

**Kilbella/Chuckwalla Chinook Salmon  
Stock Recovery Enhancement, 2017-2018  
Final Report**



*Prepared for:*

**Pacific Salmon Commission**  
1155 Robson St, Vancouver, BC V6E 1B5

*Prepared by:*

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**September 2018**



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*Prepared by:*

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## **INTRODUCTION**

Stock assessment and enhancement priorities for Rivers Inlet have been examined and discussed extensively over the past five years. This project was one of the top priorities for work on Chinook and other salmon species in Rivers Inlet identified by a Rivers Inlet Salmon Steering Committee (RISSC) comprised of representatives from the Wuikinuxv First Nation, local lodge owners, Fisheries and Oceans Canada (DFO), Rick Hansen Foundation (RHF), Pacific Salmon Foundation (PSF), and independent scientists. The RISSC was established in 2011 to guide the development of an immediate action plan for Wannock River Chinook salmon and long-term plans for other Rivers Inlet stocks and salmon species.

Historically, Chinook salmon from the Kilbella/Chuckwalla rivers (Figure 1) represented a significant portion of the Chinook salmon caught in the Rivers Inlet recreational fishery (Nelson et al. 2000). Annual escapement monitoring through 2010 indicated a 5-10 fold decline in spawners from the numbers observed in the 1998-2002 period when these stocks were being augmented through small-scale enhancement. In 2010, the escapement estimates for Chinook salmon were only 150 and 75 for the Kilbella and Chuckwalla rivers, respectively. Results from surveys conducted in September 2013 indicated that the number of Chinook salmon spawners in these rivers was similar to the very low numbers observed in 2010. Chinook salmon escapement estimates derived from 2014 DFO aerial surveys were 200-300 and 100 for the Kilbella and Chuckwalla rivers, respectively. In 2014, 44 Chinook salmon (29 Kilbella, 15 Chuckwalla) were captured during broodstock collection by Snootli Hatchery personnel and Wuikinuxv Fisheries technicians (English and MacLaurin 2015). In 2015, 62 Chinook salmon (27 Kilbella, 35 Chuckwalla) were encountered during broodstock collection by staff from Snootli Hatchery, Wuikinuxv Fisheries, and LGL Limited (Smith et al. 2016). A similar number of Chinook salmon were encountered in 2016 (34 Kilbella, 31 Chuckwalla; Smith et al. 2017).

## **PROJECT GOALS AND OBJECTIVES**

The purpose of this project was to increase Chinook salmon returns to the Kilbella/Chuckwalla watersheds through a small-scale, targeted, enhancement program. Eggs and milt were collected from Kilbella/Chuckwalla Chinook salmon and reared at the Snootli Hatchery near Bella Coola (2014-2016 brood years) and Percy Walkus Hatchery in Oweekeno Village (2017 brood year). Fed fry were returned to net pens located near the Kilbella River estuary for further rearing prior to release. Information on the contribution of these fish to coastal fisheries will be obtained by applying coded-wire tags (CWT) to a large portion of the smolts released, and recovering marked fish from ongoing sampling programs in BC and Alaska.

The enhancement goal for 2014 and 2015 was to obtain 50,000 eggs and adequate milt from each stock in each year. This equates to 10 mature Chinook salmon of each sex annually from each river. The enhancement goal for 2016-2018 was to collect 75,000 eggs and adequate milt annually from each stock (15 fish of each sex). The ultimate goal is to increase number of annual spawners in the Kilbella and Chuckwalla rivers to an initial target of 1,000 adult Chinook salmon.

