



Egg collection at Chilliwack River Hatchery. Photo courtesy Robert Stanton.

## **Acknowledgements**

This draft document was produced by the Project Team for the Chilliwack River Watershed Strategy as part of the Issues and Alternatives phase of the project.

The following individuals are thanked for their invaluable contributions of time and information, which was used in the development of this document:

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- David Barnes, Cultus Lake Salmon Research Laboratory, Fisheries and Oceans Canada
- Lance Lilley, Fraser Valley Regional District Planning
- Mark Johnson, Fisheries and Oceans Canada
- Ron Valer, Chilliwack River Hatchery, Fisheries and Oceans Canada
- Tom Cadieux, Fisheries and Oceans Canada

This acknowledgement is solely intended to recognize the numerous individuals who contributed to the preparation of this document. These individuals are not responsible for the information or the recommendations made within the document, and the document does not necessarily reflect the opinions or views of all of these individuals. The report is a product of the CRWS Project Team, and it is the Project Team that is ultimately responsible for this document. All feedback should be directed at them and not to the individuals acknowledged above.

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# Chilliwack River Watershed Strategy Issues & Alternatives: **HATCHERY PRODUCTION AND MANAGEMENT**

## 1.0 General Description of the Issue

For the past 30 years, hatcheries have generally been viewed positively because of the many social, cultural, and economic benefits that the Salmon Enhancement Program has provided to communities. Probably the most significant community concern ever voiced regarding hatcheries surrounded the announcements of pending hatchery closures in the mid 1990s. It is only very recently that hatchery programs have come under greater scrutiny from the scientific community, agencies, and to some extent, the general public. The two main reasons for this change in opinion are the limited success of some hatcheries and the inconsistency of hatchery programs with current philosophies on conservation and management of fisheries. In response to rising concern, some hatchery programs have been modified and some have been discontinued altogether.

### 1.1 *Chilliwack River Hatchery*

The Chilliwack River Salmon Hatchery (1981), a product of the Salmon Enhancement Program (SEP), is currently mandated by Fisheries and Oceans Canada to provide for a sustainable salmon fishery, to conserve wild fish and habitat, and to work within the guidelines of the Wild Salmon Policy. This current mandate differs from the mandate prior to 1996, when SEP was more focused on producing salmon to yield economic benefits rather than sustaining fish populations and conserving wild fish and their habitat.

The Chilliwack River Hatchery performs a range of operations in the Chilliwack River Watershed in order to fulfill its mandate. Millions of coho, chinook, chum, and steelhead fry and smolts are raised in the hatchery, marked, and released into the watershed each year. In addition, population trends and habitat utilization of both hatchery and wild fish are through downstream juvenile and adult carcass recovery programs.

Many of the juvenile salmon released by the hatchery do not survive to become adults and many are caught as adults in the marine environment. It has been estimated that for every 2000-5000 hatchery coho smolts released, only 100 survive to reach adulthood.<sup>1</sup> Further, of these 100 adult coho, 8-12 are harvested in marine fisheries and 15-26 are harvested by freshwater anglers; as low as 5 adults return to successfully spawn. The most recent survival estimates of hatchery fish range from 1 to 4%, depending on the species.<sup>2</sup> The few adults that return to the Chilliwack River Watershed are either caught by sport anglers, harvested for brood stock, allocated to First Nations (once brood stock requirements are met) after being caught in the hatchery trap, or left to spawn within the Chilliwack River or tributaries close to the hatchery. The further upstream or downstream from the hatchery, the fewer the number of spawning hatchery fish (the

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<sup>1</sup> Pestal, 2005

<sup>2</sup> Stanton, R. pers comm. December 11, 2007.

range within which hatchery spawners can be found is defined as the ‘hatchery footprint’).

