Hatchery Scientific Review Group
Pacific Salmon Hatchery Reform

To: The Columbia River Hatchery Reform Steering Committee
From: The Hatchery Scientific Review Group
Subject: Preview of Key Findings for Lower Columbia River Coho Hatchery Programs
Date: January 14, 2008

The Congressionally-established Hatchery Scientific Review Group (HSRG) has provided a foundation for hatchery reform principles that should aid salmon hatcheries in the Pacific Northwest in meeting conservation and sustainable harvest goals in the 21st century. The HSRG process has established principles based on goal setting, scientific defensibility, and adaptive management of hatchery programs. Tools to determine outcomes of proposed actions were developed and include a scientific framework for artificial propagation of salmon and steelhead, a benefit/risk assessment tool, hatchery operational guidelines, and monitoring and evaluation criteria.

The HSRG completed its review of coho hatchery programs recently within the Lower Columbia River ESU. The purpose of this memo is to preview some of the key findings and recommendations for coho populations in this region. More detailed results of the review will be provided in forthcoming technical reports, as will the results of similar analyses conducted on other Columbia River species and ESUs.

The foundation of the HSRG's evaluation is that conservation goals need to be met for key natural populations while at the same time continuing to contribute to harvest goals. In order for hatchery actions to effectively address conservation goals, harvest reforms are also necessary.

The main purpose of most coho hatchery programs within the Lower Columbia River ESU is to provide harvest; however, most of these programs are now inconsistent with stated conservation objectives. The HSRG and others have concluded that a major concern with these programs currently is the effect hatchery strays have on the long-term fitness and viability of naturally spawning populations. Currently in the lower Columbia, hatchery fish substantially outnumber natural coho on the spawning grounds for most populations. The percentage of fish effectively spawning in the wild that are hatchery fish (pHOS) exceeds 50% for many populations.

Coho hatchery production provides important harvest for ocean and lower Columbia River fisheries. However, due to the need to protect less productive natural populations, not all hatchery fish available are harvested. Therefore, the Lower Columbia ESU also is characterized by large hatchery surpluses.

Figure 1 compares the proportion of fish on the spawning grounds that are of hatchery origin (pHOS) to the proportional natural influence (PNI) index for current and proposed (HSRG) scenarios. Of the ten coho populations designated as Primary in the lower Columbia, seven have hatchery programs within their respective watersheds. These naturally spawning populations have a high proportion of hatchery fish on the spawning grounds (pHOS ranges from 13% to 63%) but very low proportions of natural fish in the hatchery broodstock (pNOB <10%). The remaining

three Primary populations, all have pHOS values less than 5% (the HSRG maximum standard for a Primary, non-integrated population). Under the HSRG solution, four populations would be associated with integrated hatchery programs with a PNI greater than 0.67 (HSRG minimum standard for Primary integrated populations). Also under the proposed HSRG solution, five naturally spawning populations would have pHOS less than 5%. The HSRG has concluded that the potential adverse impacts to these naturally spawning coho populations are reduced substantially by maintaining PNI values greater than 0.67 or pHOS values less than 5%.

