Provincial Framework for Steelhead Management in British Columbia

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Contents

Acknowledgements

This document is the first attempt to provide an overarching provincial approach to steelhead management in BC. It represents a collaborative effort to lay out a provincial framework that articulates how the Province intends to manage steelhead and steelhead fisheries in a consistent, science-informed way. It reflects the input and endorsement of provincial steelhead biologists from every administrative region where steelhead fisheries exist, as well as advice and comments from the ministries of Environment and Agriculture on relevant sections.

Its development has benefitted from the ongoing engagement and feedback from members of the Provincial Angling Advisory Committee and their considerable expertise, as well as feedback from the provincial public engagement website. Stakeholder engagement will help to ensure that stakeholder interests are adequately considered and solutions are workable.

The authors of this report acknowledge the many previous efforts undertaken to have steelhead concerns elevated and addressed in a more cohesive manner in British Columbia. Efforts include but are not limited to *the Steelhead Summit* and Caucus Follow-up 2008-2009, the *Greater Georgia Basin Steelhead Recovery Action Plan* 2002 and Thompson River recovery initiatives (*Thompson River Steelhead: A Resource in Crisis?* SFU Workshop 1998; *Independent Review of the Science and Management of Thompson River Steelhead* 2014). The materials from these various undertakings have been reviewed in the development of this document to assist in identifying priority issues and strategies.

Introduction

Wild, self-sustaining steelhead populations are the mainstay of the steelhead recreational fishery in British Columbia, a fact that is held in very high regard by resident and international anglers alike. Reliance on the natural production of wild fish addresses legislative conservation requirements, takes advantage of investments in habitat protection, and maintains a high benefit-cost ratio for the fishery. Additionally, (and being particularly mindful of the risk to wild populations), a limited number of steelhead hatchery programs are maintained for the purpose of increasing angling opportunities. These programs encourage BC residents and tourists to interact with nature and experience the outdoors, thereby improving the quality of life and providing economic benefits for many residents. However, maintaining the 'wild and sustainable' brand for BC steelhead fisheries remains as the highest priority for this species' management and is fundamental to its continued value and appeal. As such, the Province will continue to focus management towards protecting and restoring this unique and valuable resource for present and future generations of British Columbians.

From a management perspective, there is a recognized need to provide the regional flexibility necessary to respond to the diversity of conditions, challenges and angler preferences found across the Province. Equally important, however, is the need for a coordinating structure based on goals, objectives and strategies on which regional management plans are based. This framework document seeks to become such a mechanism and provide stakeholders, partners and First Nations with a clearer understanding of the goals and objectives for steelhead management in BC.

Purpose

To develop a framework that provides provincial direction for steelhead management and guides the implementation of regional management actions in British Columbia.

Context

The primary focus of the provincial fisheries management agency is to provide a diversity of opportunities for recreational fishing, consistent with the long-term sustainability of wild steelhead populations. Implicit to this focus is the need to protect and maintain natural diversity within and among populations to maintain resiliency in the face of uncertain environmental conditions now and in the future.

Recreational fisheries for steelhead are managed for opportunity and expectation, specifically the opportunity to go fishing with the expectation of catching a fish. This objective is fundamentally different from harvest fisheries, where the focus is more towards maximizing sustainable yield. It is critical to recognize these differences when weighing the socio-economic benefits to British Columbians derived from various types of fisheries.

The Province recognizes that many First Nations may have an Aboriginal Interest[1] to harvest freshwater fish for sustenance (food, social and ceremonial purposes) in their traditional territory. However, the management of First Nations fisheries in freshwater and marine environments, including steelhead harvest, is primarily the legislated responsibility of the federal government. The federal government also has the primary responsibility for meeting any legal obligations for consulting with First Nations when managing First Nations' harvest of freshwater fish for food, social or ceremonial purposes. The Province has delegated authority to manage recreational freshwater fisheries. If the Province has a conservation concern regarding any freshwater fish species (including Aboriginal harvesting), the Province can consult with First Nations in order to mitigate any conservation concerns.

This provincial framework is aligned with the aim of our provincial Freshwater Fisheries Program[2] Plan (2007) that states "*A naturally rich and sustainable freshwater fish resource supporting diverse uses for all British Columbians*"; and the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) vision of "*economic prosperity and environmental sustainability"* (Resource Stewardship Vision and Framework 2012).

Goal

Ensure abundance of wild steelhead populations at levels that will produce societal benefits[3] now and for future generations of British Columbians.

Management Objectives

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.**

Management objectives acknowledge that many First Nations may have an Aboriginal Interest to harvest Steelhead (for food, social and ceremonial purposes). The development of management objectives also takes into account stakeholder expectations with regards to steelhead fishing opportunities. Science will be used to inform management decisions, as well as assess the consequences of different options. Regional planning requires more specific management objectives that address the varying or competing expectations from different stakeholder groups, as well as reflect the varying characteristics of the stocks and their environments. To ensure stakeholders are aware of the consequences of various management options, a high level of transparency will be maintained during planning for major regulatory changes.

[1] Aboriginal Interest refers to a First Nation's claimed or proven Aboriginal Rights (including title) or Treaty Rights.
[2] The Freshwater Fisheries Program is developed and delivered through the Ministry of Forests, Lands and Natural Resource Operations (including the Fish and Wildlife Branch of the Resource Stewardship Division and Regional Operations Division), the Ministry of Environment (including the Ecosystems Protection and Sustainability Branch of the Environmental Sustainability and Strategic Policy Division), in partnership with the Freshwater Fisheries Society of BC.
[3] Societal benefits refer to ecological, social and economic benefits, including the needs of First Nations.

Guiding Principles

1. Conservation[4] of wild stocks and their habitats is the highest priority of provincial fisheries.
2. Management tools will be applied in response to changes to steelhead stock[5] abundance.
3. The precautionary approach[6] will be applied in decision-making where uncertainty exists.
4. Steelhead will be managed to minimize impacts to vulnerable by-catch species.

Engagement Principles

1. Engagement on the provincial-level management framework and the implementation of provincial management actions will occur with provincial angling stakeholders (see Stakeholder Engagement section). Provincial-level engagement opportunities for First Nations and the public will be available via an on-line review and commenting period.
2. Engagement on regional-level management plans and actions will occur with local First Nations and regional angling stakeholders (see Stakeholder and First Nations Engagement sections).
3. Information on steelhead management will be shared with and requested from First Nations, stakeholders, biologists and the public.

Management Authorities and Tools

Administration of the recreational freshwater sport fishery (including sea-run trout and freshwater fish species) is a provincial responsibility delegated from the Government of Canada. Regulation of recreational, commercial and First Nations salmon fisheries (marine and freshwater) remains the responsibility of the federal Department of Fisheries and Oceans (DFO). The steelhead management framework provides the basis for establishing regional steelhead objectives to inform federal integrated salmon fisheries management planning processes.

Fisheries management has limited capacity to influence wild steelhead escapement during the marine phase of the life cycle. Fishing mortality and predation mortality are two potential factors where management actions could influence abundance. However, these factors in the marine environment are not under provincial management authority.

Fisheries management tools immediately available to support provincial steelhead fisheries include recreational angling regulations and hatchery enhancement. Regulations can be implemented to alter mortalities associated with recreational angling via harvest restrictions, gear restrictions and time/area

[4] Conservation is defined as wise use (i.e. preventing wastefulness), consistent with Fish and Wildlife Branch fisheries policy *Conservation 3-2-01.00 (1993).*

[5] Stock is defined as an intraspecific group of randomly mating individuals with temporal or spatial integrity (Ihssen et al. 1981). The term is sometimes applied to stock aggregates, and in some cases, there may only be abundance data available at that level.

[6] From DFO's Precautionary Approach Framework, the Precautionary Approach is "about being cautious when scientific information is uncertain, unreliable or inadequate and not using the absence of adequate scientific information as a reason to postpone or fail to take action to avoid serious harm to the resource". For a detailed review of the application of the concept in fisheries, go to http://www.fao.org/docrep/003/W1238E/W1238E01.htm

restrictions. Hatchery enhancement is a management option used to support recreational fishery goals but has not been used increase wild steelhead production in BC.

