interviews	1228		1176		2404	
# of Overflights	9		9		9	
<b>ANGLER EFFORT</b>						
Estimated Effort (hours)	53926	15876	50023	15501	103949	31377
Estimated Effort (days)	9395		12201		20873	
Average Angler Day (hours)	5.74		4.1		4.98	
<b>ESTIMATED HARVEST</b>						
Chinook	833	213	244	60	1077	273
Jack Chinook	170	45	10	5	180	50
Sockeye	3240	896	6119	1341	9359	2237
Pink	-	-	-	-	0	-
Coho	-	-	-	-	0	-
Chum	-	-	-	-	0	-
Steelhead	-	-	-	-	0	-
Trout	15	4	-	-	15	4
Sturgeon	-	-	-	-	0	-
Other	-	-	-	-	0	-
<b>ESTIMATED RELEASE</b>						
Chinook	17	5	26	5	43	10
Jack Chinook	7	3	-	-	7	3
Sockeye	1996	521	6098	1027	8094	1548
Pink	-	-	-	-	0	-
Coho	-	-	-	-	0	-
Chum	-	-	-	-	0	-
Steelhead	-	-	-	-	0	-
Trout	38	9	-	-	38	9
Sturgeon	120	29	18	6	138	35
Other	15	5	-	-	15	5

Appendix 5. Mean monthly catch (harvest and release) by region, day type and species in the 1996 lower Fraser River sport fishery.

<b>Region 3</b>											
<b>Weekend</b>											
	Month	Chinook	Jack Chinook	Coho	Chum	Pink	Sockeye	Steelhead	Trout	Sturgeon	Other
Harvest	June	0.0174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	July	0.0199	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	August	0.0125	0.0025	0.0000	0.0000	0.0000	0.0678	0.0000	0.0008	0.0000	0.0000
Release	June	0.0005	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0009	0.0018	0.0014
	July	0.0020	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0003	0.0000	0.0000
	August	0.0000	0.0003	0.0000	0.0000	0.0000	0.0369	0.0000	0.0008	0.0006	0.0008
Total	June	0.0179	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0009	0.0018	0.0014
	July	0.0218	0.0013	0.0000	0.0000	0.0000	0.0003	0.0000	0.0003	0.0000	0.0000
	August	0.0125	0.0028	0.0000	0.0000	0.0000	0.1047	0.0000	0.0016	0.0006	0.0008
<b>Weekday</b>											
	Month	Chinook	Jack Chinook	Coho	Chum	Pink	Sockeye	Steelhead	Trout	Sturgeon	Other
Harvest	June	0.0246	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	July	0.0223	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000
	August	0.0172	0.0036	0.0000	0.0000	0.0000	0.0555	0.0000	0.0000	0.0000	0.0000
Release	June	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005
	July	0.0013	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0007	0.0000
	August	0.0005	0.0000	0.0000	0.0000	0.0000	0.0371	0.0000	0.0006	0.0032	0.0000
Total	June	0.0253	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005
	July	0.0237	0.0000	0.0000	0.0000	0.0000	0.0014	0.0000	0.0000	0.0007	0.0000
	August	0.0177	0.0036	0.0000	0.0000	0.0000	0.0926	0.0000	0.0006	0.0032	0.0000
<b>Region 4</b>											
<b>Weekend</b>											
	Month	Chinook	Jack Chinook	Coho	Chum	Pink	Sockeye	Steelhead	Trout	Sturgeon	Other
Harvest	June	0.0026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	July	0.0134	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	August	0.0045	0.0000	0.0000	0.0000	0.0000	0.0710	0.0000	0.0000	0.0000	0.0000
Release	June	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0026	0.0000	0.0000
	July	0.0000	0.0000	0.0000	0.0000	0.0000	0.0052	0.0000	0.0017	0.0000	0.0035
	August	0.0006	0.0000	0.0000	0.0000	0.0000	0.0391	0.0000	0.0000	0.0000	0.0000
Total	June	0.0026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0026	0.0000	0.0000
	July	0.0134	0.0000	0.0000	0.0000	0.0000	0.0052	0.0000	0.0017	0.0000	0.0035
	August	0.0051	0.0000	0.0000	0.0000	0.0000	0.1101	0.0000	0.0000	0.0000	0.0000
<b>Weekday</b>											
	Month	Chinook	Jack Chinook	Coho	Chum	Pink	Sockeye	Steelhead	Trout	Sturgeon	Other
Harvest	June	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	July	0.0091	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	August	0.0050	0.0003	0.0000	0.0000	0.0000	0.1404	0.0000	0.0000	0.0000	0.0000
Release	June	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	July	0.0000	0.0000	0.0000	0.0000	0.0000	0.0219	0.0000	0.0000	0.0000	0.0000
	August	0.0005	0.0000	0.0000	0.0000	0.0000	0.1510	0.0000	0.0000	0.0005	0.0000
Total	June	0.0054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	July	0.0091	0.0000	0.0000	0.0000	0.0000	0.0219	0.0000	0.0000	0.0000	0.0000
	August	0.0055	0.0003	0.0000	0.0000	0.0000	0.2914	0.0000	0.0000	0.0005	0.0000