In the first year of this program (2014-15), 4 female fish were spawned (3 Kilbella, 1 Chuckwalla), 18,857 eggs were transported to Snootli Hatchery, 16,521 fry were transferred to net pens in Rivers Inlet (12,224 Kilbella; 4,258 Chuckwalla), and a total of 16,380 5.4-g smolts were released in the Spring of 2015 (Smith et al. 2016). Survival rates from egg take to release averaged 87% (94% for Kilbella, 71% for Chuckwalla). In the second year (2015-16), 8 females were spawned (6 Kilbella, 2 Chuckwalla), 32,853 eggs were transported to Snootli Hatchery, 30,333 fry were transferred to net pens, and 30,311 smolts were released in the Spring of 2016 (Smith et al. 2016). Survival rates from egg take to release averaged 92% (92% for Kilbella, 93% for Chuckwalla). In the third year (2016-17), 12 females were spawned (4 Kilbella, 8 Chuckwalla), 47,184 eggs were planted at the Snootli Hatchery, and 41,866 smolts were released in the Spring of 2016 (Smith et al. 2017). Egg-to-release survival averaged 88.7% (93.0% for Kilbella, 86.9% for Chuckwalla). While there has been a steady increase in the number of females spawned each year, poor escapements have impacted the ability to meet annual enhancement goals.

The following sections document results from 2017-18, the fourth consecutive year of this program. Plans for 2018-19 activities are also discussed.

## **2017 PROJECT LOGISTICS**

Personnel from Wuikinuxv Fisheries, DFO, Good Hope Cannery, Duncanby Lodge, and LGL Limited contributed to the 2017-18 project. In August and September, out-of-town crew members stayed at the Percy Walkus Hatchery and Eagle's Nest Bed and Breakfast in Wuikinuxv Village. Helicopter support (Hughes 500 and A-Star; Photo 1 and Photo 2) to conduct broodstock collection and aerial surveys was provided by West Coast Helicopters (Port McNeill).

## **RESULTS OF AERIAL COUNTS IN 2017**

Broodstock crews spent a limited amount of helicopter time conducting aerial counts for Chinook salmon in 2017. However, aerial counts via helicopter were conducted independently by DFO in both river systems.

*Kilbella River:* Broodstock crews did not observe any Chinook salmon in the Kilbella River from the air during their field activities from 23 August to 7 September. A DFO crew observed 10 Chinook salmon (9 live, 1 dead) in the Kilbella River on 29 August, and none on 12 September due to high turbidity and moderate water levels (Table 1). In general, poor water clarity in the Kilbella River makes it difficult to conduct effective aerial counts.

*Chuckwalla River:* The broodstock crew counted one live Chinook salmon in the Chuckwalla River on 7 September (Table 1). A DFO crew observed 3 live Chinook salmon in the Chuckwalla River on 29 August, and 7 live fish on 12 September, although water clarity was poor during the latter survey.

## RESULTS OF 2017 BROODSTOCK COLLECTION EFFORTS

*Kilbella River:* In 12 days of fishing effort from 23 August to 7 September, 85 gillnet sets (100 ft long, 8.25 in. mesh) were made between rkm 23.7 and rkm 39.8 on the Kilbella River (Table 2; Photo 3). A total of 89 live Chinook salmon were captured, including 67 unmarked (or “new”) fish (15 female, 52 male), 21 recaptures (1 female, 20 male), and 1 male Chinook that escaped prior to being inspected for marks (Table 2; Photo 4). No Chinook salmon carcasses were encountered on the Kilbella River in 2017. Four key locations for capturing Chinook salmon on the Kilbella River in 2017 included:

- 1) “Sperm Bank” [rkm 38.9] – a right-bank side channel where fish spawn at the lower end and seek cover beneath an undercut bank;
- 2) “Shotgun Boil” [rkm 38.8] – a mainstem run where pre-spawn fish appeared to hold prior to moving to spawning areas located farther upstream;
- 3) “Left-bank Shorty” [rkm 37.6] – a short, left-bank side channel where fish appeared to be spawning; and
- 4) “Amnesia Run” [rkm 27.2] – a left-bank side channel where fish were observed spawning.

Six females were spawned, of which two were full of eggs and four were only partially full of eggs (Table 3). One of the ‘full’ females was caught on 30 August at the “Shotgun Boil” site, held in an aluminum tube for 4 days, and then spawned on 3 September. Milt from 11 different males was used to fertilize the eggs (Table 3). Females averaged 70 cm POH (range: 63-75 cm POH) and males averaged 59 cm POH (range: 40-84 cm POH; Figure 2). Successfully aged scale samples collected from Chinook salmon caught in the Kilbella River in 2017 consisted of fish of ages 3<sub>1</sub> (9), 4<sub>1</sub> (16), 5<sub>1</sub> (4), 3<sub>2</sub> (2), 4<sub>2</sub> (11), and 5<sub>2</sub> (4; Table 4).

