



November 7, 2006

## **CHEAKAMUS RIVER STEELHEAD FISH CULTURE PROGRAM November 2006 Update**

In April, 2006 the Freshwater Fisheries Society of BC (FFSBC) was directed by the Ministry of Environment (MoE) to lead fish culture efforts to supplement the wild stocks of Cheakamus River steelhead following the spill of sodium hydroxide (NaOH) into the river from a CN train derailment.

The objective of the CN funded steelhead program is to release 20,000 smolts annually for the next two years to supplement the wild adult returns in 2009 and 2010. The fish will not be subject to harvest but allowed to spawn. The steelhead culture program is will be closely monitored to try and determine effectiveness, and the Ministry of Environment will be monitoring the recovery to completion.

### **Broodstock Capture**

In order to deliver the various components of the hatchery program including adult capture, adult holding, spawning, incubation and smolt rearing, FFSBC staff have been working closely with Fisheries and Oceans (DFO) hatchery staff from Tenderfoot Creek hatchery. Tenderfoot hatchery staff coordinated the capture of 20 adults (10 females and 10 males) which were transported to Fraser Valley Trout hatchery following short term holding at Tenderfoot. Scale samples for aging and tissue samples for genetics were taken from each fish.

All 20 of the adults were spawned on May 18 – June 1 (1:1 matings), producing 10 families. The fry were moved to troughs on June 24-July 6, and the 16 surviving adults (4 perished) were returned to the river following spawning.

### **Tenderfoot and Fraser Valley Hatcheries Chosen as Holding Facilities**

In early November the fry will be split between 2 facilities for the remainder of their holding period. The main reason to split the fish is to avoid the chance of a facility failure (e.g. pipe break) eliminating all the fish. Following discussions between FFSBC, DFO and the Cheakamus

Ecosystem Restoration Technical Committee, the decision was made to split the fish evenly between Tenderfoot Creek Hatchery and the Fraser Valley Trout Hatchery. In evaluating the potential facilities, consideration was given to water sources and temperatures, holding space and pond quality, imprinting issues, and escape risk. The group to be held at the Fraser Valley Hatchery will be moved into the watershed for an imprinting period prior to release.

### **Smolt Release Target**

The smolt release number was recommended by Dr. M. Labelle in a report prepared for the Ministry of Environment following his review of recovery strategies and preferences of the residents in the watershed. To put the number into context, estimates of the natural production of smolts from the river range from 6,000- 12,000, considerably less than the 20,000 hatchery smolt release number.

The release of 20,000 smolts is expected to result in substantial returns of hatchery fish to the river, which even after residualism, commercial by-catch, and lower marine survival rates of hatchery fish are factored in, should provide sufficient numbers to seed the river. The release target was determined after careful consideration of a number of uncertainties regarding supplementation, combined with the intrinsic uncertainty and variation in external environmental factors, and therefore, the number is an attempt to balance the preferences of people in the watershed with concerns for the surviving wild fish. Some examples of the uncertainties include;

- i) wild steelhead ocean survival ranges from 2.2% - 14% (Keogh River data 1995 to present),
- ii) hatchery fish ocean survival can range from 25% - 65% of the survival rate of wild fish, and
- iii) the specific ocean survival rate for Cheakamus River steelhead is estimated to be from 1x to 3x that measured at the Keogh River.

Applying this range of factors indicates expected hatchery adult returns could theoretically range from 110 – 5,000+ fish.

It is estimated that only a few hundred fish are required to seed the Cheakamus River, and there is an anticipated return of 50-150+ wild fish in the spill impact years 2009-10.

Overwhelming wild spawners and reducing their spawning/rearing success is counter to the goals of recovery, which are to try and speed up natural recovery by adding some additional spawners. Standard operating procedures, and recommendations of several scientific hatchery reviews, recommend the number of hatchery origin spawners in a river should not exceed the number of wild spawners. One reason is that replacing wild fish with hatchery fish, or having a high number of hatchery returns relative to wild returns, decreases the overall genetic diversity, therefore, the population's genetic variation would likely be lower than expected if no hatchery production took place. There are also concerns with breeding success of hatchery fish (e.g. habitat selection) and effects on wild fish productivity.

### **Program Mating Structure**

Paired mating is the standard in fish culture programs (i.e. 1 female mated with 1 male), and was deemed to be the most appropriate for this program. It maximizes genetic effective population

size, or the number of individuals contributing to the next generation, when done in combination with equalization of family sizes. This is important particularly where limited broodstock numbers are involved (<40 for example) to optimize genetic diversity and minimize inbreeding over time.

The alternative considered was matrix spawning, or a similar protocol where eggs and milt are divided such that each of the males fertilize some of the eggs from each female. This protocol is more commonly used where the broodstock taken represents a large portion of the remaining spawners, as it increases likelihood that all gametes contribute to the next generation. It also creates half-sibling families which increases the likelihood that closely related individuals will mate with each other in the next generation.

The ten families (from the 10 couples) are equalized at several stages during development (eyed egg, ponding or moving out of egg tray, and prior to the move to the grow-out site; see July monthly update), to ensure that all ten families are equally represented in the final release of 20,000 smolts. Family survival in a hatchery can vary by a factor of two.

### **Program Quality**

One of the program goals is to produce the best 20,000 smolts possible. This will reduce potential impacts to wild fish, and maximize adult returns to the river. Factors contributing to smolt quality include mating structure and family equalization, removing unfit fish (those most likely to residualize or not migrate to the ocean), and conservative assumptions of factors such as fecundity and in-hatchery survival when collecting broodstock. The by-product of producing the best possible 20,000 smolts is excess fry. Some fry will be retained until smolt release in the spring, to be used as spares in the unlikely event of higher than expected mortality. The ministry is considering the option of stocking the remainder into one or several lakes, (Cat Lake, Loggers Lake or Mill Lake) where they will not impact wild fish, but will contribute to a local fishery.

Recent surveys of the Cheakamus River found that fry abundance, following the 2006 adult returns is extremely high. Fry habitat is currently saturated so no gains would be expected by stocking the excess fry into the river. The addition of excess hatchery reared fry to the river even may be counter to the goals of recovery as the stocked fry would compete with surviving wild fish of several species. In addition, the adult returns from past fry stocking programs have been extremely low, so the potential gains of adult returns from fry stocking must be compared to possible impacts on surviving fish. Low adult returns from fry stocking is why steelhead hatchery programs currently consist of the more expensive smolt rearing and stocking.

Regular updates will continue to be provided to the Cheakamus Recovery committees, and the public.

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