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FISH AND WILDLIFE
COMPENSATION PROGRAM

PUNTLEDGE RIVER WATERSHED *SALMONID ACTION PLAN* FINAL DRAFT

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OCTOBER 2011

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Puntledge River Salmonid Action Plan

1 INTRODUCTION

The Fish and Wildlife Compensation Program (FWCP): Coastal Region evolved from its origin as the Bridge-Coastal Restoration Program (BCRP), a program initiated voluntarily by BC Hydro in 1999 to restore fish and wildlife resources that were adversely affected by the footprint of the development of hydroelectric facilities in the Bridge-Coastal generation area. Footprint impacts include historical effects on fish and wildlife that have occurred as a result of reservoir creation, watercourse diversions and construction of dam structures.

In 2009, the program developed a strategic framework that guides overall planning for compensation investments (MacDonald 2009). The framework has guided the development of strategic plans for each watershed within the FWCP program area, which are in turn informing action plans that focus on specific priorities within each watershed (Figure 1).

This Salmonid Action Plan sets out priorities for the Fish and Wildlife Compensation Program to guide projects in the Puntledge River project area. It identifies actions to be undertaken throughout the Puntledge River in support of salmonid fish species. The plan builds on the FWCP's strategic objectives and the Puntledge River Watershed Plan (FWCP 2011). Action plans have also been developed for riparian and wetland areas and species of interest; and some actions may be complementary across the different plans.

The actions and priorities outlined in this plan have been identified through a multi-stage process involving BC Hydro, Fisheries and Oceans Canada (DFO), Canadian Wildlife Service (CWS), Ministry of Environment (MOE), local First Nations, and local communities. Initial priorities were developed through consultation with agency staff. These priorities were then reviewed and discussed at a workshop¹ to allow First Nations, public stakeholders, and interested parties to comment and elaborate on the priorities.

It is important to understand, however, that planning priorities within action plans may not translate immediately into funded projects. Limited program funding requires that priority-setting has to also be developed across the program as a whole, not just within action plans. The process of selecting which actions will be implemented in any given year will occur during the annual implementation planning cycle.

¹ Courtney, B.C. (14 March, 2008)

