

2014 Central Coast Mark-Incidence and Sport Chinook Catch Estimation Program

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INTRODUCTION

The B.C. Central Coast (CC) sport fishery is a significant harvester of chinook salmon with annual catches ranging from 3,000 to 4,000 in recent years. Impacts of this fishery are widespread and include West Coast Vancouver Island (WCVI) chinook which have formed a large component of CC sport catch in recent years. Unfortunately, these estimated impacts have been confounded by a lack of mark incidence data. In the absence of this information, DFO's MRP (Mark Recovery Program) utilizes mark-rates from other areas (global pooling) to generate expansion factors. Although it is believed these expansions likely overestimate impacts of the CC sport fishery, this cannot be rectified without annual mark-rate data as well as estimates of catch which include both lodge-based and independent angler fishery components.

The majority of sport fishing catch within the Central Coast is lodge-based and a longstanding logbook program is conducted to capture fishing information. It is believed that chinook catch is well reported by the lodges although the reported mark-rate data is questionable and believed to be under-reported. The extent of under-reporting bias is unknown and difficult to estimate. Furthermore, the use of MRP to determine mark-rate is highly problematic without the ability to link individual fish back to a specific lodge which has kept accurate catch records.

In 2011 this program was introduced with the design to provide accurate chinook mark-rate information as well as estimates of independent catch for the BC Central Coast area (DFO statistical areas 7-10). In order to accomplish these objectives, North Coast Stock Assessment partnered with the Central Coast Conservation and Protection (C&P) branch to conduct sport fishing interviews during routine patrols. These on-water inspections were to provide the necessary information. The data collected were used in MRP for the expansion of CC CWT recoveries.

In 2012 the Central Coast Conservation and Protection (C&P) branch of DFO once again agreed to conduct sport fishing interviews during routine patrols and on-water inspections to gather the necessary information for the continuation of this mark-rate study. This included chinook catch and fishing effort data as well as chinook mark-rates stratified by month and area. In an effort to increase mark-rate sample size across areas, 7 digital waterproof cameras were distributed to participating lodges for the collection of chinook images. Notebooks were also used by DFO charter patrol staff for opportunistic chinook mark-rate data gathering.

Information required to determine total independent effort including total numbers of independent anglers observed as well as numbers of boat trailers at the primary access site (Bella Coola public boat launch) was also collected. This program was conducted simultaneously with the existing lodge logbook reporting program.

In 2013 the program was conducted with changes that included the introduction of a Bella Coola land based creel survey and loss of Central Coast Conservation and Protection (C&P) on-water surveys.

In 2014 the program continued the land based creel survey in Bella Coola and the introduction of a self-survey for independent fishers out of Bella Coola and Shearwater. Charter Patrol support for Area 9 changed just before the start of the program. The total grant for this program was \$9000 CAN.

OBJECTIVES

The objective of this project was to:

1. Obtain mark-rate data for Central Coast sport fishery which is stratified both spatially and temporally from late June to early September when the majority of chinook are caught.
2. Estimate independent (non-lodge) catch for Areas 7-9 using a combination of shore-based creel interviews, trailer count data and remote moorage tallies for independent vessels. Creel data has been collected in Bella Coola and attempts were made in Shearwater as these are believed to be the primary access points for independent anglers to the Central Coast fishing area.
3. Estimate potential under-reporting bias of lodge logbook mark-rate data by comparing logbook mark-rates with those collected independently by digital cameras, CDFO staff and CDFO charter patrol staff.
4. Calculate CWT head submission rates for Central Coast sport fishery and feed data into MRP to avoid the use of proxy rates
5. Utilize Bella Coola creel data (fishing vs. non-fishing activities) to improve independent estimates of angler effort (Area 7&8) based on Bella Coola trailer count data.