Habitat protection and restoration measures can influence the productive capacity of freshwater habitats to produce juvenile steelhead where habitat is limiting, degraded or fragmented. While numerous regulatory and mitigative tools exist, the degree to which the Program has influence over these tools is varied, but generally limited and will require significant cooperation and partnerships with other authorities and stewardship efforts.

At present, the most effective option to influence adult abundance is by-catch management in salmon fisheries which is under federal jurisdiction. Steelhead mortality associated with various salmon fisheries can be significant depending on timing and gear used. For weak steelhead stocks already challenged by low abundance, the results of by-catch mortality can be devastating.

Appendix I summarizes fisheries management tools and associated authorities.

State of the Resource

Stock Status

Productive capacity[7] varies among steelhead populations and can also vary dramatically over time (due to environmental changes such as ocean regime shifts), affecting a number of population attributes including the ability of stocks to rebuild from low abundance levels. Adult steelhead numbers vary significantly due to these productivity trends or cycles, often resulting in conservation concerns. Also, some steelhead stocks have been shown to shift away from anadromy at low abundance (i.e. remain freshwater residents). The significance on stock status of this observation is still unclear; however, the impacts to recreational fishing values are obvious.

The long-term counting fence facility on the Keogh River provides the only direct measure of marine survival for steelhead in BC. Over the past several decades, we have observed marked shifts in productive capacity for steelhead stocks across the Province, reflecting medium-term (i.e. decadal) shifts in ocean climatic regime and regional differences among stocks.

The 1980s denote a decade of maximum abundances for many stocks throughout BC, whereas the onset of the 1990s saw dramatic and rapid declines in returns, particularly for many stocks of the Georgia Basin and Interior Fraser. At the Keogh, estimates of ocean survival dropped from the mid-teens (up to 25% in a couple of years) in the 1980s to less than 5% in the 1990s. Many southern BC steelhead populations (and other salmon species) have remained in a low marine survival regime since late 1990s (2000-2010 Keogh mean of ~4%), and current adult returns are about 20-25% of those of the preceding period. This triggers stakeholder demands for recovery programs to increase steelhead production and also results in declines in angling participation.

Appendix II provides further detail on key traits that are particularly relevant to stock status and fisheries management.

[7] Productive capacity relates to maximal rate of increase and maximum abundance.

Stock Assessment

Adequate stock assessment and trend monitoring are essential when evaluating stock status against objectives. This framework lays out general management objectives at a provincial level; stock assessment is generally conducted at a regional level in order to address regional objectives. Methodologies can vary with logistics, available resources, and specific characteristics of the stock (e.g. run-timing) and its environment (e.g. water clarity and flows). Regardless, it is essential that the different methodologies are defensible and are conducted consistently to enable reporting at the provincial level.

Currently, over 30 steelhead stocks (or stock aggregates) are assessed on a regular basis to maintain an index of juvenile or adult abundance over time. The Steelhead Harvest Analysis is the only province-wide survey of steelhead catch and effort and has tracked all angled steelhead rivers annually since 1967. The Keogh River smolt counting fence represents the longest times series (36 years) for abundance estimates of both smolts and returning adults.

The development of a provincial stock assessment plan to establish a set of key representative stocks across the province that (a) provide an index of status and/or (b) are highly valued by clients is an important next step. In order to manage steelhead in the face of environmental uncertainty (especially climate-related) it is critical to understand how different stocks are responding to changes. This plan will provide a synopsis of currently assessed stocks, information necessary to inform management decisions regarding fish conservation and fisheries, and criteria for prioritization and implementation of stock assessment activities.

Management Regime

Several provincial fisheries policies provide guidance for various components of freshwater fish management. The *Steelhead Stream Classification Policy* provides guidance specifically directed at steelhead management. *The Steelhead Stream Classification Policy* (and supporting procedures) was fully implemented in 2007 (see Appendix V). The overall purpose of this policy is to place priority on the conservation of wild steelhead stocks and to manage risks associated with hatcheries. The policy recognizes that angling benefits can be derived from hatchery production and outlines criteria necessary to meet the 'hatchery-augmented' classification. However, the default classification remains 'wild'.

Management approaches are defined for the 'wild' and 'hatchery-augmented' classifications. Most notably, all wild streams are non-retention only; and management actions will reflect the conservation status of both 'wild' and 'hatchery-augmented' streams. Streams classified as 'hatchery-augmented' will be enhanced for the purpose of providing harvest fisheries, not to rebuild natural production.

Appendix III provides further detail regarding the province's regulatory regime for steelhead.

Recreational Opportunities

Throughout North America, large, wild steelhead are regarded as rare and exceptional sport fish. British Columbia remains as one of the few places on Earth that provides an opportunity to encounter these wild fish in a wilderness setting. Such conditions are conducive to high levels of angler satisfaction and participation. They call for an approach that differs significantly from harvest-based fisheries where a sustainable yield philosophy underlies the basic management approach.

The Province maintains a diversity of steelhead angling opportunities that include gear type options, exceptional experiences on Classified Waters, limited entry for non-residents (on the Dean River), guided and non-guided fishing, and harvest of hatchery-origin fish. Steelhead fishing opportunities exist in almost every month of the year, at least in some part of the province.

Resident priority (as described under provincial *Allocation of Angling Opportunity Policy*, 1984) is acknowledged through reduced license fees and unrestricted (but licensed) access to Classified and Limited Entry Waters (see Skeena Angling Management Plans, Dean River regulations). The overall intent is to provide a mix of options that maintains or slowly increases participation. Since societal and economic benefits generally increase with the level of angler participation, measures such as catch-and-release have become key regulatory tools used to meet demand, particularly when the number of wild fish is limited.

Broad Strategies to Meet Objectives

1. **Implement an abundance-based management framework with zones that identify stock status, level of uncertainty, and associated management actions**

An abundance-based framework means that fisheries decisions reflect the status of a stock or group of stocks relative to a predefined set of reference points. As abundance declines, conservation and rebuilding measures are emphasized, whereas when abundance increases, the focus shifts to the generation of social and economic benefits. The development of reference points has been endorsed internationally by the Food and Agriculture Organization and has been endorsed in BC for both the federal *Wild Salmon Policy* and for steelhead in publications of the BC Ministry of Environment.

It is also important to define the uncertainty associated with the assignment of a particular abundance classification. Very accurate biological monitoring of all stocks is not practical or even necessary. Index systems, angler surveys, trend analysis, test fisheries and professional judgement are generally adequate to provide the degree of accuracy consistent with management needs for many stocks. However, there remains room for cost-effective improvements. In particular, the areas of electronic licensing and angler surveys are potential projects, since angler behaviour (with corrections for known biases) may be an underutilized addition to defining the status of stocks and the state of the fishery (e.g. level of angler satisfaction).

There are circumstances where even catch-and-release fisheries (see Strategy 3) should be limited (i.e. closures or gear restrictions may be necessary), and an estimate of abundance relative to a reference point can inform this decision. A formal stock assessment program will identify recovering stocks and also form the basis of a continuous record for trend analysis. A prioritized list of locations will be identified as part of a strategic stock assessment planning process to identify key stocks where abundance (or some index of which) can be estimated.

Appendix IV provides further detail on the application of an abundance-based management framework.

2. Invoke a precautionary policy where a population falls below a lower threshold of 100 adults

There are numerous, small coastal steelhead populations (mostly winter-run) that currently persist at very low numbers. These systems produce small numbers of smolts annually (often <1500) and generate little angler effort, but may have an important role in the protection of genetic diversity. In some cases, the small size simply reflects a limited habitat capacity in an unproductive system. In others, the population may be in a persistent, depressed state as a result of human activity. Either way, a very low absolute abundance (e.g. 50-100 adults) makes these populations more vulnerable to stochastic events and loss of genetic variability. Regardless of where these populations lie relative to theoretical reference points, they are at a higher risk of extirpation. To this end, steelhead fisheries closures should be considered when a population persists at 100 adults/year (or less), particularly where populations are exceptionally sensitive to potential angling impacts or other vulnerabilities. This policy doesn't necessitate a closure below the threshold value but rather provides the rationale for a closure if a regional fisheries manager is concerned about vulnerability.