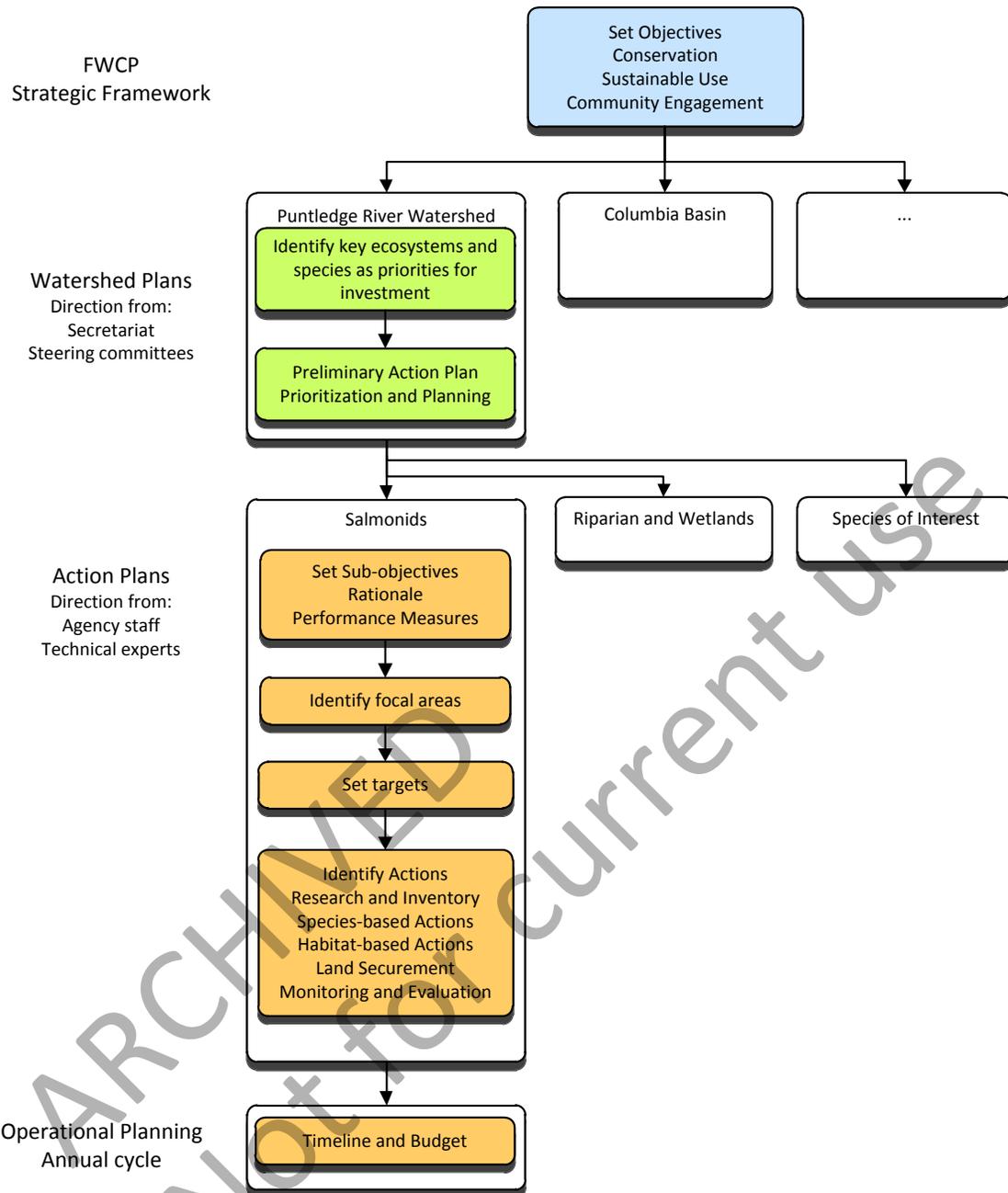


Figure 1. Relationship between the Salmonid Action Plan and higher level planning and objectives.

2 OVERVIEW CONTEXT

The Puntledge River basin lies on the eastern side of the Vancouver Island Mountain Range approximately midway along the length of the island (Figure 2). The basin is very rugged with mountain peaks rising to 2,134 m. It typically receives considerable snow pack and glaciers cover approximately 4 km² of the basin and are located above 1,310 m.

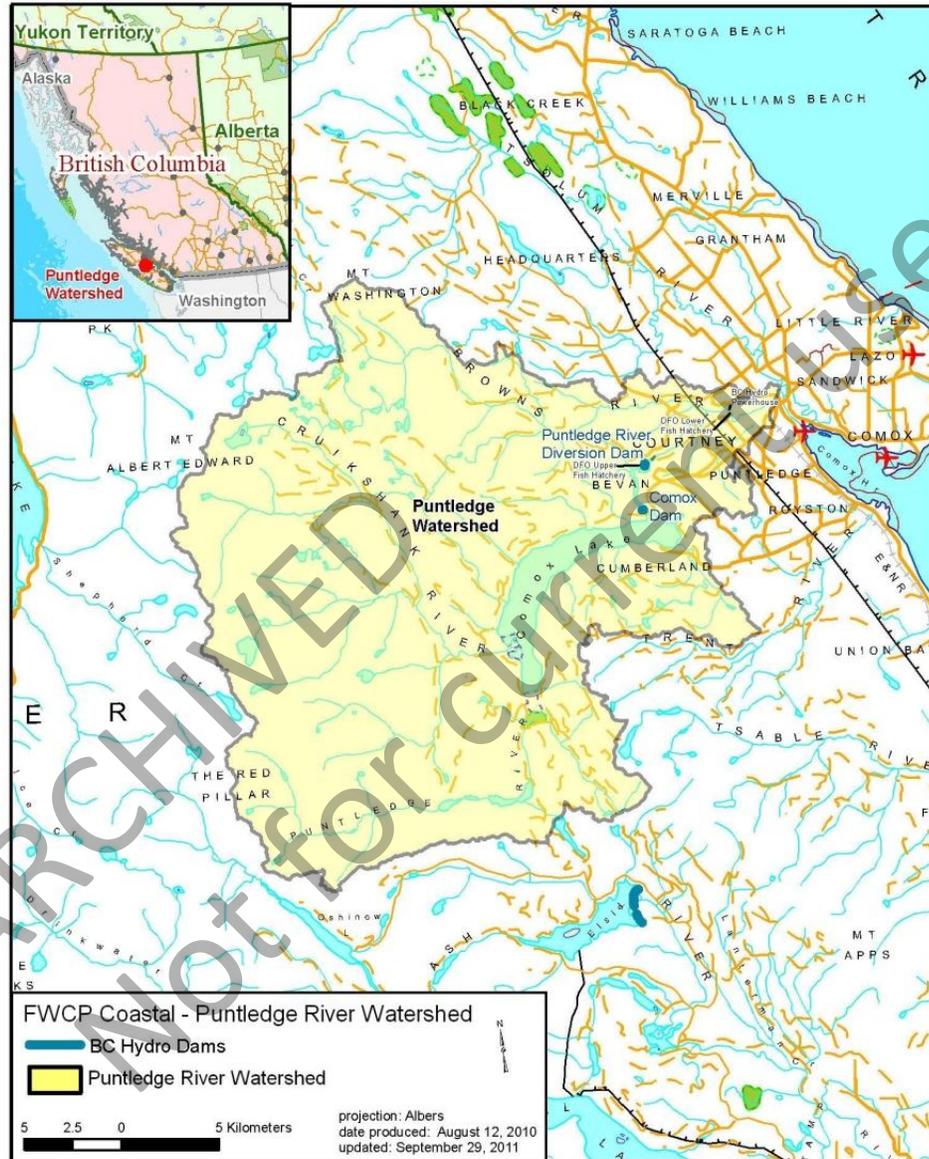


Figure 2. The Puntledge hydropower project.