## 1.2 *Potential Watershed Concerns*

Despite the fact that relatively few of the juvenile fish released from the hatchery return to the watershed as adults, the generation of large numbers of hatchery fish has led to several biological concerns:

- Competition between wild and hatchery fish for food and territory may negatively affect wild salmon populations<sup>3</sup>
- Inter-specific competition for space and food and prey-predator relationships may negatively impact populations of poor competitors (e.g., chum and fall chinook may out compete coho due to size and behaviour differences)
- High levels of hatchery production and high survival rates for certain species (e.g., chinook and coho) can contribute to harvest rates that are too high for wild fish to sustain<sup>4</sup>
- Hatchery production increases or decreases can potentially impact wild fish (e.g., the overproduction of one species relative to another can create an imbalance, particularly when there is a mix of chinook, chum, and coho)
- Hatchery operations could potentially introduce diseases, contaminants, and effluent into the watershed<sup>3</sup>
- Interbreeding of hatchery and wild fish could potentially alter the genetics of wild populations and change overall stock characteristics over time<sup>3</sup>
- The introduction of salmon species from other watersheds to the Chilliwack River Watershed can potentially harm indigenous salmon and other fish and wildlife populations (e.g., the introduction of Upper Fraser red chinook from several sources to replace a nearly extirpated indigenous summer chinook population, and the introduction of Harrison fall white chinook to create a new terminal fall chinook fishery and supplement the fall chinook marine fishery)
- Large numbers of top aquatic predators like salmon in the watershed may negatively affect other species, such as amphibians or fish.

In addition to the biological issues surrounding hatchery fish production, the abundance of fish generated by hatchery programs draws large numbers of anglers to the Chilliwack

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<sup>3</sup> Wild salmon fry are, on average, smaller than hatchery fry of the same species and age and so they may be prey to the larger hatchery fry. Hatchery adult returns may compete for holding and spawning habitat and potentially breed with their wild counterparts.

<sup>4</sup> Gardner et al, 2004

River each year. The large numbers of anglers, in turn, contribute to several social and ecological concerns:

- Overcrowding at popular fishing spots
- Damage to the ecological integrity of the watershed (e.g., through soil compaction, erosion, littering, disposal of human wastes, disturbance of wildlife populations, etc.) from high concentrations of anglers at specific locations
- Increased pressure on existing infrastructure such as roads, parking, and camping facilities
- An increase in fishing violations and other unethical behavior and resultant enforcement activities (see also: CRWS Sport Angling Behaviour Issues and Alternatives Document)
- Conflict amongst anglers and between anglers and other user groups (e.g., kayakers and campers) or residents.

## 2.0 Specific Location/Examples

The degree of influence of the salmon hatchery on the wild salmon of the Chilliwack River Watershed varies depending on the location within the watershed and the species of salmon. Wild salmon can be found in many parts of the watershed and there is evidence that hatchery fish have used most reaches and tributaries of the Chilliwack River from Chilliwack Lake to Vedder Crossing at one time or the other.<sup>5</sup> Hatchery coho have the greatest range as the donor stock came from the upper, middle, and lower reaches of the river. Fall chinook have only been released from the hatchery site and most likely have a range from slightly above the hatchery to all the way downstream. Transplant red chinook may range as high as the Chilliwack Lake. Obviously, locations where both hatchery and wild fish can be found are the areas in which interactions between hatchery and wild fish are likely to be the most significant.

Competition between hatchery and wild fish is also greater within the types of habitats that are limiting within the watershed (e.g., rearing and spawning locations) or strongly affected by environmental conditions (e.g., low flows can make tributaries inaccessible to coho leading to increased competition between coho and more dominant chum and chinook for holding and spawning areas in the Chilliwack River mainstem).

Specific examples and locations where issues such as illegal angling, littering, garbage dumping, and other forms of damage to the watershed occur are outlined in other documents, including the Angling Behaviour and Illegal Dumping Issues and Alternatives Documents.

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<sup>5</sup> Stanton, R. pers. comm. December 11, 2007.