3. Manage wild steelhead as catch-and-release fisheries

Societal and economic benefits generally increase with the abundance of adult steelhead returns, which anglers detect through changes in personal catch success or by learning of the success of others. In theory, abundance should be near maximum levels in unfished populations which are close to what would be achieved in a catch-and-release fishery (assuming post-release mortality rates remain low). The demand response to a real or apparent increase in abundance is to attract lapsed and new anglers into the fishery. For existing anglers, the response to increased abundance should take the form of improved catch success, which may also result in an increase in total hours fished per day or more days fished per season and a general increase in the overall level of angler satisfaction. Catch and release improves the likelihood of encountering fish, and therefore increases the socio-economic benefits both in the current season and the season when the offspring of spawners return. As many returning adults pass through more than one sport fishery, they become proportionally more valuable when they are able to complete their life cycle. Catch and release can provide a low-risk alternative to closures where abundance levels are low.

In contrast to catch-and-release fisheries, harvest fisheries result in abundance decreasing to levels below the unfished equilibrium, roughly in proportion to the severity of the harvest. Consequently, not only do harvest fisheries reduce the number of fish available for the angler in any given return year but harvesting also reduces returns for subsequent years as well. Furthermore, if stocks are recovering after periods of low returns, the harvesting of spawners can delay the return of the population to acceptable levels by several years (sometimes decades). These pressures are particularly apparent where interception fisheries already create a significant harvest that managers must address. The fact that many winter-run stocks have not increased in number after more than two decades of 'no harvest' in some cases clearly indicates that ocean and stock productivity is very low and in some cases below replacement. Northern summer stocks may not be subject to the same survival factors and winter runs, but persistent by-catch pressure undoubtedly absorbs some of the 'surplus' that might or might not exist prior to marine fisheries.

Under conditions where steelhead are highly vulnerable to capture (i.e. the majority of the stock is accessible to anglers) the reported catch can even exceed estimated returns. This observation underscores

the ongoing intensity of data collection and enforcement required to sustain an annual harvest in an open access fishery for wild fish. The potential for excessive harvest and possible extirpation is elevated where stock assessment estimates are imprecise, stocks are unproductive (or only moderately so) or environmental conditions are uncertain. Many of the stocks currently considered relatively 'healthy' based on catch success and other indices are unproductive northern stocks (i.e. those where 'surplus'[8] might be identified would be limited at best). The abrupt, large and persistent shifts we have seen in steelhead productivity in some populations recently only re-enforce the need for a precautionary approach in management policies to ensure we are not placing populations at higher levels of risk, or impacting their ability to provide societal benefits in the future.

Widespread freshwater harvesting opportunities for other species exist throughout the province and include wild and hatchery trout species (including those stocked in >1000 lakes) and several species of salmon and stocked steelhead in a number of rivers that are available to anglers at the same time as wild steelhead. Since wild steelhead provide exceptional quality of angling experience, they are managed with the intention of maximizing the number of such freshwater opportunities. Having said this, hatchery programs for steelhead have been maintained for a limited number of waterbodies to provide the opportunity to harvest a steelhead from a relatively abundant, hatchery-augmented population. These programs generally provide experiences that are different from those associated with wild populations and purposefully target a different demographic.

For all the reasons above, the Province will continue to administer catch-and-release fisheries for wild steelhead as described in the Steelhead Stream Classification Policy (Appendix V). Wild stocks considered to be in 'routine management' have been managed as catch and release for over a decade and will continued to be administered as such unless new information is available to support a change. Diversity of opportunity is considered within the broader context of all freshwater fishing opportunities in the province. This may preclude harvest opportunities for certain species and/or in certain geographic regions to ensure the long-term maintenance of the wild fish resource take precedence over the provision of other socio-economic benefits.

4. Implement restrictions as necessary to administer wild stock fisheries in a careful and responsible manner

In administering its catch-and-release regulation, the MFLNRO will endeavour to manage wild fisheries in a responsible and precautionary way. In some steelhead streams where a conservation concern exists, reducing cumulative mortality, even in catch-and release-fisheries, may be necessary. Today's anglers have the benefit of improved communication, knowledge, gear efficiency and access to areas previously considered to be steelhead refugia. This has led to more concern over the potential damage from the cumulative effects of fisheries. These effects are of particular significance to summer-run populations where injury from gillnets, seines and traditional fisheries, as well as poaching and even scientific sampling, during warmer water temperatures add to the stresses imposed by catch-and release-angling. In

[8] The term 'surplus' is a somewhat artificial construct is part of the Maximum Sustainable Yield definition often applied by fisheries managers when estimating how many fish can be harvested above minimum requirements. Minimum requirements don't account for broader ecosystem values and dependencies or the importance of 'ecological redundancy' that creates long-term resiliency and stability in a species and an ecosystem.

contrast, winter-run stocks are less at risk as they are not exposed to commercial fisheries and have a shorter angling season when water temperatures are cooler.

To administer catch and release in a careful and responsible manner, two types of angling regulations may be implemented. The objective is to provide recreational opportunities in a manner that does not cause unnecessary injury, harm or stress to either individual fish or the population. Some fishery management situations may require additional measures, particularly where there may be wild steelhead conservation concerns. Depending on the fishery and the management situation, these regulations may include: (1) time and area restrictions; and, (2) gear and bait restrictions.

In addition to angling regulation, stewardship and peer influence can play an important role in achieving the objective of careful and responsible recreational fisheries. BC's steelhead fisheries are well suited to benefit from stewardship initiatives, particularly as many steelhead anglers are experienced and proficient anglers, and belong to organized angling and conservation organizations. River Guardian initiatives may also be used with both regulatory compliance and stewardship. A number of BC steelhead fisheries already have longstanding River Guardian programs that serve this function.

Initially, the following measures will be considered province-wide:

a. ***Prohibit the use of bait for wild summer-run steelhead***
b. ***Prohibit the use of bait for steelhead fisheries where impacts to other vulnerable by-catch species (e.g. other trout and char species) are deemed unacceptable***
c. ***Foster improved handling practices including the discouragement of complete removal of wild steelhead from the water***

5. Encourage ongoing improvements in salmon harvesting and management to reduce steelhead by-catch mortality in commercial salmon fisheries

British Columbia's summer steelhead sport fisheries are world renowned. Most notable of these include those in the Skeena, Dean and Fraser (Thompson) watersheds. The migration timing of these summer-run steelhead stocks overlaps with that of many commercially harvested salmon stocks. Because some of BC's salmon are harvested in mixed stock fisheries with non-selective or modestly selective[9] gears and practices, some steelhead mortality remains unavoidable. Likewise, steelhead conservation measures have at times precluded the garnering of full salmon benefits to help ensure that the conservation objectives of steelhead and other stocks of concern are met.

British Columbia and Canada share the goal of long term sustainability of fisheries resources. Socio-economic goals are expressed as (1) optimized opportunities for freshwater recreational fisheries (Ministry of Environment 2007), (2) enhanced social and economic benefits through responsible management practices that protect the environment and maintain viable healthy fish stocks for marine fisheries (Ministry of Environment, 2010) and (3) economic prosperity for commercial harvest fisheries (Fisheries and Oceans Canada goal for fisheries renewal, 2014). The Province recognizes that balancing these socio-economic objectives requires the cooperative efforts of all stakeholders to consider alternative

[9]Described in a *Policy for Selective Fishing in Canada's Pacific Fisheries, 2001*.

management options in a structured decision making process. The Province acknowledges the progress to date with respect to improved selectivity in the commercial salmon fishery and strongly encourages further progress. The Province recognizes that further progress will take time and will involve strategies and policies that are developed and coordinated with industry and government.