The Puntledge River and the Cruikshank River feed Comox Lake from the SW, the latter contributing a mean annual inflow of 18 m³/sec of glacial melt. Most of the lake is surrounded by relatively steep terrain except for the northeast end where the terrain is relatively low and flat. The Puntledge system experiences a ‘spill-over’ effect from systems moving off the Pacific and heavy rains occur from

October through March. The hydrology is predominantly dominated by spring snow melt and fall and winter storms. The average precipitation in November is 300mm, but can be as high as 550mm.

The Puntledge hydroelectric facilities are in the asserted traditional use areas of the Comox First Nation, Sliammon First Nation, and Homalco First Nation. The main population centres are Courtney and Comox. The head waters of both the Puntledge and Cruikshank Rivers are in Strathcona Provincial Park.

Hydroelectric development includes a storage dam at the outlet of Comox Lake and a diversion dam downstream (Figure 2). Water is carried by an overland penstock to a powerhouse on the lower Puntledge River. The project was first developed in 1912. In 1953-56 the dams and powerhouse were redeveloped and Comox Lake storage was increased.

2.1 FISH AND FISH HABITAT IN THE PUNTLEDGE RIVER

The Puntledge River is a major tributary to the Courtenay River, and is an important salmon stream on the east coast of Vancouver Island, with stocks of Chinook, coho, sockeye, chum and pink salmon and steelhead, cutthroat and rainbow trout. Other species in the watershed include kokanee, coast range sculpin, threespine stickleback and Pacific lamprey. There are two sets of natural falls, Stotan and Nib, that restrict migration of anadromous and resident fish. Improvements to their passability were made between 1923 and 1977 by selective blasting. Chinook, coho and steelhead likely accessed areas above the falls and above Comox Lake prior to passage changes at the falls. The Chinook and steelhead using this upper section were relatively late summer-run stocks. The lower Puntledge was an important spawning area for fall Chinook, pink and chum salmon, but these stocks have declined and are now augmented by the Puntledge River Hatchery.

2.2 IMPACTS AND THREATS

Fish and Wildlife habitat and species have been significantly altered due to the construction of the dams, the development of hydro-power, and alterations in the hydraulic regimes of the systems. The following summary of the primary footprint impacts is derived from:

- Bridge-Coastal Restoration Program: Strategic Plan, Volume 2: Watershed Plans, Chapter 3: Puntledge River (December 2000);
- Puntledge River Water Use Plan Consultative Committee Report (December 2004); and
- Findings in the Community Workshop (Courtenay, B.C., March 14, 2008).

Hydro-related Impacts — The impacts that occurred are based on location in the watershed as follows:

Upstream of Comox Dam.

1. The dam flooded mainstem and tributary channels near the lake outlet.
2. Increased storage in Comox Lake flooded riparian areas and lake tributaries, and operations continue to negatively impact these areas.
3. The dam had no fish passage facilities for 10 years, which likely affected Chinook, coho and steelhead populations above the outlet of Comox Lake. There continue to be uncertainties regarding fish passage at the Comox Dam.

Downstream of Comox Dam to the Diversion Dam.

4. The headpond area flooded 90,000 m² of important spawning and rearing habitat for summer Chinook and summer steelhead in the headpond between Comox and Puntledge dams.
5. Entrainment of adults and out-migrating smolts into the diversion tunnel remains a key consideration for fish management decisions. Agencies closed the fishway to all anadromous passage upstream in 1965, until 1996 when steelhead were allowed access.

Diversion reach downstream of the Diversion Dam.

6. Water diversions and occasional spills alter habitat characteristics in this reach. The Puntledge Water Use Plan assessed the issues associated with operations, and operational procedures have been altered to offset some impacts.

Mainstem Puntledge downstream of the Powerhouse.

7. Reduced peak flows affect geomorphology of the lower river.

Non-Hydro Impacts — Other impacts on fish populations in the Puntledge River watershed include historic effects of logging, coal mining, flood protection, and urbanization. There is a general acknowledgement among agency staff and local stakeholders that predation by seals is high in the lower Puntledge and has substantial effect on anadromous fish stocks.

2.3 LIMITING FACTORS

Limiting factors for salmonids in the Puntledge watershed vary among species and include useable habitat, access to habitats (i.e., passage), and predation. The limiting factors include natural and human-induced aspects, and the latter include both hydropower and other developments. The factors are summarized here.

1. Passage at natural falls: Two sets of falls, Stotan and Nib, are located between the diversion and the powerhouse on the lower river. Improvements to their passability were made between 1923 and 1977.
2. Restricted access to historic habitats: Agencies closed the fishway at the diversion dam in 1965 to reduce entrainment mortality and to secure broodstock quotas. Entrainment has been of less concern since 1993. Since 1991, when BC Environment reconstructed the Comox Dam fishway, steelhead have been allowed upstream of the diversion dam and into Comox Lake. Historically, the fishway closure reduced diversity and abundance of fish and its current limitations continue to curb use of salmonid habitats in the upper watershed.
3. Loss of habitat: Former spawning, rearing and overwintering areas are permanently lost or seasonally reduced due to dam footprint, reservoir flooding, flow diversions, or operating flows; or from non-hydro sources. Urban encroachment along banks of the lower river and estuary has alienated off-channel, riparian and wetland areas.
4. Reduced habitat capability: Habitats below the dams are altered by reduced sediment or wood recruitment.
5. Reduced tributary access: Above Comox Dam, fish access between reservoir and tributary habitat has been reduced due to drawdown regimes.
6. Reduced mainstem access: Adult access up the river channel is reduced by the diversion flows.
7. Diversion: The diversion has reduced flows in the bypassed channel which affects wetted area, seasonal temperatures and stream productivity in a key rearing area.
8. Hatchery practices: Intervention by the hatchery has probably had positive and negative effects on wild salmonid stocks.
9. Seal Predation: A population of harbour seals in the lower Puntledge River and estuary preys on adult and juveniles of anadromous fish stocks. Channelization has likely exacerbated predation by reducing cover for resident and out-migrating fish.