One adipose-clipped Chinook salmon (male, 51 cm POH) was captured at the “Sperm Bank” site on 27 August. This was likely the first fish raised and released under the Stock Recovery Enhancement Program to be recovered on the spawning grounds (which is not surprising as it would be an age-3 fish which are seldom recovered in-river). The adipose-clipped fish was ‘green’ and thus released alive after scales were taken. It was never recaptured so that the coded-wire tag could be recovered, but the scale age/pattern may provide evidence of fish culture and confirm if it was of hatchery origin.

*Chuckwalla River:* In 12 days of fishing effort from 23 August to 7 September, 97 gillnet sets were made between rkm 7.1 and rkm 27.3 on the Chuckwalla River (Table 2). A total of 33 live Chinook salmon were captured, including 29 unmarked fish (5 female, 24 male) and 4 male recaptures (Table 2). No Chinook salmon carcasses were encountered on the Chuckwalla River in 2017. Three key locations for capturing fish on the Chuckwalla River in 2017 included:

- 1) “Side channel below John’s” (rkm 22.6) – a left-bank side channel where spawning has been observed near the outlet, approximately 400 m below the mouth of John’s Creek;

- 2) “Horse Hole” (rkm 21.9) – a mainstem site located 150 m downstream from the mouth of the lower braid of John’s Creek; and
- 3) “10-K Pool” (rkm 13.1) – a mainstem pool/run located <1 km below the canyon.

All five of the female fish that were spawned in the Chuckwalla River in 2017 were captured in the “10-K Pool” (Table 3). Of these, 3 females were captured on 4 September, held for 5 days in aluminum tubes in a right-bank side channel located immediately upstream of the capture site, and then spawned on 9 September. Milt from five different male fish was used to fertilize the eggs (Table 3). Females averaged 75 cm POH (range: 69-79 cm POH) and males averaged 57 cm POH (range: 41-65 cm POH; Figure 2). Successfully aged scale samples collected from Chinook salmon caught in the Chuckwalla River in 2017 consisted of fish of ages 4<sub>1</sub> (2), 3<sub>2</sub> (1), 4<sub>2</sub> (14), and 5<sub>2</sub> (3; Table 4).

On both rivers, all fish held in aluminum tubes to ripen were kept at or near their respective capture sites. Unlike 2016, no fish were transported via helicopter to a common holding site in the lower Chuckwalla River (rkm 0.6) in 2017. No fish died while being held in 2017 or showed any visible signs of stress (e.g., fungal growth). One female caught and held on 25 August on the Kilbella River was released on 29 August because she showed no signs of ripening.

Fishing effort in 2017 (182 sets, 14 days of effort in each river) was substantially greater than in 2016 (144 sets, 7 days in Kilbella, 8 days in Chuckwalla), due in part to using two crews for a portion of the 2017 season. Despite the greater fishing effort, only 11 females (6 Kilbella, 5 Chuckwalla) were spawned in 2017 compared to 12 (4 Kilbella, 8 Chuckwalla) in 2016.

Overall, Chinook salmon abundance in both rivers continued to be very low in 2017 (Figure 3), and the enhancement goal of collecting eggs from 15 Chinook salmon in each river was not met.

## **RESULTS OF 2017 BROOD YEAR EGG INCUBATION AND FRY RELEASE**

Based on live and dead inventory of eggs at the eyed stage, 51,043 eggs (19,081 Kilbella; 31,967 Chuckwalla) were planted at the Percy Walkus Hatchery for incubation in August and September 2017 (Table 5; Photo 5 and Photo 6). This was an 8.2% increase in the number of eggs planted compared to 2016. Green egg to eyed egg survival was 90.8% for the Kilbella and 87.2% for the Chuckwalla. The lower Chuckwalla survival rate was attributed to one female with poor fertilization success).

Fed fry were transported to net pens in Kilbella Bay. On 2 May and 11 May 2018, respectively, 17,635 Kilbella and 27,559 Chuckwalla smolts were released from the net pens. Egg-to-fry survival was excellent for both stocks and there were few mortalities through rearing. Overall egg-to-release survival was 92% for the Kilbella and 86% for the Chuckwalla (Table 5).