METHODOLOGY

Data Stratification

1) Temporal

Temporal stratification of data was important for several reasons. Firstly, to accommodate changing chinook abundance as various stock groups move through the fishery and secondly in recognition of changing chinook mark-rates throughout the duration of the fishery. Catch and effort data as well as chinook mark-rate data was stratified into an early summer and late summer period. The early period included data collected from the end on June to the end of July. The late period included data collected from the beginning of August to the end of the program which occurred in early September. This level of stratification also allows for separation of expected higher mark rates encountered in Area 9 coinciding with the arrival of marked Wannock chinook in early August.

2) Spatial

Data collected from DFO Statistical Areas 7&8 were combined due to fishery dynamic similarities and as well as the geographic separation from the key Area 9 fishing locations. Very little targeted salmon fishing activity has been observed in Area 10 in recent years, however, any data from this area is included with Area 9.

Calculation of CPUE

Data for independent anglers were analyzed separately from lodge-based sport anglers and was stratified both temporally and spatially as described previously. The unit of effort chosen was boat fishing hour and the catch of chinook per unit of effort (CPUE) was calculated as follows:

$$CPUE_{a,p} = \Sigma CN_{a,p} / \Sigma Bhr_{a,p}$$

This was calculated independently for each time period and level of spatial stratification.

Independent Angler Effort

An estimate of total boat days of independent angling effort was calculated for the various levels of spatial and temporal stratification described above. This is consistent with the ongoing logbook program which records total angling effort in boat days. Two sources of data were collected to evaluate independent effort in terms of boat days. The primary access point for independent angler fishing activity in Areas 7&8 is the public boat launch located in Bella Coola, BC. In an effort to capture this effort, counts of recreational boat trailers were recorded on a regular basis throughout the program duration. Boat trailer records were used to estimate total boat days of effort.

1) Area 7/8 Angler Effort

Upon comparison of the Bella Coola recreational boat trailer counts with on-water C&P independent vessel counts in 2012 it was determined that the trailer counts more accurately reflected the independent effort in these areas. Linear interpolation in EXCEL was used to estimate trailer counts on days where records were not available. It was assumed that daily recreational trailer counts represented daily boat effort in Areas 7&8 combined. Total angler effort in boat days was totaled for each time period.

2) Area 9/10 Angler Effort

Total counts of independent vessels observed during C&P patrols are no longer conducted as of 2012. Total Area 9/10 angler effort was represented by dock reservations at Dawsons Landing and Duncanby Landing.

Daily Hours Fishing per Boat Day Determination

Average daily hours fished per boat day of effort were calculated using interview data as well as fishery dynamic knowledge and personal communication with C&P in Bella Bella. Data was stratified with Areas 7/8 combined and separated from Areas 9/10.

Calculation of Chinook Harvest for Independent

Estimated independent angler harvest of chinook in each period and area of the fishery was calculated as follows:

$$CN_{a,p} = CPUE_{a,p} \times (\text{Mean } Bhr_{a,p} / Bdy_{a,p}) \times \Sigma Bdy_{a,p}$$

Calculation of Marked Chinook Intercepted by Independent Anglers

The following calculation was used to determine marked chinook harvested in each period and area of the fishery:

$$MCN_{a,p} = CN_{a,p} \times MR_{a,p}$$

The total estimated harvest of marked chinook by independent anglers during the program period was calculated by summing the estimates of harvested marked chinook for each time period and area.

Description of Variables

<i>a</i>	Per Statistical Area or Statistical Area combination
<i>b</i>	Per boat
<i>Bhr</i>	Boat-hour: one hour of boat fishing time
<i>Bdy</i>	Boat-day: comprised of one day of angling effort
<i>CN</i>	Chinook harvested

<i>CPUE</i>	Chinook catch-per-unit-effort: Chinook caught per Bhr
<i>p</i>	Period: Time period stratification (ie: June 14-July 31)
<i>MCN</i>	Marked Chinook harvested
<i>MR</i>	Mark-rate (as observed by C&P)

RESULTS

1) Data Collection

Lodge Camera Data

Nine lodges accepted digital camera kits for the purposes of collecting chinook mark-rate information. Four lodges provided useful data, two in Area 7/8 and two in Area 9.