2.4 TRENDS AND KNOWLEDGE STATUS

HABITAT TRENDS

A detailed account of habitat impacts from hydropower development is provided in the original Watershed Plan (BCRP 2000). In addition to present and historic hydropower impacts there are diverse impacts in the watershed from forestry, urbanization, highway development, and municipal drinking water infrastructure.

High water temperatures in the Puntledge mainstem have been identified as a concern, one that may increase with climate change. The introduced algae *Didymosphenia geminata*, commonly known as didymo or rock snot, is a species of diatom that can form large mats on the bottom of lakes and streams and can affect stream habitats and sources of food for fish. The species is now common in the Puntledge, but its effects are not known. Signal crayfish, *Pacifastacus leniusculus*, are also common and may have a negative influence on fish and their habitats.

Changes in operations agreed to by BC Hydro as a part the Water Use Plan (BC Hydro 2004) have likely improved habitat conditions in the diversion reach. The WUP is expected to increase rearing and spawning habitat and opportunities for fish to migrate past natural barriers in the Puntledge River through the provision of minimum flows, pulse flows, and the placement of spawning gravel.

BCRP habitat compensation projects have been conducted in the watershed since 1999 and have had a positive influence on habitat in many locations in the Puntledge River watershed. Works have been conducted both in the mainstem and in off-channel and tributary areas, such as Bull Island side channel, Headpond at Supply Creek, Powerhouse side channel, Powerline side channel, and Jack Hames side channel. These works created 6,900 m² of spawning habitat for Chinook and steelhead, and improved approximately 8,600 m² of spawning and rearing habitat for chum, pink, coho and trout. BCCF also placed approximately 2,000 m² of spawning gravel in the mainstem Puntledge to improve spawning for steelhead and Chinook.

STOCK TRENDS

Summer Chinook.— Puntledge River summer run Chinook are one of only two summer runs on Vancouver Island. Once numbering about 3,000 fish, the summer Chinook population were likely affected by the original Comox Dam and declined following expansion of hydroelectric development in the early 1950s. By 1965 they numbered only a few hundred fish. Enhancement efforts (e.g., spawning channels, fishway, and fishing closures and restrictions) allowed the population to slowly recover to about 1,200 in the mid 1980s. A second, severe decline began in 1990 and numbers continue to be depressed. Escapements in the 1990s were typically in the low 100s, but have rebounded to the low 1000s since 2000. The population is supplemented by the Puntledge River Hatchery. DFO has stated that recovery of summer Chinook will likely only be accomplished through a combination of restoration, fish culture and predator management.

Fall Chinook.— Escapement estimates for Puntledge River fall run Chinook mirror the abundance trends of the summer run stock. Abundance was low in the 1980s and 1990s (sometimes less than 100), but has rebounded to the low 1000s since 2000. The population is supplemented by the Puntledge River Hatchery.

Pink.— Pink salmon were historically restricted to the lower Puntledge River, but due to physical alterations to Stotan and Nib falls, a small number of pinks now ascend as far upstream as the diversion dam. Through the 1990s and 2000s pink salmon returns regularly exceeded 10,000 and reached a peak of 126,500 in 2001. The population is supplemented by the Puntledge River Hatchery.

Sockeye.— There is a small sockeye population in the Puntledge, but there is little known about status and trends. They are a low restoration priority for DFO.

Chum.— There is a healthy chum salmon population in the Puntledge River watershed, and they are a low restoration priority for DFO. A target abundance has been set by DFO at 60,000, which was exceeded in all but one of the last 10 years.

Coho.— The coho population is also relatively healthy, and they are a low restoration priority for DFO. Escapements over the last decade have ranged from about 2,700 to over 32,000.

Steelhead.— The status of wild steelhead in the Puntledge River is Extreme Conservation Concern. The stock has been in decline for some time, like many Georgia Basin steelhead stocks. Escapements were < 50 winter run and < 50 summer run fish in the mid-2000s and may be less than 10 wild fish in 2009. The population is supplemented by the Puntledge River Hatchery.

Cutthroat.— Both resident and anadromous cutthroat occur in the Puntledge River, but less is known about abundance trends of this species than of most salmonids.

Other species.— Kokanee, Dolly Varden and rainbow trout occur in the Puntledge system, but relatively little is known about their status and trends.