The federal salmon Integrated Fisheries Management Plan (IFMP) process undertaken annually for North and South BC coasts provides an opportunity to incorporate steelhead management objectives within the broader planning process for the harvesting of salmon. The Province endorses efforts to minimize exposure of summer-run steelhead to salmon fisheries in times and places of steelhead migration; efforts might include limiting, where necessary, those fisheries that are only modestly selective. This approach recognizes the value of abundant steelhead populations, not only to the natural ecosystem, but also to the socio-economic well-being of many communities in British Columbia.

The Province strongly supports commercial fisheries that are economically and environmentally sustainable. The Provincial policy is to ensure secure opportunities for all communities that benefit from salmon harvest and recreational steelhead fisheries. It supports salmon fisheries that, to the extent possible, enable maximum or as near to maximum steelhead escapements to locations upstream of salmon fisheries in which steelhead are intercepted. Salmon fisheries that enable near maximum steelhead escapements will enable provincial steelhead fisheries objectives to be met.

The Province also supports the selective fishing objectives and principles highlighted in the federal *Policy for Selective Fishing in Canada's Pacific Fisheries* (Fisheries and Oceans Canada 2001) and more recently related to the strategy of "minimizing the capture of by-catch species and specimens that will not be retained, to the extent practicable", to meet the objectives of the *Policy on Managing By-catch* (Fisheries and Oceans Canada 2014). To date, these directives have focussed on by-catch reduction of federally managed species and not on the Province's socio-economic related fisheries management objectives for steelhead.

The Province is supportive of DFO implementing an ecosystem-based approach for salmon fisheries, as endorsed in *Canada's Wild Salmon Policy* (Fisheries and Oceans Canada 2005) and the Sustainable Fisheries Framework (2014). The *Canada-BC Agreement on the Management of Pacific Salmon Fisheries Issues* (1997) identifies the shared responsibility for salmon management, and in particular, the need to develop joint steelhead management objectives for the IFMP process and the process by which those objectives will be developed. To this end, the Province will work towards having steelhead objectives recognized alongside federal salmon objectives.

6. Employ hatchery programs to increase angler opportunities where the risks to wild steelhead are low and the expected societal benefits are high

Hatchery programs for steelhead can provide benefits to anglers in terms of access to harvestable fish but also impose risks to wild populations. There are currently no known effective methods to rebuild depressed populations of wild steelhead other than reducing mortality (and in specific circumstances, restore habitat). Research in BC and elsewhere has shown that hatchery supplementation does not rebuild wild stocks, but it can be used to support a fishery at considerable financial cost. Research has also shown that hatchery stocking can reduce the productivity of wild steelhead populations, with the negative

impacts increasing with the proportion of the total population that is of hatchery origin. Thus, hatchery augmentation should only be used in special circumstances where impacts on wild populations can be avoided and the expected societal benefits exceed the costs of the program. The *Steelhead Stream Classification Policy* and Procedures provides guidance for development and maintenance of hatchery programs for steelhead. As part of this guidance, annual monitoring is required to ensure that all ongoing programs regularly meet certain performance criteria. There are currently 16 hatchery-augmented steelhead stocks in the Province, including those in systems on Vancouver Island, the lower mainland and the north coast.

7. Manage angler use to maintain exceptional fisheries on Classified Waters

Within the broad spectrum of steelhead streams in BC, a limited number have been designated as Classified Waters to recognize the exceptional experience (notably, the surroundings) and fish values (wild origin) that characterize fisheries on these systems and maintain their appeal as premier steelhead fishing destinations. Under such circumstances, a key strategy to preserve this experience is to manage angler use through the implementation of special regulations, angling management plans and enforcement.

8. Incorporate a precautionary approach into management to address environmental uncertainty

The ability of management actions to influence wild steelhead production is limited. Management actions attempt either to maintain or restore the productive capacity of freshwater environments or to minimize the mortality imposed by fisheries (or other human activities) in the marine phase of their life history. Production can be limited by factors in both or either environment(s), but adult abundance levels appear, to date, to be strongly influenced by smolt-to-adult survival in the marine environment in British Columbia, which alternates between decadal-long periods of high (up to 30%) and low marine survival with rapid and unpredictable transitions between them. Marine survival fluctuates considerably and unpredictably within a given survival regime (for example 6-27% within the last high regime, 1-6% within the current low regime for the Keogh River). Furthermore, marine survival trends vary among regions and waterbodies. These abrupt and unpredictable shifts necessitate a more conservative approach to management that may not match stakeholder perceptions of fish abundance trends.

In-season estimates of the abundance of adult steelhead are both technically difficult and expensive to obtain and have very large uncertainty, which again constrains management approaches that will ensure long-term population viability. Developing efficient ways to obtain information needed before modifying management actions as conditions vary over time is critical. A framework to assess status and threats at the population level is the first step.

9. Address key anthropogenic factors that threaten or seriously impact steelhead productivity in freshwater habitats

Research in BC suggests that large-scale habitat restoration or construction is largely ineffective in increasing the watershed-level production of wild steelhead adults under the current regime of low marine survival (i.e. where marine survival is the major influence on adult production). Juvenile (parr) abundance and growth has been shown to increase in limited instances (i.e. site-specific and very modest).

Habitat manipulation can alleviate a well-identified production bottleneck to increase the production of juveniles in freshwater. However, the long-term benefits to the abundance of the adult population can be diminished by low marine survival. These issues are identified, not to minimize the importance of intact habitats to steelhead production, but rather to highlight the challenges of addressing compromised habitats and of observing a measurable response.

Maintaining intact freshwater habitats is critical and some legislative tools are available to assist with protecting fish habitat and ensuring minimum flows for fish. Environmental regulations must be applied and adhered to, to protect the productive capacity of the freshwater environment to produce steelhead. Where habitat has the potential to be damaged or compromised by a proposed activity, mitigative measures must be taken. Appropriate actions will need to be identified and pursued on a stock-by-stock basis or by using a strategic landscape approach.

Role of Regional Management in Provincial Steelhead Management

Management for a diverse resource, such as steelhead, and its associated diversity of pressures cannot assume a one-size-fits-all approach. Stock status, client preferences and external influencing factors vary significantly among stocks and provincial administrative regions. However, a consistency in the application of provincial objectives and policy, as well as decision-making approach, is essential. Stock-specific management plans and activities should be developed and implemented at the regional level by regional MFLNRO staff working with regional stakeholders. These initiatives will be guided by the Provincial Framework for Steelhead Management in BC and the Steelhead Stream Classification Policy.

First Nations Engagement

First Nations in BC have an opportunity to comment on the Provincial Steelhead Management Framework via the online engagement process. Additional engagement may be required where a signed agreement exists between a First Nation and the Province. Given the high-level guidance outlined in this document, the framework is not expected to have any adverse impact on Aboriginal interests in harvesting freshwater fish for food, social or ceremonial purposes.

More in-depth consultation with local First Nations will occur at the regional level during the development of region-specific recreational fisheries management decisions that could have the potential to impact Aboriginal Interests.

Stakeholder Engagement

Stakeholder engagement on the Provincial Framework for Steelhead Management in BC will take place via the Provincial Angling Advisory Team (PAAT) and the online engagement process using the provincial Angling, Hunting and Trapping Engagement website. Consultation on regional management plans and regulation setting for steelhead will normally take place at the regional level.

Team Members – Roles and Responsibilities

The provincial steelhead management technical team has been tasked with the development and implementation of the Provincial Framework for Steelhead Management in BC. The Fish and Wildlife Branch leads and coordinates the development of the Provincial Framework for Steelhead Management in BC, and where appropriate, coordinates regional management actions. All team members are expected to assist in reviewing and updating the provincial framework, and with developing and reviewing future provincial management documents. Regional membership includes representation from all steelhead management regions. If regional plans are required, team members will lead or assist the process. All team members are encouraged to assist other members where possible. Individual members include: fisheries biologists from Vancouver Island, Lower Mainland, Thompson, Cariboo and Skeena administrative regions of the Ministry of Forests, Lands and Natural Resource Operations, the Fish and Wildlife Management Branch (of Ministry of Forests, Lands and Natural Resource Operations), and the Ministry of Environment (Conservation Science).