### 3.0 Contributing Factors/Causes

Numerous factors combine to create the range of issues present in the Chilliwack River Watershed related to hatchery production and management:

- The high ratio of hatchery produced salmon relative to wild salmon in the Chilliwack River;
  - Note that the high ratio of hatchery produced fish to wild fish in the Chilliwack River is a result of: (a) serious declines in wild salmon stocks as a result of past logging and development/settlement activities, overfishing, changes in weather patterns, and pollution of fresh and salt water habitats, and (b) a past mandate of Fisheries and Oceans Canada (e.g., the SEP) to “bring back salmon populations to historic levels” through enhancement activities like hatcheries.
- A high demand for prized salmon such as red and white chinook, coho, and steelhead, which creates pressure to introduce new species and/or alter natural species composition in the watershed;
- Sport angling regulations that allow for the retention of significant numbers of salmon, which creates a strong incentive for anglers to fish the Chilliwack River;
- The close proximity of the Chilliwack River Watershed to large population centers in Greater Vancouver and the Fraser Valley;
- Easy access to the Chilliwack River (i.e., Chilliwack Lake Road travels beside the Chilliwack River for many kilometers);
- The popularity of the Chilliwack River Watershed for a broad range of recreational activities in addition to angling (e.g., watersports, hiking, camping), and the close proximity of popular fishing locations to established residences along the Chilliwack River, create opportunities for potential conflicts between users;
- The existence of a subset of anglers who demonstrate a lack of respect for the watershed, other users of the watershed, and the fisheries resource and who generate conflict with other users and violate sport fishing regulations (see: CRWS Sport Angling Behaviour Issues and Alternatives Document).

### 4.0 Overall Level of Community Concern

In the Chilliwack River Watershed, the negative impacts (e.g., garbage, parking, and crowding issues) of the large numbers of anglers that fish in the watershed each year are a major concern for residents and other users of the watershed. However, potential impacts of hatchery fish on the genetics and survival of wild fish are not well understood by the general public and are therefore not often cited as a major concern. It is unlikely that

many anglers are concerned about the influence of the Chilliwack River Hatchery because fish production generally has a positive benefit for anglers.

## 5.0 Legislation, Policy, Guidelines, Strategies, and Processes

### 5.1 Legislation and Regulations

- **Federal Fisheries Act (R.S., 1985, c. F-14 )** outlines how DFO will fulfill their mandate under Section 91 (12) of the Constitution for “inland and sea coast fisheries” including the conservation of salmon and the regulation of salmon fishing. Section 57 of the *Fisheries Act* is particularly relevant to hatchery operations as it states that “the Minister can authorize any river or other water to be set apart for the natural or artificial propagation of fish.”
- **Federal Fisheries Act (R.S., 1985, c. F-14 ) - Fishery (General) Regulations, 1993 (SOR/93-53)** gives the Minister the authority to make conditions of license.
- **Federal Fisheries Act (R.S., 1985, c. F-14 ) - British Columbia Sport Fishing Regulations, 1996 (SOR/96-137)** sets provisions for sport fishing for salmon and other fin fish in tidal and non-tidal waters of BC.
- **BC Fisheries Act [RSBC 1996] Chapter 149** sets provisions for sport fishing for salmon and other fin fish in tidal and non-tidal waters of BC.
- **BC Wildlife Act [RSBC 1996] Chapter 488**, section 12 makes it an offence for a person to angle in non-tidal waters in BC unless “the person is the holder of an angling license or any other license or permit that is required by regulation, is an Indian residing in British Columbia, or is exempt by regulation.” Section 49 (1) of the Act also makes it an offence if a person “acts as a guide for fish, or offers to act as a guide for fish, unless the person holds an angling guide license, or holds an assistant angling guide license.” Section 53 of the Act enables the Lieutenant Governor in Council, by regulation, to place restrictions on guiding for fish and angling.

