A recovery hatchery program concept for Puget Sound Rivers.

Recent research has shown that hatchery reared steelhead from native wild brood stock loose productivity faster than other salmon species. The leading theory behind this loss is the fact that they are raised in the hatchery for only one year even though wild fry spend one to three years in their natal river before smolting and going to sea. When released at one year of age, it appears that about 10 to 15% are of smolting size and immigrate while most of the other hatchery fry will residualize and stay in the river. Many die during the first winter while a few may mature and become spawners. Other species of salmon are reared for the necessary time to match their normal riverine cycles. Raising steelhead fry for two years will more closely mimic their riverine life history cycle and approximately 90 percent should reach smolting size during that time.

It has been conclusively shown in recent research programs that both segregated and integrated hatcheries have productivity, genetic, ecological and mixed stock fishery impacts that are harmful to wild stocks in a one year program, and this prevents their use for recovery. There is now enough research available to tell us that the present steelhead hatcheries have, and will continue to impact wild steelhead and that Conservation Hatcheries must develop ways to alleviate those problems. The research in progress by NOAA under Barry Berejikian and sponsored by Long Live the Kings is finding ways to correctly operate hatcheries through a two year growing cycle to eliminate or greatly reduce hatchery impacts. This new hatchery concept may prove a powerful tool for recovering wild steelhead in depleted rivers. In rivers where the habitat has been badly damaged, conservation hatcheries can preserve stock genetics until the habitat is repaired.

It is important that all foreign (hatchery reared or introduced) steelhead be eliminated from a river or tributary system that is considered for a recovery program. Otherwise there is limited chance of recovery of a specific wild stock, or maintaining stock genetics and diversity until the habitat is recovered. Phelps ET. al. (1997) found moderate to high introgression rates in many of the Puget Sound rivers indicating that hatchery and wild stocks are mating and producing young. The literature has shown that productivity drops to about 2% to 37 % of normal (a comparison to wild stocks in the same river) after 5 to 10 generations in segregated hatchery plantings; and to about 70% following one generation and 35% in the second generation in wild brood stock plantings.

Hatchery fry that don't go to sea and fry from spawning adult hatchery fish compete with wild fry occupy some of the carrying capacity of the river and reduce the production of wild fish. Mal adapted hatchery fry also residualize and the males may spawn with wild females.

Temporal mixed stock fisheries (in this case December and January) created by increased fishing effort on hatchery stocks during these early months historically took far too many early run wild fish, depleting the early run and greatly decreasing the total wild runs. Early catch data show this early component historically contributed about 50% of the abundance of the total winter run on most rivers; this early segment will continue to be impacted and not recover until intensive mixed stock early fisheries are eliminated.

Two conservation hatcheries in Puget Sound, one in south or mid-Sound area (such as the Green River) and one in North Sound (possibly the North Fork of the Stillaguamish) are suggested to research the

possibility of using this type of conservation hatchery program for recovery for other depleted/ESA listed rivers. It may also be feasible to operate this type of hatchery on one or more rivers in the future for supplementation programs; but this should not be attempted until more research is completed.

A Conceptual Conservation/Recovery Hatchery for Wild Steelhead (much of this plan was designed after reading appropriate literature and a discussion with Barry Berejikian). This is a draft and open for discussion and scientific changes as appropriate.

1. All foreign stocks should be removed from the river to assure building a stock of genetically native fish.
2. Wild stocks only (PNOB + 1.0) should be carefully selected from the wild run. Each fish selected should be genetically screened via Microsite Analysis/ PCR testing to assure (as close as possible) the fish is from the original native stock.
3. Once the foreign stocks are removed from the river, the program could consider pumping eggs to obtain full genetic diversity which would include gene flow from indigenous rainbow trout.
4. Eggs and fry should be reared for two years to mimic wild diversity traits (in general the 3 year riverine diversity). Generally only 10% of the fry go to sea the first year, 80% the second and so on (including fish that naturally residualize and become rainbow trout) and the hatchery should be designed to mimic this diversity.
5. The program should consider size sorting or physiologically testing the larger fry for possible release the first year if this is scientifically and financially possible.
6. Water temperatures and feeding regimes/amounts should be planned to assure fry/smolts reach (and do not over grow) normal background river fry sizes and weights at normal out-migrating times.
7. All released fry/smolts should be marked to allow monitoring of the results.
8. Monitoring should include abundance, diversity, distribution and in-river spawning productivity. They should also include studies of the movements of the smolts after release.
9. A planning team consisting of scientists, WDFW policy and hatchery managers, and others should be established to plan and monitor the progress of the hatchery. For scientists I would suggest including Barry Berejikian from NOAA as a primary advisor.