The Provincial Angling Advisory Team will be provided with opportunities to review and comment on the Provincial Framework for Steelhead Management in BC at key points in its development. PAAT members include representation from the BC Wildlife Federation, Guide Outfitters Association of BC, Steelhead Society of BC, BC Fishing Resorts and Outfitters Association, Freshwater Fisheries Society of BC, Fly Fishers Federation of BC, North Coast Steelhead Alliance and Drift Fishers of BC.

Strategic Actions

The management strategies in the above sections identify several actions as key next steps. These are:

1) Implement an abundance-based framework to inform decision making around management of steelhead including regulation-setting, habitat restoration/protection measures and engagement with stakeholders, First Nations and federal fisheries partners.
2) Develop a strategic provincial stock assessment plan that identifies assessment priorities and describes the information required to inform decision-making associated with the abundance-based framework.
3) Explore opportunities to more effectively utilize electronic licensing and angler surveys to collect information regarding angler behaviour and status of fish stocks and fisheries (i.e. angler satisfaction).
4) Work with federal partners to develop a joint steelhead management objective in federal Integrated Fisheries Management Plans.
5) Develop a provincial risk assessment framework to track status and threats at the population level, and identify appropriate mitigation measures.
6) Develop a set of hatchery program criteria to enable regular assessment of hatchery performance.

The actions described here represent significant investments that will require sustained multiyear resourcing commitment and ongoing engagement with partners and stakeholders to deliver.

Delivery of Framework

The following outlines the proposed delivery schedule of tasks related to framework completion:

(1) Distribute draft to PAAT to solicit comments from their respective organizations	July 2014
(2) Post draft on provincial Angling, Hunting and Trapping Engagement website to solicit comments from the public and First Nations	July 2014
(3) Compile and review comments from PAAT and engagement website	October 2014
(4) Distribute second draft to PAAT, DFO and Ministry of Agriculture to solicit feedback	January 2015
(5) Finalize and distribute final framework	April 2015
(6) Implement strategic actions	Beyond April 2015

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Appendix I. Summary of fisheries management tools and associated authorities

Table A-1. Fisheries management tools and associated authorities.

Management tool	**Provincial fisheries management level of influence**	**Legal authority to apply tool**
Recreational Fishing Regulations	Direct control	Delegated Authority via the BC Sport fishing Regulation under federal *Fisheries Act*[10]
Hatchery Enhancement	Direct control	Federal *Fisheries Act* – bilateral Introduction and Transfers Committee, provincial policy (e.g. Steelhead Stream Classification Policy)
Habitat Protection/ Enhancement	Variable levels of influence, no direct control	Numerous Acts involved (e.g. *Water Sustainability Act*, federal *Fisheries Act*, *Fish Protection Act*, *Forest and Range Practices Act*, [RSBC 1996] CHAPTER 159; *Environmental Management Act* [SBC 2003] CHAPTER 53), Canada - British Columbia Fish Habitat Management Agreement, provincial *Riparian Areas Regulation* (under provincial *Fisheries Act*)
By-catch Management	Minimal; must be demonstrable conservation concern under current federal policy framework; direct control is by federal DFO	Federal Integrated Fisheries Management Plan process associated with *Fisheries Act*, supported by federal policies (By-Catch, Selective Fishing, Wild Salmon Policy)

[10] The federal *Fisheries Act* and regulations provide the legislative authority for the management and regulation of fisheries and the protection of fish habitat; it sets out the powers to regulate access to fisheries, to control the conditions of harvesting fish and development, implementation and enforcement of related regulations. The *General Regulations (1993)* state that "where a close time, fishing quota or limit on the size or weight of fish is fixed in respect of an area of non-tidal waters for any species of fish other than salmon under the *British Columbia Sport Fishing Regulations (1996)* the director responsible for fisheries management in the Ministry responsible for fisheries in the government of British Columbia may, by order, vary that close time, fishing quota or limit in respect of that area or any portion of that area". The *British Columbia Sport Fishing Regulations* apply only "in respect to sport fishing in the Canadian fisheries waters of the Pacific Ocean and of the Province" for a list of identified freshwater species. The federal *Fisheries Act* delegates authorization to the Director of the Fish, Wildlife, and Habitat Management Branch to vary regulations pertaining to method/gear/bait, no fishing, and quota for freshwater angling in British Columbia.

Appendix II. Key stock traits relevant to status and management

Overview:

Wild steelhead occur throughout all coastal regions in BC, and are able to access almost all watersheds along the 7000 km length of coast on both the mainland and large islands (Vancouver Island, Haida Gwaii). North of BC, steelhead occur throughout coastal Alaska to the Aleutian Islands, while south of the province, they occur (or once did) in coastal systems from Washington to Southern California (where they still persist to San Jose).

The breadth of environmental diversity, as well as strong homing fidelity to natal streams to spawn (resulting in reproductive isolation), has produced a large number of discrete, locally adapted stocks. Over 400 known, demographically-independent populations have been documented to occur in both coastal rivers and interior sections of large coastal rivers such as the Fraser and Skeena where upstream migration to spawning grounds may reach 600 km (Table A-2). Parkinson et al. (2005) estimated the total number of steelhead stocks based on a modelling exercise that considered genetic structure for known populations, stream size, smolt production capacity, minimum viable population estimates and run-timing.

Stocks vary in numerous ways including productivity and population size, fecundity, spawner sex ratios, migratory behaviour, life history and ecology. These variables in turn determine features highly relevant to fisheries interests such as recreational opportunity and exposure in interception fisheries. These variables are important considerations for fisheries managers when identifying the most appropriate management tools including regulations and enhancement activities, as well as identifying limiting factors. From a conservation perspective, understanding how this within-species diversity is distributed spatially and temporally is necessary to ensure that management activities do not inadvertently reduce the adaptive potential of the species, particularly given dynamic environmental conditions and climate change. Adult steelhead abundance can vary dramatically, and prolonged declines in abundance due to productivity trends, shifts or cycles, can cause conservation concerns.

Steelhead follow a life history strategy that is more dependent on rearing in streams than Pacific salmon species. Across their range in BC, steelhead spend 1-5 years rearing in streams before migrating to the North Pacific to mature for 1-3 years prior to spawning for the first time. Unlike other salmon, steelhead do not necessarily die after spawning but can return to sea to spawn up to 3 or more times (although not frequently). Run-timing (or re-entry into freshwater as adults) can vary significantly among and even within rivers and has significant implications for fisheries management.

Table A-2. Summary of steelhead stocks within each ecotype (adapted from Parkinson et al. 2005).

Ecotype	Major Drainage	Discharge Regime[1]	Number of Stocks
Coastal Summer	Lower Fraser	Snowmelt	2
	Fraser Canyon	Snowmelt	4
	South Coast	Rainfall	8
	East Vancouver Island	Rainfall	8
	West Vancouver Island	Rainfall	23
	Bella Coola, Dean	Snowmelt	2
	North Coast	Rainfall	4
TOTAL			51
Coastal Winter	Lower Fraser	Snowmelt	13
	Boundary Bay	Rainfall	3
	South Coast	Rainfall	55
	East Vancouver Island	Rainfall	28
	West Vancouver Island	Rainfall	72
	Bella Coola, Dean	Snowmelt	2
	Lower Skeena	Snowmelt	11
	Lower Nass	Snowmelt	7
	North Coast	Rainfall	58
	North Coast Islands	Rainfall	24
	Haida Gwaii	Rainfall	28
	Stikine	Snowmelt	12
	Taku	Snowmelt	4
TOTAL			317
Interior Summer	Fraser Canyon	Snowmelt	4
	Mid-Fraser	Snowmelt	5
	Mid-Columbia	Snowmelt	1
	Thompson	Snowmelt	4
	Upper Nass	Snowmelt	11
	Upper Skeena	Snowmelt	24
	Stikine	Snowmelt	1
	Taku	Snowmelt	7
	Alsek	Snowmelt	2
TOTAL			59
GRAND TOTAL			**427**

[1]Discharge or precipitation regime reflects the dominant factor determining the hydrologic cycles of rivers in this watershed. This categorization has been highlighted as a key determinant of steelhead abundance trends (see Smith and Ward 2000, Smith 1997, Northcote 1992). Note that some systems within these broader groups are a hybrid of these regimes (e.g. Coquihalla), with both coastal and inland influences.