KNOWLEDGE GAPS

Key data gaps have not been identified in detail but include better understanding of entrainment mitigation techniques, limitations to fish passage through Comox Dam, dynamics of resident fish populations in Comox Lake, and limiting factors to fish in a number of geographic locations.

3 ACTION PLAN OBJECTIVES, MEASURES AND TARGETS

Clear and realistic management objectives are necessary to guide information acquisition and prioritize management actions. Priority actions and information needs will change as both improvements to the system are realized and information is gained. The current plan reflects the information available and values expressed by stakeholders (FWCP partners, First Nations and local communities) through reports, interviews and regional workshops held between 2008 and 2010.

3.1 OBJECTIVE AND TARGET SETTING

The following terminology is used in this report.

Objectives:	Objectives are high-level statements of desired future conditions (outcomes), consistent with FWCP partner mandates and policies.
Sub-objectives and Status Indicators:	Sub-objectives are detailed statements of desired future conditions within objectives, from which status indicators can be derived and alternative management actions evaluated. Sub-objectives and indicators provide the details necessary to translate policy into actions and to evaluate their consequences. They may be arranged hierarchically within objectives, and usually indicate conditions necessary to attain the objective to which they refer.
Measures:	Measures are specific metrics whose values indicate the degree to which desired future conditions have been achieved. They can be either qualitative or quantitative. There is a preference to develop the latter where possible for ease of monitoring.
Targets:	Targets are the values of measurable items that indicate the attainment of a desired condition. In the current context these may be expressed as a single value or as a range to acknowledge the inherent variability of ecosystems.
Actions:	Management actions, plans or policies for achieving the objectives.

Objectives are the “ends” or the outcomes we ultimately care about. Actions are the “means,” or the things we do to achieve them. This report focuses on describing the actions required to achieve the objectives in relation to salmonid species and fish in general. Actions relating to specific species or habitats may also be related to actions in other Action Planning documents such as the Riparian and Wetlands or Species of Interest plans.

3.2 OBJECTIVES FOR THE PUNTLIDGE RIVER

Management objectives are common to all locations in the Puntledge River watershed, although the species of interest vary between the upper and lower watershed and thus the list of indicators and targets may differ.

This section briefly summarizes the objectives, sub-objectives and status indicators. While the objectives are expected to remain stable over time, the indicators and targets may evolve as management priorities for agencies shift, or new information becomes available.

There are two salmonid management objectives for the Puntledge River:

1. Conservation – Ensure a productive and diverse aquatic ecosystem,
2. Sustainable Use – Maintain or improve opportunities for sustainable use.

Supporting these objectives are sub-objectives that break each into its key components and provide further clarity.

Objective 1. Ensure a productive and diverse aquatic ecosystem.

Rationale — This objective addresses overall ecosystem integrity and productivity and directs compensation activities to developing productive, useable aquatic habitats. Where cost-effective opportunities exist, compensation works will be aimed at aiding multiple fish species.

There are two sub-objectives, which divide salmonids into anadromous and resident species, since priorities tend to fall along these lines in different locations in the Puntledge River.

1. Maximize the viability of anadromous salmonids and steelhead
2. Maximize the viability of resident salmonids.

Each sub-objective is supported by the following status indicators:

1. Anadromous salmon, steelhead and cutthroat trout
 - a. Chinook salmon
 - b. coho salmon
 - c. pink salmon
 - d. chum
 - e. steelhead trout
 - f. sea-run cutthroat trout
2. Resident salmonids
 - a. resident cutthroat trout
 - b. rainbow trout

The indicators focus on species of greatest management concern. There is a tacit assumption that these are to some extent true indicator species and that meeting targets for these species will support conservation of other fish species.

There are different priority species in different parts of the Puntledge watershed. Summer-run Chinook and summer- and winter-run steelhead have been identified respectively by DFO and MOE as the species of highest conservation priority in the lower Puntledge River. Projects need not focus solely on these species, but they are the species of greatest conservation concern due to local and regional trends and the values of most stakeholders. There is a small sockeye population in the Puntledge, but there is little information on this species and there is no target for escapement. Lower priority salmonid species include fall-run Chinook, coho, pink, chum, sockeye, sea-run cutthroat, Dolly Varden, rainbow and kokanee.

Due to physical and project-related constraints in the watershed, project funding may be applied to habitats upstream of Comox Dam, such as Cruickshank River and Toma Creek, or to areas downstream of the powerhouse such as the Courtenay River and estuary. Project funding may also be applied to improving fish passage, so that connectivity between useable habitats is ensured. In some cases, consideration may be given to projects in nearby systems, such as the Tsolum River. A clear rationale will be required to ensure that funding of projects outside the footprint area will be cost-effective and improve overall productive capacity for target species.

There are no species in the Puntledge that have been identified by the Conservation Framework as priority 1, and there are no SARA-listed species in areas affected by hydropower development. Morrison Creek lamprey are listed under SARA and occur in a tributary to the Puntledge, but the threats assessment in the COSEWIC status assessment (COSEWIC 2000) and in the SARA Recovery Strategy (National Recovery Team for Morrison Creek Lamprey 2007) do not indicate hydropower footprint or operations as an impact.

