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## **Canadian Salmon Catch and Enhanced Salmon Production in 2016 and 2017**

by

Mary E. Thiess<sup>1</sup>, Joan Bateman<sup>2</sup>, Jason Parsley<sup>1</sup> and Shelee Hamilton<sup>1</sup>

<sup>1</sup>Fisheries and Oceans Canada  
3190 Hammond Bay Road  
Nanaimo, B.C., Canada V9T 6N7

<sup>2</sup>Fisheries and Oceans Canada  
200 - 401 Burrard Street  
Vancouver, B.C., Canada V6C 3S4

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## ABSTRACT

This document reports final catch estimates for 2016 and preliminary catch estimates for 2017 for the six major salmon species in British Columbia (B.C.) and Yukon fisheries. Catch is reported for commercial fisheries (numbers and total weight) in tidal waters, and recreational (numbers only) and aboriginal fisheries (numbers only) in tidal and non-tidal waters. Catches include non-Canadian origin fish caught in B.C. and exclude Canadian origin fish caught in fisheries outside B.C. This document also summarizes release information for salmon including steelhead trout from Fisheries and Oceans Canada (DFO) and Freshwater Fisheries Society of BC enhancement facilities in BC in 2016 and 2017.

**Keywords:** Salmon, steelhead, catch, enhancement, British Columbia

## INTRODUCTION

The six species of salmon native to B.C. contribute to commercial, recreational, and aboriginal fisheries. Commercial net fisheries tend to focus on sockeye (*Oncorhynchus nerka*), chum (*O. keta*), and pink (*O. gorbuscha*) salmon, while recreational harvesters catch mostly Chinook (*O. tshawytscha*), coho (*O. kisutch*), and steelhead (*O. mykiss*). All species of salmon are valued by aboriginal fisheries, which typically occur in terminal areas within freshwater, but harvest also occurs in marine waters. Steelhead trout constitute a relatively minor component of the catch.

This document reports 2016 final catch estimates and preliminary 2017 catch estimates of salmon in B.C. and Yukon fisheries. Estimates are reported for retained commercial catch (numbers and total weight) in tidal waters (except the Yukon fisheries) and recreational (numbers only) and aboriginal catch (numbers only) in tidal and non-tidal waters by species. Catches include non-Canadian origin fish caught in B.C. and exclude Canadian origin fish caught outside B.C.

The objectives of the DFO Salmonid Enhancement Program (SEP) are to rebuild stocks and increase catch through the expanded use of enhancement technology. The program produces Chinook, coho, chum, pink, and sockeye salmon, as well as small numbers of steelhead and cutthroat trout (*O. clarki*). Steelhead and cutthroat enhancement takes place at SEP facilities under a cooperative arrangement with the Government of B.C. Projects include hatcheries, fishways, spawning and rearing channels, and small classroom incubators; releases range in size from nearly 100 million juveniles from spawning channels, to less than one hundred from school classroom projects, annually.

## CATCH ESTIMATES

A brief description of the data and sources of information for the four major fishery types follows:

### *Commercial Catch Estimates*

The Fisheries Operating System (FOS) is the official salmon commercial fishery catch database for DFO in the Pacific Region. FOS maintains various fisher-produced data (e.g. sale slips, logbooks, at-sea interviews) and fisher-independent data (e.g. on-board observers and dockside monitors). The final

commercial catch estimates reported here for 2016 and 2017 are manager-determined estimates based on resolution of all data sources.

Commercial catch estimates for 2016 and 2017 are presented as numbers and weights (**Error! Reference source not found.**) of fish retained by commercial salmon vessels (salmon gill net, salmon seine net and salmon troll). Weights are based on sale slip data and are given as round (i.e., whole fish) equivalents. Sale slips record gear type, area of catch, date of landing, and landed weight and value by species. Since the value of the landing and resulting payments are based primarily on the landed weight, weight estimates are considered reasonably accurate (Sandher et al. 2012).

Piece estimates recorded on sale slips are usually estimated by applying an estimated average weight to the landed weight, particularly for high volume net landings (i.e., net landings of sockeye, pink and/or chum salmon). The average weight estimates are obtained by weighing counted samples of landed catch during offloading. Sampling for average weights is conducted to allow relatively accurate and precise, species-, area-, time- and gear-specific estimates of average weights to be generated. Such estimates have been widely available for Chinook and coho salmon since the early 1980s and for sockeye, chum and pink salmon since 1994.

