

Fraser River Recreational Fishery Estimates: a general overview on how they are generated

Definitions Used Here

Harvest: a kept or retained fish

Release: a fish released (with *intent*) after being caught

Catch: equals harvest (or kept or retained) + release

HPUE: harvest per unit effort

RPUE: release per unit effort

CPUE: catch per unit effort

Rate of Harvest: in this case, synonymous with HPUE

Angler Effort: there are many measures of angler effort, usually expressed as a time (e.g. hours) but could be expressed as other discrete units (e.g. boat trips)

Creel Survey: synonymous with Recreational Fishery Survey

In a Nut Shell (using Harvest as the example)

To estimate harvest in the Fraser River recreational fishery, we use two key pieces of information:

- 1) a **Rate of Harvest** estimate: in the Fraser Creels, this is expressed as the number fish harvested per hour of effort (or fish harvested per angler-hour); and,
- 2) an **Angler Effort** estimate: this is expressed in hours of angling (or angler-hours).

And one key calculation:

- 3) the **Harvest** estimate is generated by multiplying together the two estimates above (Rate of Harvest x Angler Effort = Harvest).

1) Rate of Harvest – how we estimate this

A Rate of Harvest is estimated from angler interviews, which most of you may have been a participant. Recreational angler interviewers (also known as creel surveyors) ask a variety of questions like “where were you fishing?”, “what method did you use?”, “how long were you fishing?”, “what did you catch?” to name just a few.

The two key pieces of info we gathered from the interview to help us estimate a Rate of Harvest are:

- a) what have you caught (# harvested and released by species)? and,
- b) how long have you been fishing?

The Rate of Harvest is how many fish were caught per unit of effort. In our assessment, we use “an hour of angling” (or angler-hour) as our unit of effort.

An estimate of Rate of Harvest is calculated for each species of salmon caught in the fishery, by day-type (i.e. weekend or weekday), by river section, and for every analysis period (data is usually rolled-up, analyzed and reported in half month periods).

Table 1 below shows how we would calculate a HPUE for multiple interviews. What this Table shows is that on average, 0.08 Chinook were harvested every hour (i.e. a total of 1 CN harvested divided by a total of 12 hours fished = $1 / 12 = 0.08$ CN for every hour of angling or, to say it another way, **0.08 CN per angler-hour**).

Table 1. Weekend Interviews (please keep in mind, there can be hundreds of interviews on the weekend)

Weekend Interviews	Number of CN harvested	Number of hours fished by angler	Rate of Harvest (CN kept per hour of angling)
Angler Interview 1	1	7	0.14
Angler Interview 2	0	5	0.00
Total	1	12	0.08

CN = Chinook

Additionally, whenever possible and when allowed by the angler, the creel surveyor inspects the harvested salmon. This is to verify the species, amount harvested and to look for adipose fin presence. In 2008, of the ~4600 angler interviews, ~1300 indicated they harvested a fish. Of these, ~1075 (80%) let us inspected their harvest for species identification and adipose fin status. Of the 1075 that let us inspect their harvest, 99.9% of the harvest was correctly identified by species.

2. Angler Effort – how we estimate this

Estimating Angler Effort is a little more involved. We have to collect data from a couple of sources and then have to combine the information in a stepped approach as we move from hourly angler effort... to daily angler effort... to total angler effort for the analysis period.

Data sources:

- a) hourly rod count data; and,
- b) overflight rod count data (this is also referred to as an instantaneous rod count or IRC)

Calculations:

- c) calculating the percentage (or proportion) of the daily rod count total (i.e. angler effort) occurring at each hour;
- d) determining the percentage (or proportion) of the daily angler effort observed on the IRC;
- e) calculating the daily angler effort; and,
- d) calculating the total angler effort for the analysis period.

Hourly rod counts: For at least one fishing “area” on the river (e.g. Island 22 down to Grassy Bar, Pegleg, Landstrom, Pattullo), a creel surveyor will perform hourly rod counts (one might also refer to these as hourly angler counts but we count the rods not the people). Basically, the surveyor will count the number of rods that are actively fishing, in the fishing area, at the top of every hour. These rod counts are generally performed in areas with strong angling effort. What this provides is a “picture” or “profile”, of the angling effort throughout the day: when the effort rises,

when it's highest, and when it falls. The hourly rod counts are conducted every day the surveyors are working.

These hourly rod counts are then averaged for each hour to estimate an Average Hourly Rod Count (Table 2; column 2).

Table 2. Average hourly rod counts for analysis period

Time	Average Hourly Rod Count	Percentage of Daily Rod Count
6 AM	29.3	8.7%
7 AM	36.3	10.8%
8 AM	38.3	11.4%
9 AM	37.0	11.0%
10 AM	31.3	9.3%
11 AM	29.0	8.6%
12 AM	25.2	7.5%
1 PM	22.7	6.7%
2 PM	21.8	6.5%
3 PM	13.7	4.1%
4 PM	13.7	4.1%
5 PM	12.3	3.7%
6 PM	10.0	3.0%
7 PM	9.0	2.7%
8 PM	7.0	2.1%
Daily Total	336.7	100%

(Day-type = Weekend; Analysis Period = Sep.01 to Sep.15)

Average hourly rod counts are calculated for each day-type (i.e. weekend or weekday) for every analysis period.