DFO Notebooks

A Notebook was distributed to the one remaining charter patrolmen whose catch monitoring and validation activities involved travelling to many of the lodges throughout the Central Coast area if possible. The charter patrol operates mostly in Area 7 & 8 and was unable to collect data in Area 9; as stated earlier Charter patrol staff from Area 9 retired in 2014 and DFO has not been able to find a replacement. Notebook data accounted for 51 chinook observations.

Table 1. Chinook observed for Mark-rate (Area 7-10, June 15-Sept 1, 2014).

Data Source	Chinook Observed
Camera	1643
DFO Notebooks	51
Creel Observer	256
Total	1950

2) Chinook Mark-rate

Data were stratified both temporally and spatially to include differences in fishery dynamics as well as to account for changing population mark-rates through the season as various stocks migrate through the fishing area. Camera, notebook and Creel Observer data were combined within the chosen strata (Table 2). Logbook mark-rate information was similarly combined (Table 3) and chinook mark-rates between the independent study and lodge logbook data were compared to identify potential bias between the two (Table 4).

Table 2. 2014 Central Coast Chinook Mark-rate Study Observations

Camera, Notebook, Creel Observer	Area 7&8 (N=799)			Area 9&10 (N=1151)		
Temporal Strata	Marked	Unmarked	Mark Rate	Marked	Unmarked	Mark Rate
June/July	20	375	0.0506	149	770	0.1621
Aug/Sept	44	360	0.1089	43	189	0.1853

Table 3. 2014 Central Coast Chinook Logbook Mark-rate Data

Logbook Program Data	Area 7&8 (N=3972)			Area 9&10 (N=2041)		
Temporal Strata	Marked	Unmarked	Mark Rate	Marked	Unmarked	Mark Rate
June/July	25	1756	0.0140	144	1223	0.1053
Aug/Sept	34	2157	0.0155	50	624	0.0742

Table 4. Comparison of 2014 Central Coast Chinook Mark-rates Collected; Independent and Lodge Logbook Data.

Area and Time Strata	Study Mark-Rates (S)	Logbook Mark-Rates (L)	Logbook Bias (L-S)/S (%)
7/8 June-July	0.0506	0.0140	-72%
7/8 Aug-Sept	0.1089	0.0155	-86%
7/8 Combined	0.0801	0.0149	-81%
9/10 June-July	0.1621	0.1053	-35%
9/10 Aug/Sept	0.1853	0.0742	-60%
9/10 Combined	0.1668	0.0951	-43%

As noted in the results, significant negative bias exists in the logbook reporting of mark rate among chinook for both temporal and spatial strata.

