Upper Puntledge River Watershed
Chum Carcass Distribution

FWCP Project No. COA-F21-F-3254

Prepared for:

Fish and Wildlife Compensation Program

Prepared by:

E. Guimond[1] and W. White[2]

Prepared with financial support of:

**Fish and Wildlife Compensation Program
on behalf of its program partners BC Hydro, the Province of BC,
Fisheries and Oceans Canada, First Nations and public stakeholders.**

21 March 2021

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[1] 473 Leighton Ave., Courtenay, BC, V9N 2Z5

[2] Box 3177, 3780 Colake Road, Courtenay, BC, V9N 8H9

Executive Summary

Salmon carcasses play a key role in maintaining the productivity and sustainability of salmonid ecosystems and are important for transporting marine nutrients to the aquatic and terrestrial food web through various pathways. Nutrient enrichment, through the addition of hatchery salmon carcasses, is an effective habitat restoration and enhancement tool that has been used to increase fish production and biodiversity in oligotrophic lakes and streams.

Between October 27 and November 3, 2020, volunteers from the Courtenay and District Fish and Game Protective Association transported and placed 4,100 chum salmon carcasses from Puntledge River Hatchery into the upper Puntledge River watershed. The Chum Carcass Distribution program addresses 'Habitat-based' Level 1 Priority actions for anadromous and resident salmonids, identified in the Puntledge River Salmonid Action Plan (FWCP 2011). Priority Actions PUN.RLR.HB.17.01 and PUN.RLR.HB.14.05 focus on implementing habitat restoration, enhancement and/or protective measures within the Upper Puntledge and Cruickshank rivers, Perseverance Creek and other tributaries to Comox Lake, to sustain and restore habitat capacity and population viability of anadromous and resident salmonids.

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Introduction

Salmon carcasses play a key role in maintaining the productivity and sustainability of salmonid ecosystems and are important for transporting marine nutrients to the aquatic and terrestrial food web through various pathways. The nutrient recycling process includes organic and inorganic components, both important for biological diversity maintenance (Cederholm et al. 1999). Studies suggest that the input of marine-derived nutrients from spawning salmon has been reduced to only 6-7% of historical levels in Pacific Northwest streams (Gresh et al. 2000; Stockner and Ashley 2003). The loss or disruption of this critical 'salmon mediated' nutrient transport system, due to significant declines in salmon returns in British Columbia, is adversely impacting ecosystem productivity and biodiversity in many freshwater systems. With the continued decline and/or low levels in abundance of salmon and trout populations in the Puntledge River watershed, it is important to take action in multiple ways to address the issue.

Nutrient enrichment is an effective habitat restoration and enhancement tool that has been used to increase fish production and biodiversity in oligotrophic lakes and streams in BC and Alaska. Extensive research has shown that the addition of salmon carcasses to streams can result in increased juvenile density, growth rate, body size, improved fish condition, improved overwintering survival and ultimately increased marine survival. The use of hatchery salmon carcasses to increase the nutrient loading in salmon rearing streams was found to increase densities of age-0-plus Coho salmon, and age-0-plus and age-1-plus steelhead in small southwestern Washington streams (Bilby *et al.* 1998).

Goals and Objectives

The Chum Carcass Distribution initiative in the upper Puntledge River watershed was developed in consideration of these ecological benefits. The Courtenay and District Fish and Game Protective Association (CFGPA) has been involved with the program since its inception in 2010, in partnership with Fisheries and Oceans (DFO) Puntledge River Hatchery, and BC Hydro.

Direct application of Puntledge River hatchery chum salmon carcasses is a cost-effective short-term restoration technique for transferring large amounts of nutrients to the ecosystems in the upper watershed, because of its accessible roads and readily available supply of carcasses. The distribution of salmon carcasses and the release of marine derived nutrients into streams and tributaries in the upper Puntledge watershed, will increase biological productivity through various energy pathways, and improve rearing conditions for juvenile salmonids

This project addresses 'Habitat-based' Level 1 Priority actions for anadromous and resident salmonids, identified in the Puntledge River Salmonid Action Plan (FWCP 2011). Priority Actions PUN.RLR.HB.17.01 and PUN.RLR.HB.14.05 focus on implementing habitat restoration, enhancement and/or protective measures within the Upper Puntledge and Cruickshank rivers, Perseverance Creek and other tributaries to Comox Lake, to sustain and restore habitat capacity and population viability of anadromous and resident salmonids.