Measures — Measures for the sub-objectives relate to the long-term viability of indicator fish populations, and may include distribution, population structure, abundance, and size or age distribution. At this time, the focus will be on abundance. Compensation activities may focus on improving habitat, but success will ultimately be assessed with measures of abundance. Abundance is currently measured through escapement estimates, snorkel swims, and Water Use Plan monitoring activities. Where necessary, additional monitoring may be required for the compensation program to assess progress under this objective.

Targets — Species targets were determined by DFO and MOE and are indicated in the Table 1.

Table 1. Species management targets for the Puntledge River system.

Location	Species	Target (5 year average)
System-wide	Summer run Chinook	3500 spawners
	Summer and winter steelhead	325 wild spawners. The summer run is critically imperilled and is expected to remain considerably below this target for the next several years.
	Coho	10,000 spawners
	Cutthroat	no target
	Rainbow	no target
downstream of Comox Dam	Fall run Chinook	4500 spawners
	Pink	50,000 spawners
	Chum	60,000 spawners
	Sea-run cutthroat	100 – 300 adults

Objective 2. Maintain or improve opportunities for sustainable use.

Rationale — This objective reflects the important sustainable use benefits that can be derived from healthy fish populations. Many salmonid species are the focus of First Nations, commercial and recreation fisheries. Consequently, any actions aimed at achieving the above objective also support this sustainable use objective. Although there are no direct actions for improving sustainable use at this time, it is conceivable that projects aimed at generally improving opportunities or increasing the participation in the fisheries could be identified by the program partners in the future.

As additional context, it should be noted that fisheries management agencies have an overall responsibility to manage the fisheries resource at a level of abundance and distribution to support First Nations' traditional uses and rights. These responsibilities are dealt with through the ongoing process of decision-making, which is not a formal part of this FWCP plan. In addition to this, First Nations' interests in overall conservation and sustainable use benefits have been incorporated into the development of this plan.

Measures and Targets — There are no specific measures or targets required at this time, aside from those associated with objective 1.

As part of their overall management responsibilities, DFO uses information such as abundance trends and escapement estimates to regulate angling and commercial harvest. MOE collects information on angler days, catch per unit effort,

and number of fishing licences sold in the region, which informs decisions related to angling regulations.

From a fisheries management perspective, the highest priority is steelhead. Coho and resident trout species are lower priorities. It is expected that for some species (e.g., steelhead and Chinook) the fishery will be managed as a catch and release fishery. Targets will be set by MOE and DFO and revised as necessary.

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4 ACTION PLAN

4.1 OVERVIEW

The Action Plan has many individual actions, which are presented in Section 4.2. Some actions support multiple sub-objectives, which in turn support multiple objectives. Figure 3 provides an overview of the link between actions and objectives.