Proportion of the daily rod count total occurring each hour. One can sum the "Average Hourly Rod Counts" to come up with a daily rod count total (e.g. 336.7 in Table 2. above), and then the "Percentage of the Daily Rod Count" occurring at each hour can be estimated (Table 2; columns 3).

What these estimates are used for will hopefully become more evident in the following sections below, however, it should be pointed out here that another way of expressing the benefits of the hourly rod count "picture" or "profile" is to say that we now have a way to estimate the proportion of the daily angler effort that occurs at any given hour.

IRC or overflights: Each week, at least two overflights are conducted: one on each day-type (i.e. one on the weekend and one during the week). The flights will usually survey the entire study area. Similar to the Hourly Rod Counts, the surveyor only counts the number of rods actively fishing and records the information by fishing "site" (e.g. Grassy Bar) and fishing technique (e.g. Bar). For each analysis period (e.g. Sep.01st to Sep.15th), an average of the analysis period overflights are calculated for each day-type (Table 3).

Table 3. Overflight data for analysis period

Date	Day	Flight Start Time	Flight End Time	Flight Duration	Overflight Rod Count
Sep.06	Saturday	10:08	11:05	57 min (0.95hrs)	408
Sep.14	Sunday	9:58	11:05	67 min (1.12hrs)	415
Averages		10:03	11:05	62 min (1.03hrs)	412

(Day-type = Weekend; Analysis Period = Sep.01 to Sep.15)

Proportion of the daily angler effort observed during the IRC: Combining the information in Table 2 & 3 can provide us with an estimate of the daily angler effort seen during the IRC. For example, if an overflight is conducted between 10AM and 11AM, we would use the average of the 10AM and 11AM percentages (Table 2; column 3) to determine the "Percentage of the Daily Rod Count" total (i.e. percentage of the daily angler effort) that was observed during the overflight. So, using the percentage of daily rod count data from Table 2 and the flight times from Table 3, we would estimate that the overflight observed 8.9% of the daily angler effort for the day.

$$\begin{aligned} \text{Percent observed during IRC} &= (9.3\% + 8.6\%) \div 2 \\ &= 8.9\% \text{ or } \mathbf{0.089} \text{ (as a proportion)} \end{aligned}$$

Daily angler effort: The next step is to combine the IRC Rod count data with the proportion estimate in the section above. Doing this, we could now state that an average of 412 rods observed on the overflights represented an estimated 8.9% of the Daily Rod Count total or, to put it another way, an estimated 8.9% of the Daily Angler Effort would have been observed on the overflight between 10AM and 11AM.

To estimate 100% of the Daily Angler Effort, we take the average Overflight Rod Count and divide by the proportion of the Daily Rod Count observed at that time(s) of the overflight:

$$\begin{aligned} \text{Daily Angler Effort} &= 412 \div 0.089 \\ &= \mathbf{4,629} \text{ angler-hours} \end{aligned}$$

Total angler effort for the analysis period: This average Daily Angler Effort is then multiplied by the number of days (for that day-type) in the analysis period to estimate **Total Angler Effort** for that analysis period day-type. Continuing with the weekend day-type example, there is either four to five weekend days in the usual analysis period (e.g. Sep.01st to 15th). For the calculation below, we will say there was four weekend days in this analysis period. Therefore, the total estimated weekend effort for this analysis period example would be:

$$\begin{aligned} \text{Estimated Total Effort} &= 4 \text{ weekend days} \times 4,629 \text{ angler-hours/day} \\ &= \mathbf{18,516} \text{ angler-hours} \end{aligned}$$

3. Harvest - putting it all together to estimate this

So, now that we have a Chinook **Rate of Harvest** estimate (e.g. 0.08 CN/hour), as well as the **Total Angling Effort** estimate (e.g. 18,516), we can calculate the Chinook **Harvest** estimate for that particular day-type in the analysis period.

$$\begin{aligned}\text{Harvest estimate} &= 0.08 \text{ CN harvested per angler-hour} \times 18,516 \text{ angler-hours} \\ &= \mathbf{1,481} \text{ CN harvested}\end{aligned}$$

Note: this is an example; real data not used

In the example above, we would estimate that 1,481 Chinook salmon were harvested on the weekends for the analysis period Sep.01st to Sep.15th.

Summary/Lose Ends

The above method is used to calculate both **Harvest** and **Release** estimates for all salmon species for both day-types (i.e. weekdays and weekends) in the assessed fisheries for each analysis period. Using the above example, we would add the weekend Chinook harvest estimate of 1,481 to the estimate generated from weekday data, to estimate the total Chinook harvested for the analysis period Sep.01st to Sep.15th.

Holidays are considered a weekend day-types: all our data is stratified by day-type as historical surveys have clearly shown that effort during the weekends is significantly different (greater) than effort on the weekdays; effort seen on holidays is very similar to the weekend days and therefore holidays are considered a weekend day-type.

Further Information

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