#### *Recreational Catch Estimates (non-Steelhead)*

Recreational salmon catches for 2016 and 2017 are reported in pieces (**Table 1**). Creel surveys are the primary source of recreational catch data, resulting in estimates by DFO Pacific Fishery Management Area (PFMA) and month. Creel surveys generally cover the times and areas with relatively large effort and catch, but typically not times and areas where fishing is open with relatively low effort and/or catch rates. Catch from sport fishing lodges are based on logbook programs where they are in use. Catch from lodges not reporting via logbooks is incorporated in creel survey-based estimates. Further, the numbers provided here are the unexpanded estimates from the creel and logbook programs; they do not include estimates for catch from times and areas not surveyed. Consequently, recreational catches reported here underestimate total catch.

#### *Recreational Steelhead Catches – a Historical Overview*

Although there are no targeted fisheries on steelhead in marine waters, valuable freshwater recreational fisheries occur and are a provincial responsibility delegated from the Government of Canada. The B.C. management objectives for these fisheries are:

1. Maintain a diversity of sustainable recreational angling opportunities for steelhead in British Columbia.
2. Maintain, protect and restore the productive capacity of the freshwater environment to produce steelhead. (BC Ministry of Forests, Lands and Natural Resource Operations, July 2014).

There has been no retention of wild steelhead in BC sport fisheries since April 1, 2007; recreational fisheries that currently operate on non-enhanced rivers are strictly catch and release. Recreational fisheries also occur in approximately 13 hatchery-augmented rivers, where an angler is allowed to harvest one fish per day (with a maximum 10 per season). Total catches are estimated via the Steelhead Harvest Analysis – a questionnaire mailed to 50% of all BC and 100% of non-BC residents who purchased a steelhead licence. Estimates are currently available up to the end of the 2015/2016 fiscal year (M. Beere, BC Ministry of Forests, Lands and Natural Resource Operations, Smithers; pers. comm., January 23, 2018; **Table 2**). Conservation concerns about two populations of Interior Fraser

River steelhead led to emergency listings as “endangered” in January 2018. It can be expected that actions taken as a result of this listing will impact future catches of steelhead in BC waters.

### *Aboriginal Catch Estimates*

Aboriginal (subsistence) catch represents retained catch, and is reported in pieces (Table 3). Aboriginal catch statistics can usually be resolved to PFMA and year, but areas may be grouped in some cases. A variety of approaches have been used to generate estimates. While aboriginal catch estimation programs cover many of the largest aboriginal fisheries, coverage is incomplete both temporally and spatially. Similar to recreational catch, aboriginal catch estimates presented here do not include catch from times and areas not covered by catch estimation programs, and therefore underestimate total catch.

## **ENHANCED PRODUCTION**

Annual egg and juvenile stock production targets for hatcheries are set pre-season, in consultation with project managers, stock assessment biologists and harvest management biologists. Production objectives include conservation or rebuilding, harvest and/or assessment. Other considerations include potential species and stock interactions, effects on natural stocks, harvest concerns, habitat capacity and project capacity. The production plan is finalized after review by industry, the public and other interested groups in the Salmon Integrated Fisheries Management Planning process.

Depending on the species and enhancement approach, juvenile fish are released at various life stages. Chum and pink salmon are released either immediately after emergence as unfed fry or after one month of feeding (fed fry). Coho are released as fry, either at emergence or after three to five months of rearing, or as smolts after one year of rearing. In B.C. sockeye enhancement is typically conducted using spawning and rearing channels rather than hatcheries, and juveniles emigrate volitionally soon after emergence. Sockeye are also enhanced through lake fertilization programs, and most migrate to sea after one year of lake rearing. Coastal ocean-type chinook stocks are released after three to four months of rearing. Interior stream-type stocks are frequently reared for one year, and generally constitute a very small component of the total numbers of chinook released. Releases from hatcheries are usually estimated by subtracting known egg and fry mortalities from egg numbers. Releases from rearing channels are estimated by sampling out-migrants.

Release information for salmon from DFO enhancement facilities and the Fraser Valley Trout Hatchery (Freshwater Fisheries Society) in B.C. in 2016 (final) and 2017 (preliminary) is summarized in Table 4. Approximately 271.5 and 368.1 million salmon were released, in 2016 and 2017, respectively. In both years, sockeye and chum releases account for approximately 80% of the enhanced production. Since 2016, all thirteen hatcheries augmenting steelhead production are smolt release programs, and approximately 375,000 to 460,000 steelhead smolts have been released across the province annually since 2014 (Table 4) (Mark Beere, BC Ministry of Forests, Lands and Natural Resource Operations, Smithers; pers. comm., January 23, 2018).