3)Independent Angler Effort

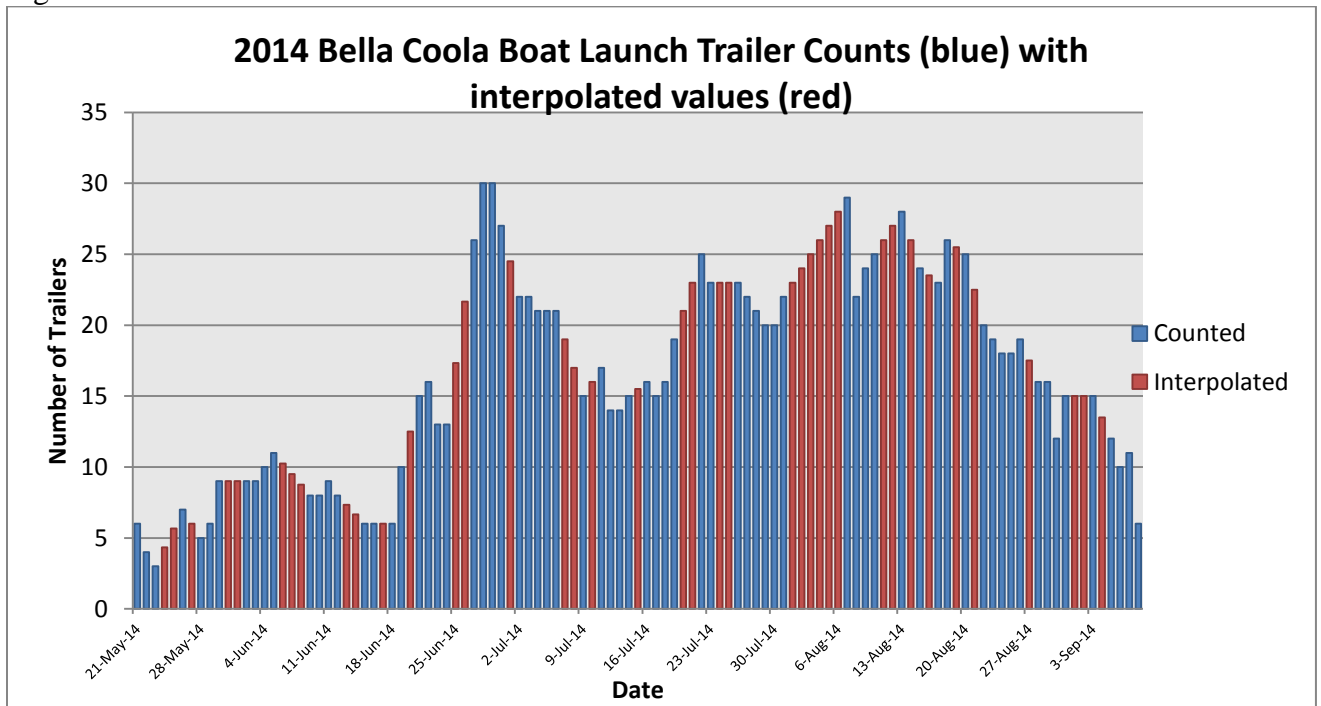
Expanded trailer count data from the Bella Coola boat launch (Fig. 1) was used to estimate total angler effort (boat days) in Area 7 & 8 (Table 5). Estimates of independent angler effort in Area 9 & 10 were gathered from independent dock moorage bookings at Duncanby Landing and Dawsons Landing; presented in Table 5.

Table 5. Estimates of 2014 Angler Effort in Boat Days for Central Coast Areas.

Temporal Strata	Origin (Source: 2012 C&P on-water interviews)		Bella Coola Boat Days	Area 7 & 8	Area 9
	Bella Coola	Other		Expanded Effort (Boat Days)	Effort (Boat Days)
June 15-July 31	0.37	0.63	862	2351	559
Aug 1- Sep 1	0.56	0.44	715	1275	310
Total	0.48	0.52	1577	3626	869

4) Bella Coola Boat Trailer Population Study

Figure 1. 2014 Bella Coola Boat Launch Trailer Counts.



Trailer counts were conducted daily between May 21 and September 8, 2014. Each trailer was identified by plate number to ensure individual trailer identification. For days when data were not collected the count was interpolated during data analysis stage. A total of 862 trailers were counted between June 15 – July 31, and the count for August 1- July 31 was 715 for a total trailer count of 1,577.

From C&P on water interviews conducted in 2011 and 2012, it was determined that approximately 37% and 56% (June15-July 31 and Aug. 1-Sept. 1 respectively) of boats interviewed originated from the Bella Coola boat launch. This information is believed to accurately reflect the composition of boats within the Central Coast area and is used to expand the Bella Coola trailer count (boat days).

5) Submission Rate

Table 6. Estimates of 2014 Total Submission Rate for Central Coast Areas.

Stat Areas	Time Period	Chinook Mark-rate	Reported Lodge Catch	Estimated Independent Catch	Total Chinook Catch	Estimated Marks in Fishery	MRP Head Recoveries	Submission Rate
7 & 8	June/July	0.0506	1790	2291	4081	207	34	16.5%
	Aug/Sept	0.1089	2191	447	2638	287	57	19.8%
Total			3981	2738	6719	494	91	18.4%
9 & 10	June/July	0.1621	1367	678	2045	349	142	40.7%
	Aug/Sept	0.1853	674	126	800	154	77	50.1%
Total			2041	804	2845	503	219	43.6%

Total chinook catch and estimated marked chinook harvested in the fishery were calculated (Table 2).