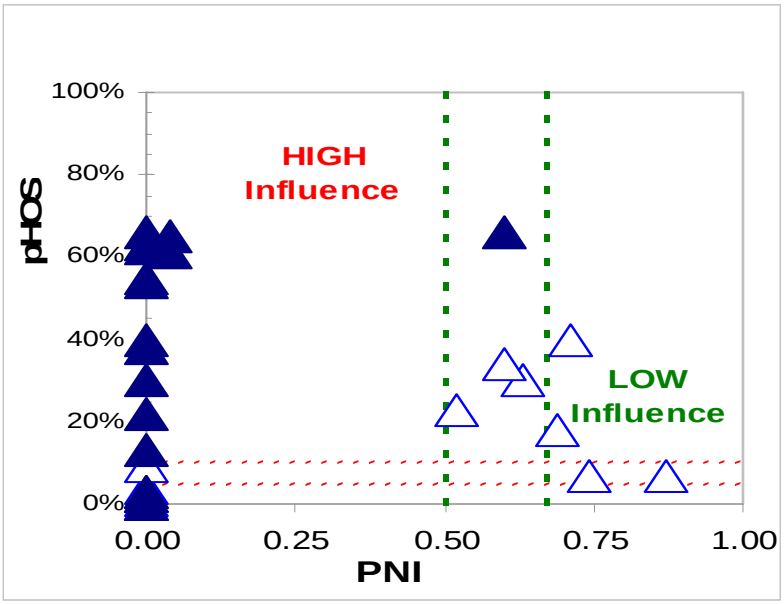

Figure 1. Relationship of the proportion of fish on the spawning grounds that are of hatchery origin (pHOS) and the proportionate natural influence index (PNI) for Primary coho populations in the lower Columbia River. All populations designated either as Primary or Contributing by the managers are shown. (Solid triangles represent values for current programs and open ones represent values for the HSRG solution.)

The key to controlling genetic and ecological risks due to straying and the resulting fitness loss is to manage hatchery broodstock and the natural spawning escapement such that the natural habitat (and not the hatchery environment) drives the adaptation and productivity of the naturally spawning population. This is achieved by operating either (a) well-integrated programs where the proportion of hatchery-origin fish in the natural escapement is less than the proportion of natural-origin fish in the hatchery broodstock; or (b) well-segregated programs where the contribution of hatchery fish to natural spawning is kept very low.

The Lower Columbia Recovery Plan designates natural populations as Primary, Contributing or Stabilizing, depending upon their importance to the recovery of the ESU.

For designated **Primary populations**, hatchery programs were modified to meet a set of genetic broodstock management goals for either segregated or integrated hatchery populations. This requires either:

- For segregated populations, controlling the proportion of hatchery-origin fish on the spawning grounds to less than 5% of the total spawning escapement (pHOS is less than 0.05); or

- For integrated populations, ensuring that the proportion of natural-origin broodstock used in the hatchery program exceeds the proportion of hatchery-origin fish spawning naturally by a ratio of 2:1 (i.e. PNI is greater than 0.67).

For **Contributing populations**, broodstock management goals are either:

- Controlling the proportion of hatchery-origin fish on the spawning grounds to less than 10% of the total spawning population (pHOS is less than 0.1); or
- Ensuring that the proportion of natural-origin broodstock used in the hatchery is greater than the proportion of hatchery-origin fish spawning naturally (PNI is greater than 0.5).

For **Stabilizing populations**, the current operating condition was considered adequate to meet their conservation goals.

In order to achieve stock conservation goals while maintaining harvest benefits, it is necessary to make a number of critical strategic changes to current harvest and hatchery programs. Some of the population designations in the Lower Columbia ESU appear to be inconsistent with available habitat information. In these cases, the HSRG has offered alternative designations for consideration, consistent with current the habitat evaluations. Some populations were upgraded and some downgraded (see Table 1).

Table 1. Population designations from the Lower Columbia Recovery Plan and HRSG broodstock standards met for each population under the current scenario and the HSRG solution.