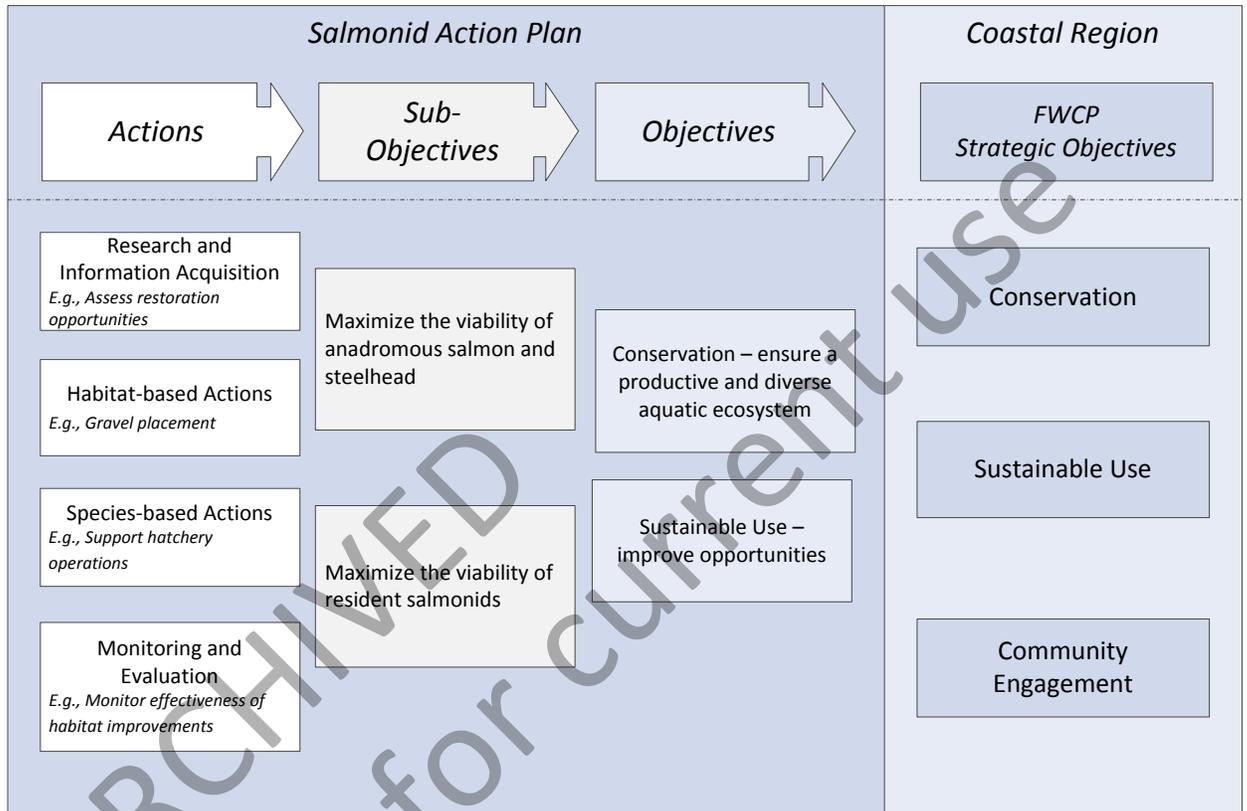


Figure 3: Relationship between actions, sub-objectives and objectives in this Salmonid Action Plan and the FWCP strategic objectives in the Puntledge River Watershed Plan.

4.2 COMPONENTS

This section presents the main actions identified (Table 2) along with the supporting rationale for why the actions are required and what they will achieve. Actions are organized under five broad categories: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Also provided are priority ratings to guide investment planning efforts. Actions are assigned priorities from 1-3. Note that low priority actions are not included in the table.

Sub-objective: Maximize the viability of anadromous salmonids.

Table 2. Actions with associated priorities and target species in the Puntledge River.

Actions	Lower Puntledge	Comox Lake Reservoir	Upper Puntledge	other	multiple species	Anadromous						Resident		
						Chinook	Coho	Pink	Chum	Steelhead	Sea-run cutthroat	Cutthroat	Rainbow	
Research & Information Acquisition														
Improve understanding of current limitations to upstream and downstream fish passage throughout the Puntledge system, primarily for steelhead and Chinook, for both juveniles and adults.		1	1			x				x				
Improve understanding of fish production limitations (e.g., nutrient limitations) of habitats in Comox Lake and tributaries.		1	1		x									
Develop a better understanding of fish production limitations of habitats in the Courtenay River and estuary, Tsolum River and Morrison Creek and develop options for addressing these limiting factors.				1	x									
Develop a better understanding of the effect of predation by seals and the means of addressing this limit to fish production in the watershed. Proponents must review the DFO seal initiative (underway) and have support of the DFO marine mammal section prior to submission.	1				x									
Continue stock differentiation analyses to assess whether stocks are genetically differentiated (e.g., summer and fall run Chinook). This action is most relevant for Chinook and steelhead.	1	1	1	1		x				x				
Develop an integrated habitat restoration plan for the Puntledge system and tributaries, and ensure compatibility with WUP implementation and monitoring. Proponent should discuss project scope with program staff before submitting a proposal.	3	2	2	2	x									
Conduct surveys of habitat limitations in the Puntledge River mainstem with sufficient frequency to identify site-specific habitat issues as they arise and develop an understanding of the means to address the issues.	3				x									
Habitat Based Actions														
Restore habitats in the Courtenay River and estuary (e.g., address channelization and naturalize the river banks, instream complexing, and restoration of tributary habitats). These actions may be specifically designed to reduce predation by seals.	2			1	x									
Implement habitat enhancements in the upper Puntledge and Cruickshank Rivers, and other tributaries to Comox Lake. Projects should be based on priorities developed in the aforementioned watershed restoration plan.			2		x									
There are numerous habitat enhancement opportunities in Tsolum River (e.g., stabilize the Tsolum River banks, live stock fencing, instream complexing, and restoration of tributary habitats) which will be considered by the program. Additional watersheds may also be considered (e.g., enhancement of habitat in Morrison Creek, Browns River and other watersheds).				3	x									
Maintain existing constructed habitat enhancements for all salmonids (e.g., gravel placements to enhance or increase spawning habitat).	3				x									
Restore habitats in the Lower Puntledge mainstem.	3				x									
Species Based Actions														
The program will support hatchery activities focussed on enhancing the earliest returning adults of the summer Chinook run. Specific actions may include holding of early run Chinook in cool water hatchery facilities to enhance their survival or holding of smolts in sea-pens to enhance survival and reduce predation by seals.	1					x								
Land Securement - Habitat Acquisition														
There are possible opportunities in the lower Puntledge and Courtenay Rivers or in the lower Tsolum where land securement may address fisheries management objectives.	3			3	x									
Monitoring & Evaluation														
Assess the efficacy of passage throughout the Puntledge system.	1	1	1	1	x									
Assess adult returns and out-migrating smolts as a measure of overall fish production in relation to specified targets.	1	1	1	1	x									
Assess efficacy of habitat enhancements undertaken by the program.	3	3	3	3	x									

Rationale.— To support targets for anadromous salmonids several actions are proposed. Most actions focus on improving habitat for one or more species and life stage, but there is much we don't know biologically and physically about the

species and habitats of interest, so actions also include collecting information to help evaluate and implement compensation options and assess performance of implemented restoration activities.