## PLANS FOR 2018 BROODSTOCK COLLECTION EFFORTS

The experience gained since 2014-15 has been used to develop plans for 2018-19 that will address the challenges encountered to date related to helicopter access, fish holding, and the number of crews during broodstock collection. The five project components for 2018-19 will include:

- 1) additional survey effort to improve the reliability of annual escapement estimates and determine the best locations and approach for obtaining broodstock;
- 2) broodstock collection in late August and early September;
- 3) reporting and recovery/sampling of adipose-clipped adult fish;
- 4) egg incubation, fry ponding/rearing, and CWT application at Percy Walkus Hatchery; and
- 5) transport of fry to net pens in Kilbella Bay for further rearing from April until release in May of 2019.

These activities will be coordinated with the enhancement efforts for Wannock River Chinook salmon to ensure there is capacity to accommodate both groups of fish at the Percy Walkus Hatchery and in the net pens. Wuikinuxv Fisheries personnel will play an integral role as members of the Percy Walkus Hatchery crew, and will conduct escapement monitoring, broodstock collection, incubation, rearing, marking, and final rearing of Chinook salmon fry in the net pens prior to release.

The proposed 2018 escapement monitoring and broodstock collection program will include a full-time field program supervisor (Jason Smith or Brydon Peace) who will be on-site for the entire broodstock collection period. Similar to 2014–2016, one 3-4 person field crew will be used at the start of the program. The utility of deploying two crews will be reviewed by the project team prior to the field season. The utility of deploying two crews will be reviewed by the project team prior to the field season. Two crews were utilized for the initial portion of the 2017 season; however, the benefits of increased fishing effort may not outweigh the costs of increased helicopter time and associated logistical challenges.

In 2018, escapement numbers and broodstock collection locations will be determined using a combination of aerial, snorkel, and ground-based survey techniques. Broodstock collection will be conducted using gill nets (100 ft long, 8.25 in. mesh), similar to the methods used from 2014 to 2017, which have also been used successfully for Wannock River Chinook salmon. Fishing effort in 2018 will be focused in the upper reaches of both rivers (i.e., from the 10-K Pool up to John's Creek on the Chuckwalla River [rkm 13–23], and from the cascades up to Mallon Creek on the Kilbella River [rkm 30–40]). Relatively few Chinook salmon have been observed in the lower reaches of either river since 2014. Any Chinook salmon present in these lower reaches tend to be co-mingled with hundreds of pink and chum salmon which makes it difficult to target Chinook salmon with a gillnet. Crews will also focus their initial fishing effort in the few key locations where fish have been captured in the past (e.g., "10-K Pool" on the Chuckwalla; "Sperm Bank" and "Amnesia Run" on the Kilbella).

Similar to 2017, pre-spawn Chinook salmon that are considered 'close' to being ripe will be held in submerged aluminum tubes for short periods of time until they are ready to be spawned. The holding sites will be located at or near the location where fish are captured. All fish held in 2017 remained healthy until spawned, no aluminum tubes were lost during high water events, and there was no evidence of tampering by predators (e.g., bears). Note that in 2016, crews transported 'close' fish via helicopter from their capture sites to a common holding location in the lower Chuckwalla River (rkm 0.6). And lastly, uniquely numbered operculum tags will be applied to all Chinook salmon captured and released to help keep track of fish that may be recaptured and spawned.

## **PLANS FOR 2018 BROOD YEAR EGG INCUBATION AND FRY RELEASE**

Eggs and sperm from the 2018 brood year will be collected on the rivers and the gametes taken to the Percy Walkus Hatchery. Eggs will be fertilized, rinsed, and placed in Heath-type, vertical incubators with a 100 ppm iodine solution. The antiseptic bath will be timed for 10 minutes, and then the trays will be placed into flowing water. At the eyed stage of development, eggs will be shocked, picked, enumerated, and placed back in Heath trays. Fish will be ponded in Capilano-type troughs or 8-ft circular tubs, depending on inventories at the time. When fry are over 1.5 g, all fish will be CWT marked, which will also verify fish numbers. Rearing will continue until fry reach ~3 g, at which point they will be transported to net pens in Rivers Inlet for final rearing and release. One float with two nets (15' long x 15' wide x 15' deep per net) will be used. This will ensure density at maximum size will not exceed the recommended 5 kg/m<sup>3</sup>. Fish will be feed a daily ration until they reach an average weight of 5 g (target date to reach this size is 15 May). Records of mortality will be kept throughout rearing so an accurate number of fish released can be reported.