It is not possible to conduct assessments of each enhancement project and/or release strategy individually. Consequently, certain stocks are used as indicators, their production is tagged or marked annually and rigorous fishery and escapement sampling and estimation programs are conducted. Survival and exploitation estimates are used for time series analyses of both wild and enhanced populations. Enhanced contributions and survivals of chinook, coho, and chum salmon are

normally estimated by applying a tag and /or external mark to a portion of the fish released and subsequently recovering these marked fish through sampling programs in the fisheries, on the spawning grounds and at enhancement sites. Visual marks are chiefly the removal of the adipose fin, with some chinook and coho stocks also receiving an implanted coded wire tag to enable identification of stock and release year. Beginning in 1996, most enhanced coho from southern BC have been marked with a fin clip to enable the prosecution of mark-selective fisheries. Some species and stocks are given a thermal otolith mark to estimate enhanced contributions to terminal areas. Thermal marking is coordinated with the DFO Salmon Assessment Section and is reported separately.

## **ACKNOWLEDGEMENTS**

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**Table 1.** Canadian commercial catch estimates of Pacific salmon (excluding steelhead) for 2016 and 2017, presented in pieces (000's) and weights (MT). Catches reported for 2017 include First Nations commercial fisheries.

Reporting Area	Year	Commercial Catch Number (000's)						Commercial Catch Round Weight (MT)					
		Pink	Chum	Sockeye	Coho	Chinook	Total	Pink	Chum	Sockeye	Coho	Chinook	Total
Fraser River	2016		337.57	49.31	0.82	2.33	390.02	0.0	1469.6	129.7	3.1	14.8	1,617.2
	2017	4.12	199.59	3.30	0.73	1.74	209.49	9.0	977.4	8.2	2.3	11.5	1,008.4
South Coast	2016	0.88	2099.55	178.18	0.44	0.03	2,279.08	1.9	9002.7	428.3	1.7	0.2	9,434.8
	2017	37.24	760.14	11.00	0.46	0.06	808.90	81.1	3649.2	23.9	1.5	0.4	3,756.0
West Coast Vancouver Island	2016	0.01	420.47	572.95	4.33	71.02	1,068.77	0.0	1719.5	1278.1	20.0	268.1	3,285.6
	2017	0.03	56.64	57.00	2.71	99.01	215.38	0.1	264.1	121.7	10.8	682.4	1,079.0
Central Coast	2016	125.48	475.27	76.92	1.78	3.19	682.64	259.1	2342.1	237.3	7.2	23.1	2,868.8
	2017	744.92	316.50	0.77	1.90	3.00	1,067.09	1654.8	1852.5	1.9	6.0	19.6	3,534.9
North Coast	2016	1,599.18	97.41	156.46	95.93	1.69	1,950.66	3476.7	484.0	373.8	378.6	12.1	4,725.2
	2017	831.50	77.31	38.61	78.48	1.93	1,027.82	1845.6	445.7	97.0	209.0	11.0	2,608.3
Haida Gwaii	2016	33.69	0.02	0.55	159.89	149.45	343.60	69.5	0.1	1.3	521.6	807.4	1,399.9
	2017	33.06	0.34	0.00	273.19	97.59	404.18	49.2	1.7	0.0	866.0	709.3	1,626.1
Yukon/Transboundary	2016		2.70	113.37	14.81	2.62	133.51		9.6	277.7	61.1	15.8	364.2
	2017		2.4	63.1	13.2	1.3	80.00		8.5	154.6	54.5	7.8	225.4
Whole Country	2016	1,759.2	3,433.0	1,147.7	278.0	230.3	6,848.3	3,807.3	15,027.5	2,726.2	993.3	1,141.4	23,695.7
	2017	1,650.8	1,412.9	173.8	370.7	204.6	3,812.8	3,639.7	7,199.1	407.3	1,150.1	1,442.0	13,838.2

**Table 1.** Canadian recreational catch estimates of Pacific salmon (excluding steelhead) for 2016 and 2017, presented in pieces (000's).

<b>Reporting Area</b>	<b>Year</b>	<b>Recreational Catch Numbers (000's)</b>					
		<b>Pink</b>	<b>Chum</b>	<b>Sockeye</b>	<b>Coho</b>	<b>Chinook</b>	<b>Total</b>
South Coast	<b>2016</b>	5.0	5.6	4.7	34.4	85.6	135.3
	<b>2017</b>	27.5	5.1	0.2	25.5	81.5	139.9
West Coast Vancouver Island	<b>2016</b>	0.2	0.2	53.0	21.2	65.3	139.8
	<b>2017</b>	2.6	0.0	12.6	24.3	95.6	135.2
North Coast	<b>2016</b>	4.3	2.5	0.1	50.3	16.2	73.3
	<b>2017</b>	4.0	0.3	0.3	58.5	18.0	81.1
Haida Gwaii	<b>2016</b>	1.9	1.6	0.0	30.9	42.8	77.1
	<b>2017</b>	1.2	0.9	0.2	35.1	45.6	82.9
Yukon/Transboundary	<b>2016</b>	NR	NR	NR	NR	NR	NR
	<b>2017</b>	0.0	0.0	0.1	0.0	0.2	0.3
Whole Country	<b>2016</b>	11.4	9.9	57.8	136.7	209.8	425.6
	<b>2017</b>	35.2	6.3	13.3	143.5	240.7	439.0