Table 7. 2014 Central Coast Independent Harvest of Marked Chinook

Stat Areas	Time Period	Chinook Mark-rate	Estimated Independent Catch	Independent Estimated Marks in Fishery
7 & 8	June/July	0.0506	2291	116
	Aug/Sept	0.1089	447	49
Total			2738	165
9 & 10	June/July	0.1621	678	110
	Aug/Sept	0.1853	126	23
Total			804	133
Total			3542	298

Table 8. 2014 Central Coast Total Harvest of Marked Chinook

Stat Areas	Time Period	Chinook Mark-rate	Reported Lodge Catch	Estimated Independent Catch	Total Chinook Catch	Estimated Marks in Fishery
7 & 8	June/July	0.0506	1790	2291	4081	207
	Aug/Sept	0.1089	2191	447	2638	287
Total			3981	2738	6719	494
9 & 10	June/July	0.1621	1367	678	2045	349
	Aug/Sept	0.1853	674	126	800	154
Total			2041	804	2845	503

6) Discussion & Recommendations

The 2011 pilot program was initiated with the primary objective of providing reliable, stratified mark-rate data independently of the existing logbook program. It was hoped these data along with comprehensive estimates of catch would allow estimation of marked chinook harvested in the Central Coast sport fishery and eliminate the need for using “pooled” mark-rate information in MRP to estimate Central Coast sport fishery harvest impacts. In past years, the mark-rate data collected via logbooks has been inconsistent and often unreliable.

This project has evolved since its inception to encapsulate several different aspects:

- 1) Lodge mark rate of chinook
- 2) Logbook mark rate comparison to study data
- 3) Independent Angler effort Area 7 & 8
 - a. Bella Coola Boat Launch Survey
 - b. Bella Coola Boat Launch Trailer Count
 - c. Bella Coola Self Survey
 - d. Self-Survey Bella Coola & Shearwater
- 4) Independent Angler Area 9 & 10 (moorage)
- 5) On-water Interviews (no longer done)
- 6) Mark Estimation
- 7) Chinook Catch Estimation
- 8) Submission Rates

Following the first year of the program several areas for possible improvement were identified and almost all have been incorporated to improve the quality of the data collected.

Specific areas of ongoing refinement include:

Bella Coola Creel Interviews:

This information is useful as an indicator of the activity in Areas 7 & 8 but still requires refinement. First and foremost, the facility at Bella Coola is used as a boat launch and pullout and fishers using the facility are faced with 8 or 9 hours driving over the Chilcotin plateau to the nearest town of Williams Lake. Consequently their coolers are usually packed away for transport when they reach Bella Coola and the interviewer cannot view fish to verify accuracy of the information collected; there is definitely no chance to collect biological samples.

From another point of view, there are no facilities or amenities such as a restaurant, trailer or building the creel collector may stay; they are forced to sit in their vehicle until a boat arrives. There is no available workstation, internet or media outlet available to allow the interviewer to conduct business while they await interview candidates. While some of the returning fishers familiar with the program made a point of documenting

fishing activities, those who were not aware of the program were often ‘guesstimating’ their fishing activity. A far more efficient means of collecting such data would include better awareness of the program prior to fishermen leaving the Bella Coola boat launch, possibly coupled with a Self-Survey (information and reporting) package that would be taken along to be filled out during their trip as opposed to after the trip.

Attempts to introduce the self-survey in Shearwater and Bella Coola proved minimally successful, however better participation could be achieved if DFO works with local Harbour authority to promote the program and survey package to fishers before they leave to fish. Alternately, efforts to incorporate collection of this information into DFO’s new online angler survey/questionnaire is also being investigated.

Program Recommendations for 2015:

- Continue to refine the Bella Coola based trailer counts
- Continue to refine methods to collect Area 7&8 information
- Continue to refine and implement ‘Self Survey’ in Shearwater and Bella Coola
- Continue seeking funding for on-water interviews and alternate methods to collect independent information

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