Run-timing Ecotypes:

Ecotype (i.e. a group adapted to a specific set of environmental conditions such as the annual hydrograph) diversity of steelhead in BC is a key consideration when assessing status, threats (e.g. interception, climate conditions) and recreational opportunities. The three broad ecotypes are Coastal Summer, Coastal Winter and Interior Summer ecotypes (Smith 1969; Hooton 2001). These three groups are based on freshwater migratory distance to spawning grounds and time of freshwater entry (which reflects state of reproductive maturity). Summer run fish generally enter freshwater from June to November (though specific timing depends on the river) where they will overwinter and mature in time for spring spawning; thus freshwater residency time prior to spawning can be up to 7-10 months during which time a fish must rely mainly on fat reserves it built up prior to freshwater entry. Winter run fish enter freshwater from November to June in a more advanced state of maturity; freshwater residency is relatively short prior to spawning. Coastal stocks are those generally migrating less than 150 km upstream, usually in small to moderate sized streams. Inland stocks originate from upstream tributaries of larger drainage systems where freshwater migration distances tend to exceed 150 km. Table A-3 summarizes key features of the three ecotypes.

Table A-3. Ecotype summary as defined by river entry (run-timing) and location of natal stream.

Ecotype	Run timing	Details
Coastal Summer	River entry coincides with spring runoff	Least common ecotype distributed sparsely in southern and central coastal BC. Usually small, unproductive systems supporting small stocks (i.e. adults in low 100s) given limited smolt production capacity of streams, with a couple of exceptions (e.g. Dean).
Coastal Winter	River entry timing varies south to north with southern stocks usually entering Dec-March while mid to north stocks entering April-June	Most common ecotype distributed throughout coastal BC. Rainfall driven *versus* snowmelt driven discharge regime will also influence timing. Usually involves small, unproductive systems supporting small stocks (i.e. adults in 100s) although some exceptions like the Chilliwack exist. In total, there are probably fewer than 10 such systems that can support more than 1000 adults.
Inland Summer	River entry from mid-summer to early fall, prior to onset of winter	Limited to large systems with upstream tributaries (Fraser, Skeena, Nass, Stikine, Taku). Productivity of individual tributaries varies. Individual stock size also varies (100s to 1000s). Fish may overwinter in mainstem or lakes before moving into tributaries to spawn. Overwintering conditions are harshest for this ecotype.

Abundance and Productivity:

Steelhead stocks in BC vary tremendously in both abundance and productivity; these two features are essential in determining both health of a stock and recreational opportunities. However, it is important to understand that the two terms are not interchangeable (i.e. high productivity does not imply high

abundance and vice versa). Abundance is simply the size of the stock which is largely constrained by the size of the habitat base (wetted area or kms of stream) and natural freshwater capacity (biomass per unit area). Stock productivity is based on the stock-recruit curve (number of smolts produced per spawner) and is determined by the physical habitat (freshwater and marine environment), as well as the characteristics of the stock itself (e.g. fecundity, sex ratio, body size). Productivity is a key factor in considering recovery times for over-exploited populations. Even where a stock is at high abundance, it may be easily over-exploited if it is relatively unproductive. Steelhead production is the net result of (1) a freshwater phase (egg-to-smolt stages) where mortality varies with density (includes the extent and quality of the habitat base) and (2) a marine phase (smolt-to-adult stages) where mortality is generally considered independent of density although recent research suggests that limits exist here too (Beamish et al. 2004, Beamish et al. 2012).

Climate change, and particularly ocean regimes, has also been a key factor influencing productivity. In the 1990s, large ocean regime cycles became increasingly unpredictable, leading to increasing uncertainty in the results of predictive modelling and the ability to forecast salmon returns. It has also become evident that these shifts in ocean regime can easily eclipse efforts to enhance freshwater productivity.

Coastal rivers with high unit runoff and low nutrients usually have low productivity and support small, unproductive stocks (although the larger Chilliwack, Cowichan and Stamp/Somass systems are notable exceptions; here, flows are moderated by upstream lakes). Interior systems may vary in productivity from the highly productive Nicola River tributaries to low-productivity systems such as some tributaries of the Skeena and Nass rivers. Length of each growth season (determining how many years it takes to grow a smolt) and nutrient input both influence freshwater productivity. As an example of how important productivity is when thinking about vulnerability of populations to over-exploitation and ability to rebound, consider the Upper Sustut (in the Skeena drainage) versus the Chilliwack (in the Lower Fraser) stocks of steelhead. Because steelhead must reach a threshold minimum size to undergo smoltification and migrate to sea, it may take up to 5 years or more for an Upper Sustut fish to grow to such a size under the harsh conditions of its freshwater residency. It may only take 1-2 years in the productive warmer waters of the Chilliwack, Little Campbell or Cowichan, where the growth season is longer. Even if annual mortality rates are the same during freshwater stage for northern and southern stocks, it will take possibly more than 4 times the number of fry and about 3 times the stream area to produce a smolt in the Upper Sustut compared to the Chilliwack.

Overall, most steelhead stocks in BC originate from small, relatively unproductive systems. Thus, the capacity to produce smolts is also limited and the majority of stocks likely produce less than (and in many cases, much less than) 500 adults (Hooton 2001) with a few dozen producing up to 1000 adults, and even fewer with the capacity to produce much more than this. This is a very different scenario than many systems in US states south of the province which historically were capable of producing 10s to 100s of 1000s of steelhead prior to the mid-1900s. This difference highlights the inherent vulnerability of BC stocks relative to southern stocks to over-exploitation (recruitment over-fishing) and extended recovery times once they reach an over-exploited state.

Steelhead populations generally occur in much less abundant numbers than other sea-run salmonids most notably Pacific salmon that are commercially harvested. Steelhead and salmon stocks with similar adult run timings can be subject to common fisheries in ocean and mainstem river migration corridors; these

"mixed-stock" fisheries (commercial, recreational and First Nations) may impose quite different impacts on populations that differ in abundance and productivity. Ensuring desired levels of socio-economic benefits from mixed-stock fisheries may drive low-productivity populations to very low abundance, increasing the risk of irreversible declines or extirpation. Fisheries may target steelhead (e.g. in-river recreational fisheries and some First Nations fisheries) or capture steelhead as incidental by-catch (commercial salmon net fisheries at sea and in-river) with different impacts depending on stock timing and productivity. The various fisheries that catch steelhead have different management objectives, only some of which can be influenced by provincial fisheries policies and actions. As a result, negotiated trade-offs between conflicting objectives may be required to maintain desired abundances of steelhead.

Status:

The most comprehensive assessment of BC steelhead stock status to date was conducted using the steelhead harvest analysis (SHA) results up to 2003 by Ahrens (2004). The analysis determined stock status based on the definitions provided by Johnston et al. (2000) for over 400 stocks. While significant concerns were expressed regarding the potential biases associated with the survey data, the province-wide conclusions agreed with expert opinion. The analyses indicated that in general, stocks north of Bella Coola/Dean improved in status in the 1980s and 1990s and were considered relatively healthy (i.e. routine management zone), with the possible exception of Haida Gwaii stocks. Southern stocks generally doubled in size during the 1980s, but significant declines occurred in the 1990s, with many considered to be in the extreme conservation concern zone. East coast Vancouver Island area contained the most stocks in decline. However, some exceptions were also evident on the West coast Vancouver Island and Lower Fraser. Data from this study and another (Smith and Ward 2000) also suggested that more rapid declines along the south coast and east coast Vancouver Island were observed in hatchery-augmented stocks.