Study Area

The Puntledge River watershed encircles an area of approximately 600 km^2 on the northeast side of Vancouver Island, BC, approximately 6 km west of the City of Courtenay (Figure 1). Comox Lake lies at 135 m above sea level, and has a surface area of 2118 ha, an average depth of 61 m and a maximum depth of 109 m (BC Hydro 2003). Comox Lake receives inflows from two large tributaries, the Cruikshank and Upper Puntledge rivers, and numerous smaller tributaries. The headwaters of these two main tributaries extend into the Comox Glacier and Forbidden Plateau and provide a continuous flow of freshwater from snow melt during the spring/summer months. The Cruikshank River is a high gradient system with several tributaries within its watershed of 213 km^2, including Comox, Rees, and Eric creeks. The Upper Puntledge River drains an area of 92 km^2, and is of lower gradient than the Cruikshank in its lower reaches. Forbush and Willemar Lakes are located in the lower mainstem of the Upper Puntledge River. These small lakes are 47 and 82 hectares in area, respectively, and are important rearing areas for trout, and juvenile coho. Comox Lake and its tributaries are classified as nutrient limited, and as a result, have low biological productivity (Epps 2011).

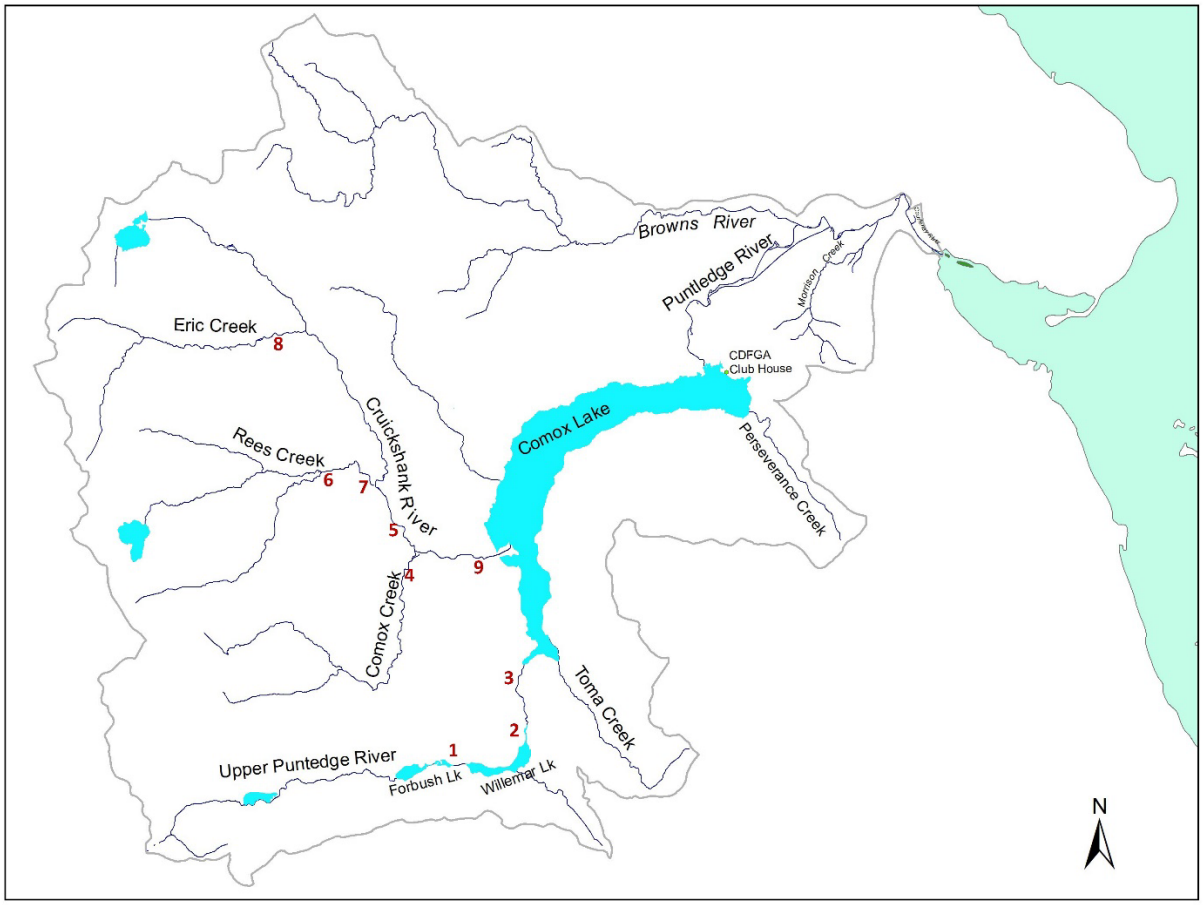

Figure 1. Location map of the Puntledge River watershed and chum placement sites (see Table 1 for description).