		HSRG standards met	
Population	**Designations**	**Current**	**HSRG**
Willamette_Upper Clackamas Coho	**Primary**	**Primary**	**Primary**
Lewis_EF Lewis Coho	**Primary**	**Primary**	**Primary**
Cowlitz_Coweeman Coho (Type N)	**Primary**	**Primary**	**Primary**
Sandy Coho	**Primary**	**Contributing**	**Primary**
Columbia Estuary_Big Creek Coho	**Primary**	Stabilizing	Stabilizing
Columbia Estuary_Scappoose Coho	**Primary**	Stabilizing	Stabilizing
Cowlitz_Lower Cowlitz Coho (Type N)	**Primary**	Stabilizing	**Contributing**
Cowlitz_Toutle Coho (Early-Type S Natural)	**Primary**	Stabilizing	**Primary**
Grays Coho (Late-Type N)	**Primary**	Stabilizing	**Primary**
Elochoman Coho (Late- Type N)	**Primary**	Stabilizing	**Primary**
Columbia Estuary_Mill-Aber-Germ Coho (Type I	**Contributing**	Stabilizing	**Primary**
White Salmon Coho (Early- Type S)	**Contributing**	Stabilizing	**Contributing**
Hood Coho	**Contributing**	Stabilizing	Stabilizing
Kalama Coho (Natural)	**Contributing**	Stabilizing	Stabilizing
Lewis_NF Lewis Coho (Late-Type N)	**Contributing**	Stabilizing	**Contributing**
Washougal Coho	**Contributing**	Stabilizing	**Contributing**
Cowlitz Upper Cowlitz Coho	**Contributing**	Stabilizing	**Primary**
Willamette_Lower Willamette Tribs Coho	Stabilizing	Stabilizing	Stabilizing
Columbia Estuary_Youngs Bay Tribs Coho	Stabilizing	Stabilizing	Stabilizing
Columbia Estuary_Clatskanie Coho (Late-Type	Stabilizing	Stabilizing	Stabilizing
Willamett_Upper Willamette Tribs coho	Stabilizing	Stabilizing	Stabilizing
Fifteenmile Creek Coho	Stabilizing	Stabilizing	Stabilizing
Willamette_Lower Clackamas Coho	Stabilizing	Stabilizing	Stabilizing
Columbia Estuary_Chinook River Coho	Stabilizing	Stabilizing	Stabilizing
Columbia Estuary_Gnat Creek Coho	Stabilizing	Stabilizing	Stabilizing
Columbia Estuary_Klaskanine River Coho	Stabilizing	Stabilizing	Stabilizing
Klickitat Coho	Stabilizing	Stabilizing	Stabilizing
Lewis_NF Lewis Coho (Early-Type S)	Stabilizing	Stabilizing	Stabilizing

Estimates of PNI and pHOS under current conditions (for hatchery operations and harvest regimes) reveal that only three of the ten Primary and one of the six Contributing coho populations in the Lower Columbia ESU currently meet the broodstock goals described above. Therefore, current hatchery and harvest programs are not compatible with conservation needs for these populations. The HSRG was able to design solutions where the conservation standards are met for twelve of the seventeen designated Primary or Contributing populations, while retaining most harvest benefits. Also under the HSRG solution, two designated Contributing populations met the standards for a Primary population.

Figure 2 compares spawner abundance and productivity relationships between current and HSRG-proposed scenarios for the ten Primary coho populations in the lower Columbia River. In all cases, population productivity and spawner abundance showed an increase under the HSRG proposed solution.

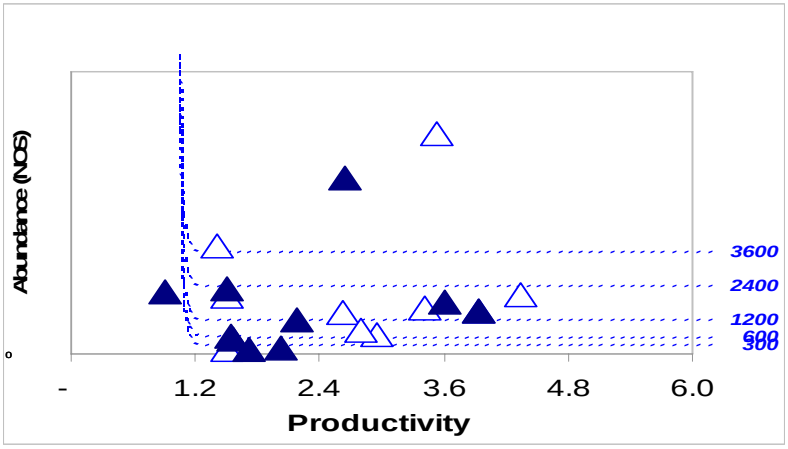

Figure 2. Productivity and spawner abundance for ten designated Primary coho populations under current habitat conditions in the Lower Columbia River ESU. (Solid triangles represent existing productivity and spawner abundance levels. Open triangles represent the HSRG solution.)