These patterns have generally continued in terms of status although recent observations suggest a general improvement for many south coast (Vancouver Island and mainland) stocks since 2009. In particular, significant increases in abundance have been reported for a number of summer and winter run stocks on Vancouver Island (Tsitika, Cowichan, Heber, Gordon) and the lower mainland (Silverhope, Coquihalla, Cheakamus, Alouette, Coquitlam), and are thought to reflect a modest improvement in ocean survival. Estimates for summer-run stocks in the central to north coast also indicate relatively strong runs in most recent years with the exception of 2013 (Skeena, Nass, Dean). Other systems continue to persist at record low, but seemingly stable, abundance levels suggesting there are other factors at play here (e.g. Englishman, Keogh, Thompson/Chilcotin, Bella Coola/Atnarko).

Appendix III. Summary of provincial and regional regulations for steelhead

The Province regulates steelhead fisheries via combinations of gear restrictions, seasonal and area closures. Barbless hook requirements are in place in all steelhead management regions (federally imposed in some cases to protect salmon), and harvest is limited to hatchery fish in hatchery-augmented systems. Non-retention has been in place for all steelhead management regions since 1997 when the Skeena and Nass watersheds were moved to catch-and-release only. Allowable gear types (including use of bait), seasonal and area closures, conservation closures (i.e. full river closures due to conservation concerns) vary among and within management regions. With regard to the harvest of hatchery fish, once the daily hatchery quota has been caught (i.e. one fish), the angler must stop fishing for steelhead for the remainder of day. The annual quota for hatchery steelhead is 10. A Steelhead Conservation Stamp must be purchased annually to fish for steelhead and when fishing on coastal Classified Waters at certain times of year, even if target is not steelhead.

It is useful to put the provincial approach into the broader management context for steelhead south and north of BC. Washington permits an overall mortality rate of no more than 10% in recreational fisheries except where research indicates otherwise. Steelhead fishing is not permitted in wild steelhead streams (i.e. no hatchery production) where abundance or escapement is not known. Retention is permitted for hatchery fish (two is daily limit, no annual limit). Retention of wild fish is only permitted on eight rivers in the state, and retention is limited to one fish in total (i.e. all rivers combined) annually (based on the 2014-2015 regulations) Where steelhead must be released, total removal from water is prohibited. Annual limit in Southeast Alaska is two fish (minimum size 36 inches); there are no hatchery programs for steelhead in this jurisdiction.

In 1990, a number of BC streams containing wild steelhead populations were designated as Classified Waters, thus requiring an additional license to fish on these waters at designated times. The intent was to maintain a quality experience for exceptional fisheries and regulate the expansion of guided angler days. Further steps have since been taken with the development of Angling Management Plans to restrict non-resident access.

Appendix IV. Application of an abundance-based framework

Conceptually, the development and application of an abundance-based management decision framework is straightforward and logical. Specifically, this involves the establishment of two reference points and three management zones into which steelhead stocks can be classified according to abundance status. Clear objectives, assessment and regulatory approaches can then be assigned to each zone that put the achievement of conservation and use objectives in context with stock status.

Objectives for the three management zones are summarized as follows (based on Johnston et al., 2000, 2002):

Extreme Conservation Concern Zone (ECC) **– Rebuild stock to Conservation Concern** *(<10% carrying capacity)*

- Minimize all significant sources of mortality including that associated with various fisheries. Fishing closures may be necessary where uncertainty is high, or absolute numbers are very low and even very low exploitation rates cannot be tolerated.

Conservation Concern Zone (CC) **– Rebuild stock to Routine Management Zone within a defined time in the absence of harvest, or allow stock to remain in current zone for other socio-economic objectives (such as restricted fisheries, especially First Nation priority)** *(10-30% carrying capacity)*

- In most cases, fishing closures are not expected but efforts to curtail exploitation rates will likely be undertaken.

Routine Management Zone (RM) **– Provide a diversity of social, economic and cultural benefits while maintaining healthy stocks** *(>30% carrying capacity)*

- Maximize angler opportunities to the extent possible although some limitations in terms of acceptable options will still be applied (reflecting stock and environmental characteristics, policy and well-established risks associated with certain activities).

This conceptual approach is not meant to be highly prescriptive but rather to provide a set of principles to enable consistent decision-making. Stock-specific objectives and management tools will be refined according to specific characteristics of a particular stock that will influence a number of factors such as ecotype, exposure to various fisheries, and the nature of stock assessment information. Thus, an appropriate management response will reflect both stock status and the suite of factors.

In practice, the application of an abundance-based framework presents significant challenges. For steelhead, the adult stock assessment information, such as measured watershed capacity, required to develop abundance-based reference points and performance measures is extremely limited or not available. In most cases, surrogate measures may be the only option (e.g. trend data not directly comparable to reference points). Furthermore, the absolute abundance may influence management decisions more than the management zone, particularly when dealing with very small populations where uncertainty becomes far more significant and risk of (quasi-)extinction increases. In many cases, surrogate measures should be adequate to inform management decisions, assuming uncertainty is taken into account and we can describe how we are managing for risk. As complexity associated with types of

influencing fisheries increases, so too will information needs. Finally, there may be a very limited number of cases where very detailed adult information is available and certainty is higher; in such cases where we can monitor status with some confidence we may be able to deviate from more precautionary measures we apply elsewhere because we can demonstrate that we have the science evidence.

It might be argued that non-retention on wild stocks as a province-wide policy negates the need for an abundance-based framework. An abundance-based framework is necessary and relevant for a number of reasons:

1. To assist staff in establishing priorities for stock assessment and monitoring
2. To provide the status information necessary for reporting out to stakeholders for 'state of environment' documentation and demonstration of resource knowledge
3. To provide the status information necessary for confirming conservation and use objectives in federal and First Nation fisheries forums
4. To assist staff in determining whether or not to open or close recreational fisheries

We recognize that in most cases, the data collected does not meet the adult data input needs as described in Johnston et al. (2000). However, we also believe that the type of stock assessment data relating to measurable freshwater capacity which we are able to readily collect is adequate in most cases to qualitatively or quantitatively establish stock status and inform most management decisions. What still remains to be undertaken is a province-wide re-evaluation of current stock assessment approaches and prioritization of assessed systems to meet regional and provincial information needs.

Appendix V. Steelhead Stream Classification Policy and Procedures

Policy 3-2-02.01

Steelhead Stream Classification

• *Effective Date:* December 13, 2005

This Policy Replaces:

None.

Staff, Organizations Directly Affected (including but not limited to):

Ministry of Water, Land and Air Protection [now Ministry of Environment], Ministry of Sustainable Resource Management [now Ministry of Forests, Lands and Natural Resource Operations], Ministry of Agriculture, Food and Fisheries [now Ministry of Agriculture], Freshwater Fisheries Society of British Columbia Fisheries and Oceans Canada contract/volunteer hatchery operators, angling and guiding organizations and First Nations.

POLICY STATEMENT

Purpose: The use of hatchery steelhead (*Oncorhynchus mykiss*) and/or retention of wild steelhead can provide angling benefits, but may also impose risks to wild stocks. The overall purpose of this policy is to manage the risks in order to maintain healthy, self-sustaining wild steelhead stocks.

It is the Policy of the Ministry:

1. That all streams containing steelhead will be classified as:

(a) wild; or

(b) hatchery-augmented.

2. Streams will be classified as wild unless specifically designated as hatchery-augmented.

3. That streams designated "wild" will be managed to maintain and protect the abundance, distribution and genetic diversity of indigenous steelhead stocks in the province while providing angling opportunities when stock abundance permits.

4. That streams designated "hatchery-augmented" will be managed to maintain or develop new angling opportunities while minimizing risks to wild indigenous steelhead.

5. In no cases will hatchery-augmentation be considered as a substitute for habitat protection and restoration.

Reasons for Policy

1. To maintain the genetic diversity, general health, and long-term viability of wild indigenous steelhead stocks.

2. To recognize the risks of hatchery augmentation and to acknowledge the lack of scientific evidence to support the use of traditional hatchery practices to recover "at-risk" steelhead stocks.