### 5.2 Policies

- **Canada’s Policy for the Conservation of Wild Pacific Salmon, 2005 (i.e., “Wild Salmon Policy”)** was created with the goal of restoring and maintaining healthy and diverse salmon populations and their habitats for the benefit and enjoyment of the people of Canada in perpetuity. The policy stresses that measures for habitat protection and salmon enhancement should focus on sustaining wild salmon. As defined in this policy, wild salmon do not include hatchery produced fish. However, the policy does support hatcheries and spawning channels that are part of strategic plans as a means of addressing social and biological objectives (e.g., rebuilding fish populations with an unacceptable chance of extirpation by providing harvest opportunities and fishery benefits).

### 5.3 Guidelines

- **Genetic Guidelines for Broodstock Spawning** discusses protocols for maintaining and increasing genetic variability and integrity. There are specific protocols for dealing with limited numbers of broodstock.
- **Salmon Carcass Disposal Guidelines** outlines protocols regarding the distribution of carcasses originating from hatcheries.

### 5.4 Strategies, Committees, and Processes

- **Fish Health Management Planning** incorporates many of the policy issues related to effective disease management and control.
- **Fisheries Management Strategies** are created to reduce the interception of wild salmon. These strategies include time, area, species, size and quota restrictions and selective fisheries strategies such as mass marking of hatchery salmon.
- **Integrated Fishery Management Planning Teams (IFMP)** are comprised of First Nations and stakeholders such as commercial and sport fish groups. These teams discuss salmon allocations and fish hatchery production activities.
- **Introductions and Transplant Committees** oversee salmon introductions and transplants within and between watersheds. Approvals are based on potential genetic and disease issues as well as wild vs. enhanced fish compatibility issues. They are guided by existing Fisheries & Oceans Canada policies and directives.
- **Local Area Enhancement Planning Teams** are groups of fishery personnel directly involved with hatchery operations and production who finalize egg production targets.
- **Sport Fish Advisory Board (SFAB)** is comprised of stakeholders who primarily represent recreational interests. SFAB is represented on the IFMP planning teams.
- **Sport Fish Working Groups** engage fisheries personnel from various disciplines in dialogue regarding recreational fishing opportunities and policy. Representatives from this group meet regularly with the Sport Fish Advisory Board.
- **Stock Assessment and Monitoring Surveys** of the abundance and distribution of hatchery adult salmon have historically been done through hatchery crews in conjunction with the Stock Assessment and Enhancement Assessment and Support Unit.

## **6.0 Vision & Goals**

### **6.1 VISION**

Wild salmon stocks within the Chilliwack River Watershed are sustained at healthy levels over the long term, sport angling on the river is a positive experience for all, and the integrity of the watershed and human infrastructure is maintained for years to come.

### **6.2 GOALS**

- To prevent any potential negative biological impacts of hatchery production on wild salmon stocks and other species within the watershed
- To better understand the impacts of hatchery production/management on (a) the angling experience and numbers, (b) the watershed health, and (c) other residents, users, and stakeholders within the watershed
- To better understand and determine the carrying capacity of the watershed for fish populations and for angling activities along the river
- To balance the need to produce hatchery fish for the purposes of satisfying angler demand and maintaining salmon population levels with the need of minimizing negative impacts to the watershed and other users/residents from large numbers of anglers attracted by high numbers of hatchery fish
- To ensure that annual hatchery production targets and management practices are generated through a collaborative process between fisheries management staff, First Nations, and all community stakeholders.

### **6.3 MEASURES**

- Levels of hatchery production
- Survival of hatchery and wild salmon
- Status of wild stocks
- Amount and condition of fish habitat
- Level of angling effort and satisfaction
- Level of participation of community groups and stakeholders in decision-making.

## 7.0 Issue Analysis

The issues related to hatchery production and fisheries management are among the most complex in the Chilliwack River Watershed. Unfortunately, due to the complexity of this issue, an in depth analysis of all aspects of the issue was beyond the scope of the issues and alternatives phase of the watershed strategy. Rather, this analysis will focus on perhaps the most important biological aspect of this issue: the potential impact of hatchery fish on wild fish populations through predation, competition, genetic alterations, and the introduction of disease.