## **PROJECT FUNDING AND COSTS FOR 2017-18**

The PSC funding available for activities associated with the second year (2017-19) of Kilbella-Chuckwalla Chinook recovery enhancement efforts was \$93,655. The current contract is slated to end on 30 September 2018. The final project and financial report to be submitted within 45 days of the end of the project to ensure that costs associated with the preparation of the project reports, preparations for the 2018 field program and complete project accounting and deliverables are covered by the 2017-18 project.

## **ACKNOWLEDGEMENTS**

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Table 1. Aerial counts of Chinook salmon conducted by DFO and PSC crews in 2017.

River Section Date & Crew	River km		Chinook Salmon			Water Level	Water Clarity	Water Visibility
	From:	To:	Live	Dead	Total			
Kilbella River								
29 August (DFO)								
Mallon Cr to Cascades	40.0	29.5	1	0	1	Low	Silty	Poor
Cascades to 9-Mile Br	29.5	17.3	8	0	8			
9-Mile Br to Mouth	17.3	0.0	0	1	1			
Total			9	1	10			
12 September (DFO)								
Mallon Cr to Cascades	40.0	29.5	0	0	0	Med	Very Silty	Very Poor
Cascades to 9-Mile Br	29.5	17.3	0	0	0			
9-Mile Br to Mouth	17.3	0.0	0	0	0			
Total			0	0	0			
Chuckwalla River								
29 August (DFO)								
Above Johns Cr	> 23.0		0	0	0	Low	Good	Fair
Johns Cr to Cascades	23.0	20.0	0	0	0			
Cascades to Canyon	20.0	14.0	0	0	0			
Canyon to Bridge Pool	14.0	6.0	3	0	3			
Bridge Pool to Mouth	6.0	0.0	0	0	0			
Total			3	0	3			
7 September (PSC)								
Above Johns Cr	> 23.0		not surveyed			Low	Fair	Fair
Johns Cr to Cascades	23.0	20.0	1	0	1			
Cascades to Canyon	20.0	14.0	0	0	0			
Canyon to Bridge Pool	14.0	6.0	0	0	0			
Bridge Pool to Mouth	6.0	0.0	0	0	0			
Total			1	0	1			
12 September (DFO)								
Above Johns Cr	> 23.0		not surveyed			Low	Silty (Green)	Poor
Johns Cr to Cascades	23.0	20.0	0	0	0			
Cascades to Canyon	20.0	14.0	0	0	0			
Canyon to Bridge Pool	14.0	6.0	7	0	7			
Bridge Pool to Mouth	6.0	0.0	0	0	0			
Total			7	0	7			