**Table 2.** Canadian recreational catch estimates of steelhead since 2005/2006, presented in pieces (000's). ). Total catches are estimated via the Steelhead Harvest Analysis. BC Regions are defined as follows: 1=Vancouver Island; 2=Lower Mainland; 3=Thompson; 4=Kootenay; 5=Cariboo; 6=Skeena. Provided by M. Beere, BC Ministry of Forests, Lands and Natural Resource Operations, Smithers.

Year	BC Region					Unknown	Grand Total
	1	2	3	5	6		
2005/2006	16.844	22.626	2.730	2.636	32.312	0.259	77.406
2006/2007	22.332	11.465	1.812	3.698	25.367	0.372	65.046
2007/2008	15.923	14.027	0.809	2.492	26.949	0.358	60.557
2008/2009	NA	NA	NA	NA	NA	NA	NA
2009/2010	20.134	9.639	1.204	2.018	38.793	0.580	72.366
2010/2011	18.015	23.399	0.023	4.390	45.267	0.370	91.463
2011/2012	16.596	27.164	1.633	5.230	36.312	0.235	87.168
2012/2013	14.117	25.680	1.922	6.777	55.483	0.333	104.312
2013/2014	8.293	19.300	2.004	3.693	41.896	0.502	75.687
2014/2015	13.007	23.602	1.361	5.341	51.242	0.769	95.323
2015/2016	8.103	14.191	0.244	8.027	43.240	0.525	74.329



**Table 3.** Canadian subsistence catch estimates of Pacific salmon (including steelhead) for 2016 and 2017, presented in numbers (000's).

Reporting Area	Year	Subsistence Numbers (000's)						Total
		Pink	Chum	Sockeye	Coho	Chinook	Steelhead	
South Coast	2016	2.46	92.37	174.60	5.06	11.23		285.72
	2017	64.75	106.49	131.57	2.43	34.48		339.71
West Coast Vancouver Island	2016	0.03	2.90	37.35	6.70	5.87		52.85
	2017	0.02	1.56	25.07	4.57	7.60		38.81
North Coast	2016	9.10	1.31	208.72	8.99	11.02	2.04	241.18
	2017	17.46	2.52	116.30	13.52	11.67	0.89	162.36
Haida Gwaii	2016			7.34				7.34
	2017			4.87				4.87
Yukon/Transboundary	2016		4.00	11.65	0.05	3.61		19.30
	2017		3.30	9.40	0.80	1.10		14.60
Whole Country	2016	11.58	100.58	439.67	20.80	31.72	2.04	606.39
	2017	82.23	113.87	287.20	21.32	54.85	0.89	560.36

**Table 4.** DFO Salmon Enhancement Program and Fraser Valley Hatchery enhanced Pacific salmon releases (including steelhead) in 2016 and 2017, presented in numbers (000's).

Reporting Area	Release Year	Enhanced Salmon Releases (000's)						Total
		Pink	Chum	Sockeye	Coho	Chinook	Steelhead	
BC Interior	2016			10,453	176	1,226		11,855
BC Interior	2017			22,702	174	1,206		24,083
Fraser River	2016	1,516	10,611	3,773	1,830	2,140	173	20,044
Fraser River	2017		9,382	1,483	1,786	2,229	188	15,069
South Coast	2016	10,016	37,967	329	4,020	14,288	94	66,713
South Coast	2017	11,044	82,066	257	3,769	14,278	55	111,469
West Coast Vancouver Island	2016		21,219		795	15,327	100	37,441
West Coast Vancouver Island	2017		30,968		942	15,899	41	47,850
Central Coast	2016		8,366	171	71	2,680		11,288
Central Coast	2017		9,257	133	30	2,429		11,849
North Coast	2016		1,631	119,427	908	1,635	45	123,646
North Coast	2017		1,767	152,634	663	2,224	52	157,339
Haida Gwaii	2016		145		212	117		473
Haida Gwaii	2017		131		196	88		415
Whole Country	2016	11,532	79,938	134,154	8,013	37,413	412	271,461
Whole Country	2017	11,044	133,571	177,209	7,562	38,353	336	368,075