Several axioms or principles regarding hatcheries and the role of stock enhancement as a fisheries management tool were recently summarized by Molony et al (2004). These axioms included:

- “Stocked fish will interact with other components of the ecosystem. That is, releasing stocked fish will have an effect on the ecosystem, whether stock enhancement is successful or not, and some of these impacts may be irreversible;
- “Stock enhancement is complex and includes risks;
- “Stock enhancement must be empirically evaluated and monitored to allow for continual modification and improvement of a project, or the cancellation of a project;
- “Stock enhancement programs require regular review and refinement, and may cease to be applicable if or when the management objectives for a stock or ecosystem are met.” (p418)

The paper continues:

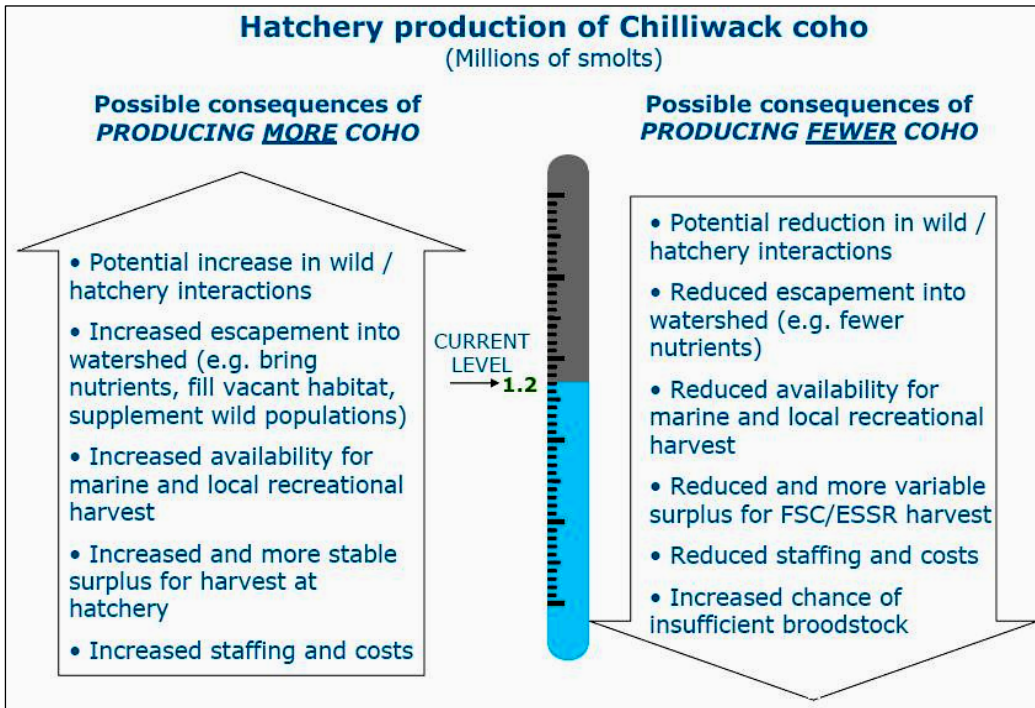
“It should be noted that, if effective, stock enhancement programs should not be considered as an ongoing management strategy. That is, as the variables that caused the decline in stock have been mitigated or removed, and the stock or species has recovered to target levels, there should be no need to supplement natural production by releases of hatchery-produced stock. Often, however, there will be ongoing pressure to grow and release fish, especially if the stock enhancement project meets its objectives... In hatcheries developed to enhance recreational fisheries, a risk exists in continuing production and stocking, with the effect that a fishery of this type will either be expensive to manage (i.e., the unnecessary costs of producing and releasing fishes) or be converted to a put-and-take fishery.” (p424-5)

The risk to wild fish from hatchery operations depends on the scale of production (e.g., the number of enhanced fish released relative to wild juvenile production and habitat capacity) and the species of wild salmon involved (e.g., chinook, coho, and steelhead have the highest potential for causing competition, predation, genetic, and fish health interactions on wild fish).<sup>6</sup> The possible consequences associated with producing more

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<sup>6</sup> Gardner et al. 2004

coho at the Chilliwack River Hatchery, and with producing fewer coho at the hatchery, are summarized in Figure 1.