**Table 2. Number of live Chinook salmon encountered during broodstock collection in 2017.**

River & Date	No. Sets	New Fish		Recaps		New Fish + Recaps			CPUE
		Female	Male	Female	Male	Female	Male	Total	
Kilbella									
23-Aug	3	0	0	0	0	0	0	0	0.00
24-Aug	9	0	6	0	0	0	6	6	0.67
25-Aug	10	2	1	1	0	3	1	4	0.40
27-Aug	5	1	6	0	0	1	6	7	1.40
28-Aug	10	0	0	0	0	0	0	0	0.00
29-Aug	10	2	12	0	2	2	14	16	1.60
30-Aug	10	4	2	0	3	4	5	9	0.90
1-Sep	6	2	7	0	4	2	11	13	2.17
3-Sep	5	0	1	0	3	0	4	4	0.80
5-Sep	2	1	6	0	4	1	10	11	5.50
6-Sep	9	3	5	0	1	3	6	9	1.00
7-Sep	6	0	6	0	4	0	10	10	1.67
Subtotal	85	15	52	1	21	16	73	89	1.05
Chuckwalla									
23-Aug	9	0	4	0	1	0	5	5	0.56
24-Aug	11	0	0	0	0	0	0	0	0.00
25-Aug	9	0	1	0	0	0	1	1	0.11
27-Aug	13	0	0	0	0	0	0	0	0.00
28-Aug	10	0	7	0	1	0	8	8	0.80
29-Aug	10	0	0	0	0	0	0	0	0.00
31-Aug	12	0	3	0	0	0	3	3	0.25
1-Sep	1	0	0	0	0	0	0	0	0.00
4-Sep	16	3	5	0	1	3	6	9	0.56
5-Sep	3	2	1	0	0	2	1	3	1.00
6-Sep	1	0	0	0	0	0	0	0	0.00
7-Sep	2	0	3	0	1	0	4	4	2.00
Subtotal	97	5	24	0	4	5	28	33	0.34
Total	182	20	76	1	25	21	101	122	0.67

Note:

No dead Chinook salmon were found during broodstock collection activities on either river in 2017.

**Table 3. Number of Chinook salmon spawned in 2017, by river and capture date.**

River & Date Caught	Female		Male
	Full	Partial	
Kilbella			
23-Aug	0	0	0
24-Aug	0	0	0
25-Aug	0	0	0
27-Aug	0	1	2
28-Aug	0	0	0
29-Aug	0	1	2
30-Aug	1	2	2
1-Sep	0	0	3
3-Sep	0	0	0
5-Sep	1	0	2
6-Sep	0	0	0
7-Sep	0	0	0
Subtotal	2	4	11
Chuckwalla			
23-Aug	0	0	0
24-Aug	0	0	0
25-Aug	0	0	0
27-Aug	0	0	0
28-Aug	0	0	0
29-Aug	0	0	0
31-Aug	0	0	0
1-Sep	0	0	0
4-Sep <sup>b</sup>	3	0	4
5-Sep	2	0	1
6-Sep	0	0	0
7-Sep	0	0	0
Subtotal	5	0	5
Total	7	4	16

<sup>a</sup> 1 female caught on 8/30 was held and spawned on 9/3.

<sup>b</sup> 3 females caught on 9/4 were held and spawned on 9/9.

**Table 4. Age composition of Chinook salmon sampled in the Kilbella/Chuckwalla rivers in 2017.**

	European	0.2	0.3	0.4	1.1	1.2	1.3	M1	M2	M3	M4	
River	Gilbert-Rich	3 <sub>1</sub>	4 <sub>1</sub>	5 <sub>1</sub>	3 <sub>2</sub>	4 <sub>2</sub>	5 <sub>2</sub>	1M	2M	3M	4M	Total
Kilbella	Male	9	10	2	2	11	1	1	10	4	0	50
	Female	0	6	2	0	0	3	0	0	2	0	13
	Total	9	16	4	2	11	4	1	10	6	0	63
Chuckwalla	Male	0	1	0	1	14	0	0	3	1	0	20
	Female	0	1	0	0	0	3	0	0	0	1	5
	Total	0	2	0	1	14	3	0	3	1	1	25

Notes:

M1 (1M) = 1 marine annuli; M2 (2M) = 2 marine annuli; etc.

Table 5. Number of Chinook salmon reared and released, by river and brood year.

River & Brood Year	Females Spawned <sup>a</sup>	Eggs Planted <sup>b</sup>	Fry Transferred to Sea Pens	Fry Released in Ocean <sup>c</sup>	Egg-to-Release Survival
<b>Kilbella</b>					
2014	3	12,859	12,224	12,122	94.3%
2015	6	21,252	19,523	19,518	91.8%
2016	4	14,082	-	13,096	93.0%
2017	6	19,081	17,635	17,606	92.3%
Subtotal	19	67,274	49,382	62,342	92.7%
<b>Chuckwalla</b>					
2014	1	5,998	4,297	4,258	71.0%
2015	2	11,601	10,810	10,793	93.0%
2016	8	33,102	-	28,770	86.9%
2017	5	31,962	27,559	27,432	85.8%
Subtotal	16	82,663	42,666	71,253	86.2%
<b>Combined Total</b>					
2014	4	18,857	16,521	16,380	86.9%
2015	8	32,853	30,333	30,311	92.3%
2016	12	47,184	-	41,866	88.7%
2017	11	51,043	45,194	45,038	88.2%
<b>Total</b>	<b>35</b>	<b>149,937</b>	<b>92,048</b>	<b>133,595</b>	

<sup>a</sup> Number of females that were partially spent, by brood year: 2014 (1 Kil), 2015 (3 Kil, 1 Chu), 2016 (2 Kil, 3 Chu), 2017 (4 Kil).