Figure 3 describes current as well as estimated changes in harvest (marine, mainstem Columbia River and terminal harvest areas) that would occur following implementation of the management solution proposed by the HSRG.

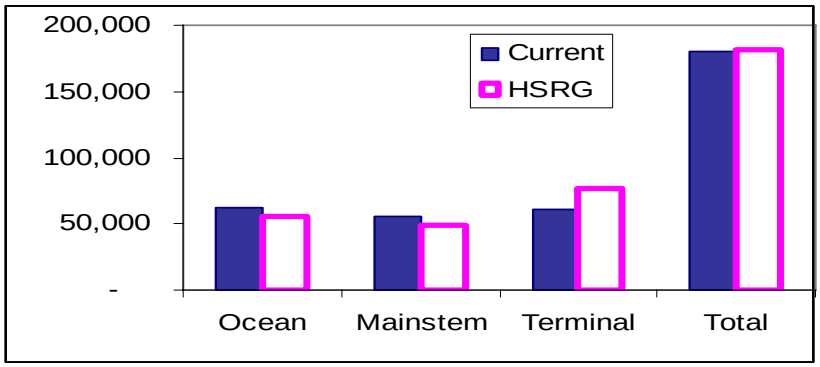

Figure 3. Estimated marine, mainstem Columbia River and terminal coho harvest under current and HSRG-proposed hatchery management solution.

Conclusions

The HSRG concluded that, in order to achieve the managers' stated conservation and harvest goals, they should implement the following reforms:

1. Implement effective integrated or segregated hatchery broodstock management practices to achieve HSRG broodstock standards by including appropriate numbers of natural-origin fish in hatchery broodstock and/or limiting the number of hatchery-origin fish spawning naturally. To this end, the following are recommended:
   - Increase differential harvest of hatchery fish through the use of in-river selective gear and weirs. This includes developing additional harvest methods and gear that enable selective removal of hatchery fish with low mortality of natural fish.
   - Spatially and temporally separate fisheries to target harvest on hatchery fish.
   - Rear and release fish in ways that improve homing to the hatchery.
   - Increase the use of selective harvest in ocean fisheries.
   - Modify infrastructure so that facilities are capable of meeting natural and hatchery broodstock management goals.
   - Mark all hatchery fish. Population goals can be accomplished only if hatchery fish can be reliably distinguished from natural-origin fish.
   - Operate broodstock management weirs in four watersheds: a 20% effective one in the Toutle and 90% effective ones in the Elochoman and Grays Rivers, and Abernathy Creek.
   - Reduce the size of on-station releases from programs that result in large surpluses of returning adults and stray rates that substantially exceed HSRG guidelines.
2. Assure that ecological impacts of hatchery structures and operations are minimized and at least meet all regulatory requirements (i.e. water withdrawal and discharge, fish passage and screening).

The HSRG also concluded that hatchery reforms alone will not achieve recovery of listed populations. Habitat improvements and harvest reforms are also necessary. It is also clear that the effectiveness of habitat actions will be greatly increased if they are combined with hatchery and harvest reforms. For example, a 15% increase in natural spawner abundance resulting from habitat improvements alone would translate into a more than 40% increase if combined with hatchery and harvest reforms (even with a 10% increase in harvest). **The benefits of habitat quality improvements will more than double if combined with hatchery and harvest reforms. Unless hatchery and harvest reforms are implemented, the potential benefits of current or improved habitat cannot be fully realized. The HSRG has concluded that a holistic strategy that combines reforms and improvements in all three "H's" will be necessary to meet the managers' conservation and harvest goals for coho salmon in the lower Columbia River.**