The primary options for enhancing salmonid habitat in the Puntledge River are improved fish passage and restoration of fish habitats throughout the watershed. There may also be good opportunities for restoration in adjacent watersheds like the Tsolum, though additional studies are required to assess benefits and costs associated with these activities.

Improved fish passage is related to increased passage over Stotan and Nib Falls, and potentially at Comox Dam. Improved passage over the falls would permit greater numbers of salmon and steelhead to access spawning and rearing habitat. Better fish passage at Comox Dam would allow access to suitable spawning and rearing areas above Comox Lake Reservoir for anadromous salmon and steelhead, but again, a detailed assessment of the benefits and negative impacts should be completed before any changes in passage are implemented. A series of studies are required, some of which have been completed or are underway, and the issue should be addressed a step at a time. The priority for work on passage at this time is Comox Dam.

It is believed that historically summer run Chinook adults ascended into Comox Lake where they would reside until spawning time, when they would drop back down into the Puntledge mainstem below the lake or ascend further into the tributaries of the lake. It also seems likely that other anadromous species like steelhead historically used tributary habitats above Comox Lake. This habitat is now thought to be underutilized and represents a portion of the watershed that can sustain additional fisheries production. To better utilize this area will require information on limiting factors, better understanding of passage constraints, and the implementation of habitat improvement projects. The primary focus over the next while is likely to be Cruickshank and the upper Puntledge Rivers, but other smaller tributaries should also be considered.

BCRP and other programs have completed a large number of habitat enhancements over the years within the BC Hydro project area, resulting in measurable improvements. Many of the most cost-effective projects have been completed, and there is a sense that some of the most cost-effective opportunities now exist outside the immediate project area. Areas downstream of the powerhouse (e.g., Courtenay River and estuary) and adjacent watersheds (e.g., Tsolum River, etc.) appear to offer considerable opportunity for increasing fish productivity through habitat enhancements. The program will seek out opportunities that are cost-effective and that offer the best opportunity for multiple benefits. To do this requires information collection to better understand the opportunities. The program will then implement projects addressing these opportunities. Explicitly included in this program element are efforts to address, to the extent practical, the issue of seal predation in the lower river and estuary.

Enhancement of sustainable fisheries will help ensure First Nation fisheries and support recreational fisheries, which directly address sustainable use interests.

Improvement of sustainable fisheries will necessarily involve augmenting the population of certain species, but also can include improving access to harvest or use of those species. Clearly, many of the activities that enhance the status of certain species or the ecological integrity of their habitats will also benefit a sustainable fishery. BC Hydro funding has not typically been directed at funding of hatchery operations, but program partners have a responsibility for sustainable use of fish resources and will therefore consider fisheries issues under the compensation program.

Monitoring is a cornerstone of good resource management because it provides information on present status and trends and allows post-implementation assessment of management decisions and programs. Fundamentally, monitoring provides direction on adjustments that may be necessary. There are multiple elements related to anadromous salmon and steelhead that require monitoring. Realistically, monitoring will likely focus on abundance of different life stages of sportfish and species of concern. Results of monitoring should feed directly into compensation program evaluation and help revise objectives and targets, where necessary. Special care will be required to ensure that implementation and monitoring of FWCP: Coastal projects complements that of the Water Use Plan.

The program will seek to maintain the performance of existing habitat works, and to identify and act on opportunities to improve conditions in the Puntledge River. To do this requires ongoing information collection. The program will then implement projects that are able to address these opportunities in a cost-effective manner.

Sub-objective: Maximize the viability of resident salmonids.

Table 3: Actions with associated priorities for resident species.

Actions	Lower Puntledge	Comox Lake Reservoir	Upper Puntledge	other	multiple species	Anadromous					Resident	
						Chinook	Coho	Pink	Chum	Steelhead	Sea-run cutthroat	Cutthroat
Research & Information Acquisition												
Develop a detailed inventory of potential restoration projects directed at resident salmonids in mainstem rivers and reservoirs, and tributaries.	1	1	1	1	x							

Rationale.— The rationale for the proposed actions related to resident salmonids are similar to those discussed earlier for anadromous salmon and steelhead, and some of those proposed projects will benefit resident fish also. The primary action required for resident salmonids is to develop a better understanding of present stock status and possible restoration options.

4.3 UNSUPPORTABLE PROJECTS

DFO and MOE have indicated they would not support the following projects.

- BC Hydro has implemented operational changes under the Puntledge Water Use Plan, which are expected to improve conditions for fish and other resources. There are concerns that some restoration works could confound results from studies underway to evaluate aspects of the WUP. FWCP partners support the WUP and its associated monitoring studies and recognize the need to avoid confounding WUP monitoring results.
- Projects related to fish passage at BC Hydro facilities must adhere to the Fish Passage Decision Framework for BC Hydro Facilities (BC Hydro 2008), including requirements for evaluation of specific prerequisite biological studies.
- Habitat enhancement projects (e.g., improving fish passage at natural barriers, modifications to specific habitats) may require agency review, and in some cases prerequisite biological studies, to evaluate risks and benefits.

ARCHIVED
Not for current use

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