<sup>b</sup> Eggs were planted at the Snootli Hatchery for the 2014-16 brood years and the Percy Walkus Hatchery for the 2017 brood year.

<sup>c</sup> Net pens were located in Kilbella Bay, Rivers Inlet.



Figure 1. Map of the Kilbella and Chuckwalla rivers and the location of the sea pens in Kilbella Bay.

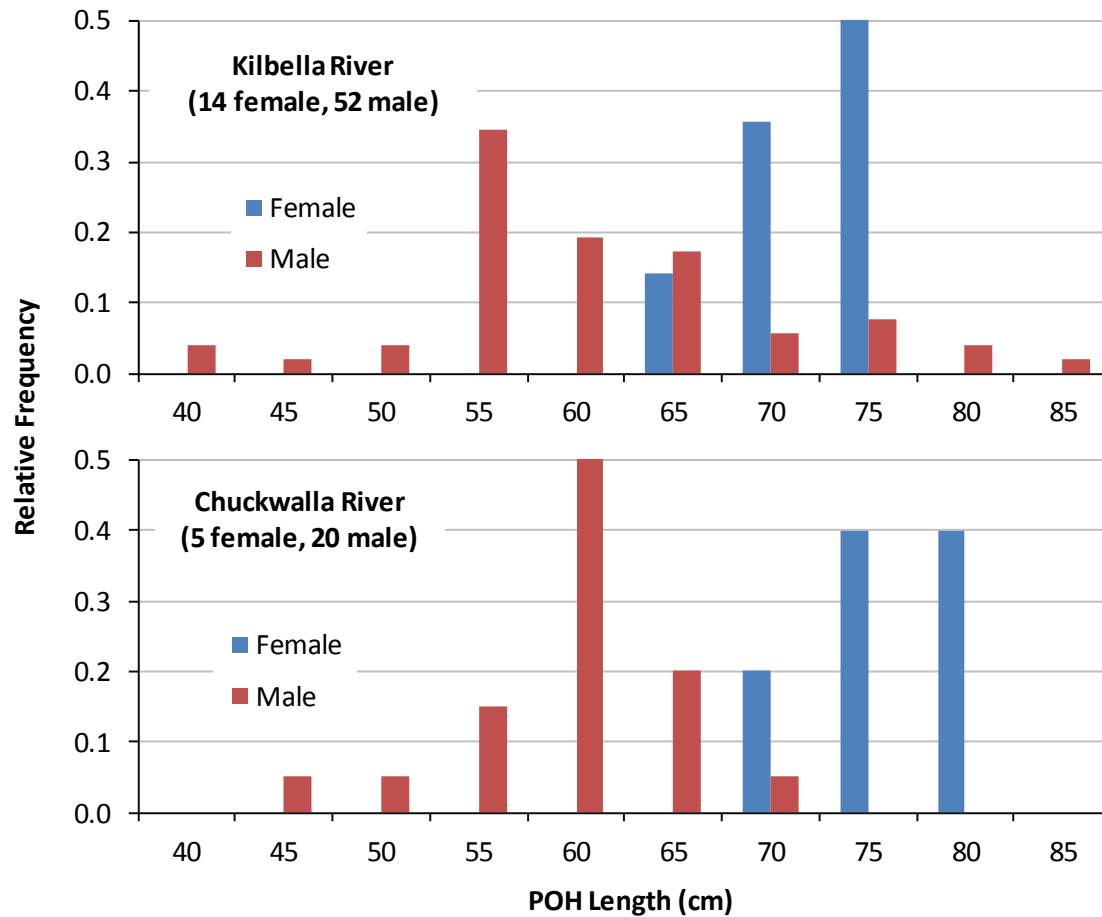


Figure 2. Length-frequency distribution of unmarked ('new') Chinook salmon sampled in 2017, by river and sex. Post-orbital hypural (POH) length was used. These data exclude recaptures.