3. To allow for the maintenance and development new steelhead angling opportunities in the province in appropriate locations.

4. To provide standard designations to support development of consistent management plans for steelhead stocks in the province.

5. To ensure that decisions with respect to the use of hatchery-augmentation are science based and consistently applied throughout the province through a structured decision making process.

6. To facilitate understanding and support for steelhead conservation, management and recovery strategies.

Definitions:

"Wild" steelhead streams — streams in which steelhead stocks and steelhead angling opportunities are sustained only by naturally produced indigenous fish. The historic stocking of hatchery fish does not preclude a wild designation if there is reasonable expectation that the indigenous stock remains intact or can be recovered.

"Hatchery-augmented" steelhead streams — streams in which marked artificially propagated steelhead are released ***for the purpose of creating angling opportunities***. Propagated steelhead includes progeny resulting from projects where eggs are taken from adults, fertilized and incubated in a facility of any kind. They also include trapping fry, parr or smolts and raising them for subsequent release or use as captive brood stock.

"Viable wild stock" — for steelhead will be determined on a stream-by- stream basis using the best available science and stock and habitat information.

Wild stock status is expressed relative to the estimated existing capacity of each individual watershed to produce naturally spawning steelhead as follows:

"Routine Management Zone" (RMZ) — stocks at least 30% of habitat capacity;

"Conservation Concern Zone" (CC) — stocks are 10% to 30% of habitat capacity;

"Extreme Conservation Zone" (ECC) — stocks less than 10% of habitat capacity;

"Special Concern" (SC) — stocks are not well documented but believed to be very low.

Procedure 3-2-02.01

Steelhead Stream Classification

• *Effective Date: December 13, 2005*

A.) Classification of Steelhead Streams

- The Ministry will classify provincial streams containing steelhead as "wild" or "hatchery-augmented" to meet steelhead conservation and management objectives.
- The objective is to maintain healthy, self-sustaining wild steelhead populations in British Columbia and, as such, the default classification will be "wild". Criteria for classifying a stream as "hatchery-augmented" include:

    1. Systems which have been historically augmented and where continued augmentation is not considered to pose a risk to extant wild stocks or;
    2. Systems where a wild stock has been depleted or otherwise impacted to the point that recovery is not considered possible or;
    3. Systems where a steelhead population never existed and potential impacts to other native species have been evaluated and are considered acceptable.

In all cases there must be a reasonable expectation of creating a viable angling opportunity in a cost-effective manner.

- Initial classifications and proposed subsequent changes will be developed regionally and must be reviewed technically by the Ministry's Anadromous Fisheries Committee [now Rivers Committee] before forwarding to the Environmental Stewardship Division Management Committee (DMC) [now Resource Stewardship Directors] and for a final decision.
- Requested changes to the designation of a steelhead stream will be directed to the accountable regional manager who will prepare an evaluation that includes management objectives, potential consequences and their likelihood and, performance indicators.
- A schedule of hatchery-augmented streams will be established and updated as required.

B.) Management of Designated Steelhead Streams

The Ministry will manage designated provincial steelhead streams as follows:

"Wild" steelhead streams

- No hatchery augmentation will be permitted.
- Angling regulations are to be enacted that prohibit retention of wild steelhead to conserve wild fish, provide higher catch rates and simplify management.
- Angling regulations are to be enacted to minimize catch and release impacts.
- Management priorities should be identified and implemented to maintain stock abundance in the "Routine Management Status". When the stock status of wild steelhead populations are declining towards or have declined to "Conservation Concern" levels or lower, management prescriptions designed to recover stocks to the "Routine Management Status" should be developed.

- Management prescriptions should focus first and foremost on restoring stock abundance through improved stock management and/or habitat protection, habitat improvement that mimics natural habitat or enrichment of natural habitat.
- Where the requirement for a Recovery Plan (under the Accord for the Protection of Species at Risk or the *Species at Risk Act*) is identified for a steelhead stock or stock group, then it will be undertaken according to provincial policy and procedures. The use of conservation fish culture[11] designed to conserve with-in stock genetic diversity is an acceptable short-term option (one generation) if it is part of a provincially approved recovery plan.
- Adult brood stock, smolts or parr may not be taken from wild steelhead streams for hatchery augmentation on other systems unless:
    1. a risk assessment has been prepared by the proponent and approved by the Anadromous Fisheries Committee as an exception to the general practice of not transplanting steelhead between watersheds;
    2. the status of the wild donor stock is in the Routine Management Status and
    3. approval is obtained from the Federal/Provincial Introductions and Transfer Committee.
- Non-government partners and public involvement groups should be encouraged to undertake projects which promote wild stock recovery through, habitat protection and restoration or enrichment of natural habitat.

"Hatchery-augmented" streams

- All hatchery-augmented fish must be marked with at least an adipose fin clip and regulations enacted that will limit catch and release impacts on wild steelhead as much as possible, and only permit retention by angling on marked hatchery-augmented fish.
- Hatchery programs must be evaluated annually to confirm predicted program objectives and outcomes are being achieved for the augmented and neighbouring streams. Hatchery programs, which are not meeting predicted objectives and outcomes, will be adjusted or discontinued.
- Hatchery augmentation, must follow current best practices for steelhead culture as established by the Freshwater Fisheries Society of BC and the Ministry of Land, Water and Air Protection [now Ministry of Forests, Lands and Natural Resource Operations].

a) Where an indigenous population is extant in a stream that has been or will be hatchery augmented to create a retention fishery for marked steelhead:

- A management prescription must be prepared that is designed to maintain indigenous populations and their habitats.
- The management prescription must consider the consequences identified during the classification process and establish practices to minimize any potentially negative impacts on indigenous steelhead stocks.

[11] Conservation Fish Culture is a specialized and experimental form of hatchery intervention designed to prevent the extinction of a population or species while the root causes of population decline are ascertained and addressed. The primary focus of conservation fish culture is to protect the natural genetic integrity of the population. Such a program requires a carefully designed breeding plan and release strategy to mimic what would happen in the wild. These programs are planned to be "temporary", usually lasting for one generation. A conservation fish culture program differs significantly from the traditional production hatchery program where the main objective is to provide for angling opportunities.

- This risk will be considered acceptable where there are or expected to be significant angling benefits and the augmentation program is not expected to impact the overall health of wild-indigenous steelhead populations.
- Management priorities should be identified and implemented to maintain the abundance of unmarked wild –indigenous steelhead populations in the "Routine Management status". When the stock status of wild steelhead populations are declining towards or have declined to "Conservation Concern" levels or lower, management prescriptions designed to recover stocks to the "Routine Management Status" should be developed.
- Management prescriptions should focus first and foremost on restoring stock abundance through improved management and/or habitat protection, habitat improvement that mimics natural habitat or enrichment of natural habitat.
- Unmarked steelhead adults from the same stream should be used for brood stock when sufficient wild stock are available and comprise the majority of annual spawning escapements.
- Hatchery steelhead releases must be at locations and times where they will have minimum impact on wild fish.

b) Where a wild population of steelhead has never existed, been extirpated, or is not sufficiently abundant to meet the accepted definition of a viable stock, a new population of steelhead may be considered for introduction through hatchery augmentation to create a steelhead angling opportunity.

- A management prescription must be prepared that considers consequences identified during the classification process and establishes practices to minimize any potentially negative impacts.
- Marked steelhead brood stock from the closest available stream, which is part of the same stock grouping, is the preferred source for hatchery augmentation. Progeny from captive brood programs may be used for this purpose.

Management prescriptions will be developed regionally and reviewed technically by the Anadromous Fisheries Committee. They will be submitted to the Environmental Stewardship Division Management Committee (DMC) for a final decision. A structured decision making process will be followed where required.

The Ministry will use measurable criteria, standards and guidelines, including monitoring and evaluation requirements, to implement the Steelhead Stream Classification Policy and Procedure.

The Steelhead Stream Classification Policy and Procedure will be reviewed within five years by the DMC [now Resource Stewardship Directors] and modified where appropriate based on experience and changing conditions.