**Figure 1.** Consequences of changing production levels at the Chilliwack River Hatchery (from Pestal, 2005).

Reducing the risk to wild salmon may therefore involve altering the scale of production or the mix of species released from hatcheries. It is also possible to reduce risk through various hatchery management strategies. For example, integrated hatcheries strive to minimize the differences between enhanced fish and wild fish, which in turn reduces the risk of genetic impacts. Operational practices also reduce risk: the timing of releases from the hatchery, the size of the fish when released, and the conditions in the hatchery reduce risk associated with overharvesting of wild fish, competition/predation, and fish health impacts.<sup>7</sup>

At the Chilliwack River Hatchery, fish culture practices are aimed to produce high quality smolts in order to maximize survival and minimize unit cost.<sup>8</sup> In addition, records of the distribution and numbers of hatchery salmon entering the Chilliwack Watershed are kept annually through stream surveys, hatchery trap collection, salmon carcass recovery, and creel programs conducted by Hatchery staff and stock assessment crews. When complimented with data regarding the health of wild stocks, this data could be used to help determine the actual impacts of hatchery production on wild salmon populations in the Chilliwack River Watershed.

<sup>7</sup> Gardner et al. 2004

<sup>8</sup> Stanton, R. pers. comm. December 11, 2007.

There is unlikely to be any disagreement amongst stakeholders regarding the value of wild salmon to the Chilliwack River Watershed. Therefore, it is important that managers and stakeholders continue to find ways to minimize negative impacts and promote positive impacts of hatchery and fisheries management on wild salmon. Numerous avenues currently exist for this to occur. Fisheries & Oceans Canada periodically conducts internal program reviews to assess hatchery programs, making recommendations to improve efficiency in financial, biological, and cultural aspects of production. Open public forums and exclusive stakeholder forums have been held throughout B.C. to inform and receive input from local communities regarding Wild Salmon Policy development and hatchery program operations. New best management practices and operational guidelines have been developed in response to these program reviews, consultations, and evaluations. In addition, a new Risk Assessment Tool for hatchery coho production in the Chilliwack River Watershed is under development<sup>9</sup>. This tool is designed to analyze and assess detailed hatchery operations process in the context of Wild Salmon Policy objectives.

More dialogue and analysis is needed regarding hatchery production levels and operational practices, and fisheries management in general, in the Chilliwack River Watershed. The new Risk Assessment Tool may provide a good starting point for further discussion and analysis.

## **8.0 Recommendations**

1. Engage First Nations, stakeholders, and the local community in dialogue and decision-making regarding hatchery production levels and ways to mitigate negative impacts of high hatchery production levels & angling effort on wild salmon populations, angling success and experience, other users and residents, local infrastructure, and other wildlife species.
2. Evaluate and adjust hatchery production levels and rearing and release strategies according to continued annual monitoring and stock assessment of both wild and hatchery populations to determine if stock enhancement is successful or not and if it is helping to meet the program objectives (i.e., ‘adaptive management’).
3. Investigate the interrelationship between hatchery production levels, escapement levels of both wild and hatchery fish, angling effort and success, and impacts to the watershed and its native species (e.g., salmonids and non-salmonids).
4. Continue to strengthen wild salmon populations by restoring freshwater habitat (e.g., improving access to existing habitat or creating new habitat) (see: CRWS Habitat Restoration & Enhancement Issues & Alternatives Report).

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<sup>9</sup> Pestal, 2005

## 9.0 References

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