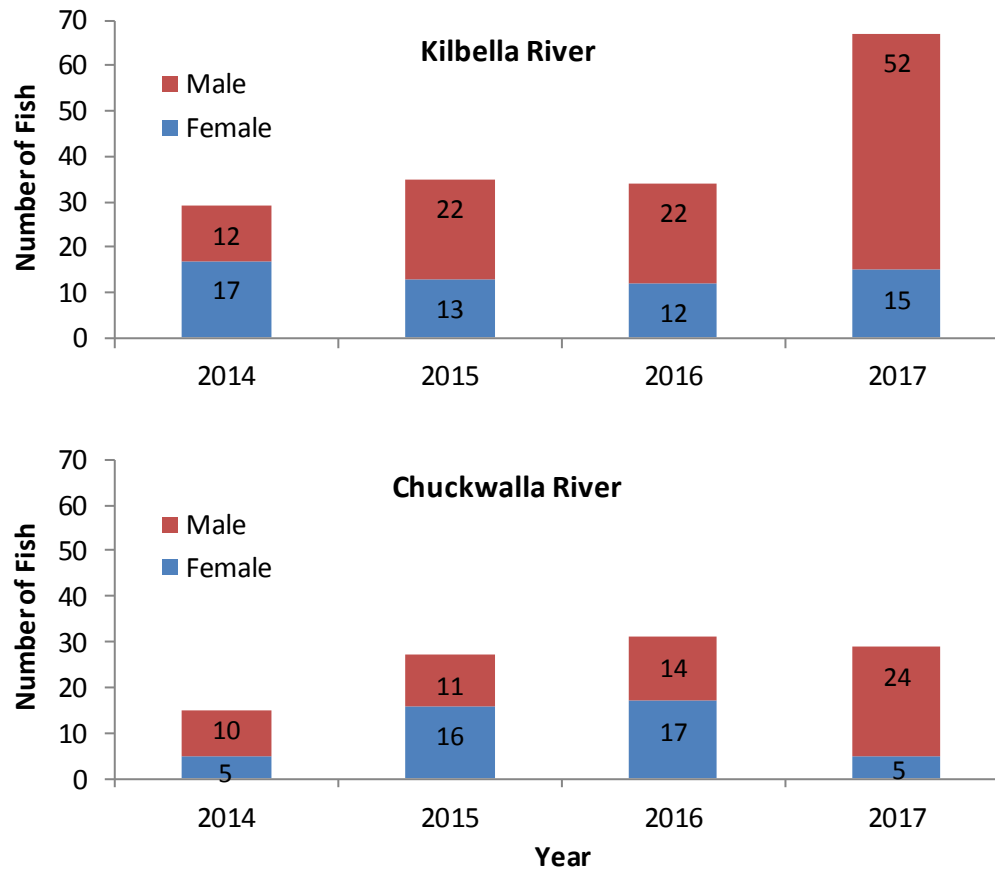


Figure 3. Number of unmarked ('new') Chinook salmon encountered during broodstock collection activities, 2014 to 2017. These counts include both live and dead fish, but exclude recaptures.



**Photo 1. A-Star helicopter used to transport crew and gear between the hatchery and rivers (31 August 2017).**



**Photo 2. Hughes 500 helicopter used to transport crew and gear between the hatchery and rivers (24 August 2017).**



**Photo 3. Inflatable raft used for broodstock collection on the Kilbella River (28 August 2017).**



**Photo 4. Billy Johnson (left) and Ian Douglas (right) with a female Chinook salmon caught on the Kilbella River (25 August 2017).**



**Photo 5. Sandie MacLaurin weighing a bucket of Chinook salmon eggs collected from a ripe female on the Kilbella River (26 August 2017).**



**Photo 6. Sandie MacLaurin placing fertilized Chinook salmon eggs into a tray at the Percy Walkus Hatchery (27 August 2017).**