Methodology

Carcass dispersal in the upper Puntledge watershed followed established DFO Draft Guidelines for In-stream Placement of Hatchery Carcasses, (http://docs.streamnetlibrary.org/CanadaDFO/cdfo-carcass_guide_e.pdf). The guidelines are intended to increase the overall benefits from carcass placement by providing best management practices that will minimize disease risk and other concerns while underlining the interagency process to avoid potential conflicts between agencies and stakeholder groups.

A Carcass Placement Plan was developed with assistance from Puntledge River Hatchery that outlined the project objectives and rationale, approximate timing of carcass distribution, location of treatment streams and carcass loading density (i.e. number of carcasses per stream). The maximum number of chum carcasses permitted from Puntledge River Hatchery is based on the number of chum salmon broodstock used in their enhancement program, or a total of 5,100 pieces.

Table 1. Locations of chum carcass planting in the upper Puntledge River watershed. Map reference # indicates carcass placement site in Figure 1.

Tributary	Planting Site	Map Ref #
Upper Puntledge River	Outlet of Forbush Lake	1
	Outlet of Willemar Lake	2
	Lower river bridge crossing	3
Cruickshank River	South Fork (Comox Creek)	4
	Side channel (approx 4 k)	5
	Rees Ck Upper (west fork)	6
	Rees Ck Lower (approx 6 k)	7
	Eric Creek (top bridge)	8
	Bridge on Mainstem	9

Results and Discussion

Between October 27 and November 3, 2020, a total of 4,100 chum salmon carcasses from Puntledge River Hatchery were distributed to the 9 treatment sites in the Upper Puntledge and Cruickshank rivers (Figure 2). This is 1000 carcasses short of the maximum number that are typically placed each year, due to a protracted start of the chum migration, and a brief period when few adults were swimming into the hatchery. The migration behaviour of the fish, combined with the hatchery operations for brood collection, influence when fish are available in sufficient numbers to transport to the upper watershed. At the beginning of the 2020 chum migration and broodstock collection program, there were not enough chum carcasses to fill the four totes required per trip (ie: 2 totes/truck and 2 trucks/site). Chum salmon decompose very quickly, therefore storing the carcasses unrefrigerated for more than 24 hours is not desirable as the carcasses begin to putrefy and become too soft to handle

during in-stream placement. Furthermore, due to Covid-19, the number of volunteers involved on any given day was reduced. These measures ensured that safe work procedures for Puntledge Hatchery staff and CFGA members while on site, and during carcass transport and placement, were maintained. A total of 4 volunteers participated per day with a total cohort of 6 for substitutions.

Reporting on the chum distribution program was provided to members of the CFGPA Conservation Committee and the Board of Directors during regular meetings, but due to Covid-19 we could not report to the membership.

As a requirement under the carcass placement Authorization, monitoring of the chum carcass placement sites was conducted on November 16, 2020. Information on the number of carcasses remaining, as a percentage of total placement, condition of carcasses, signs of predators or carcass removal, distance of movement downstream, and other environmental variables was recorded. DFO maintains game cameras to monitor predation from the time the fish are dispersed until their final monitoring trip noted above.

Figure 2. CFGPA volunteers (left) ready to distribute chum carcasses (right) to treatment sites in the upper Puntledge River watershed.

Figure 3. Pitching chum carcasses with peugh sticks is hard, but satisfying work (left). Chum carcasses beginning to decompose at one of the treatment sites in the Cruickshank River (right).

Summary and Recommendations

The CFGPA anticipate that the challenges caused by the pandemic in 2020, in distributing the maximum number of chum carcasses to the upper Puntledge watershed will be resolved for the coming year of the program. The CFGPA plans to partner with the K'ómoks First Nation Guardian Watchmen in the chum distribution program and provide mentorship to youth and students in the future years.

Acknowledgements

We are grateful for the financial support for this study from Fisheries and Oceans Canada (DFO) Ecosystem Management and the Fish and Wildlife Compensation Program (FWCP), on behalf of its program partners BC Hydro, the Province of BC, Fisheries and Oceans Canada, First Nations and public stakeholders. The chum carcass distribution program was made possible by the commitment and contributions of various DFO personnel from Puntledge River Hatchery, and volunteers with the Courtenay and District Fish and Game Protective Association Conservation Committee (CFGA).

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