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 Hatchery Programs
Date: July 18, 2007

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 for goal setting, scientific defensibility, and adaptive management of hatchery programs. Tools to determine outcomes of proposed actions have been 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 has completed its review of Chinook hatchery programs in the lower Columbia River. The purpose of this memo is to preview some of the key findings and recommendations for Chinook 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 maximizing harvest. In order for hatchery actions to effectively address conservation goals, harvest reforms are also necessary.

The original purpose of most Chinook hatchery programs in the lower Columbia River is to increase 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 is the effect hatchery strays have on the long-term fitness of naturally spawning populations. Currently in the lower Columbia, hatchery fish dominate natural Chinook escapement. The percentage of fish effectively spawning in the wild that are hatchery fish (pHOS) exceeds 50% for most populations.

Figure 1 illustrates the proportion of fish on the spawning grounds that are of hatchery origin (pHOS) to the proportionate natural influence index (PNI) for current and proposed (HSRG) scenarios. Of the nine primary Chinook populations in the lower Columbia, six have hatchery programs designated as integrated associated with them. Most of these populations are characterized by high proportions of hatchery fish on the spawning grounds (pHOS) and low proportions of natural fish in the hatchery broodstock (pNOB). Potential adverse impacts to Chinook populations are reduced by maintaining PNI values greater than 0.67 or pHOS values less than 0.05.

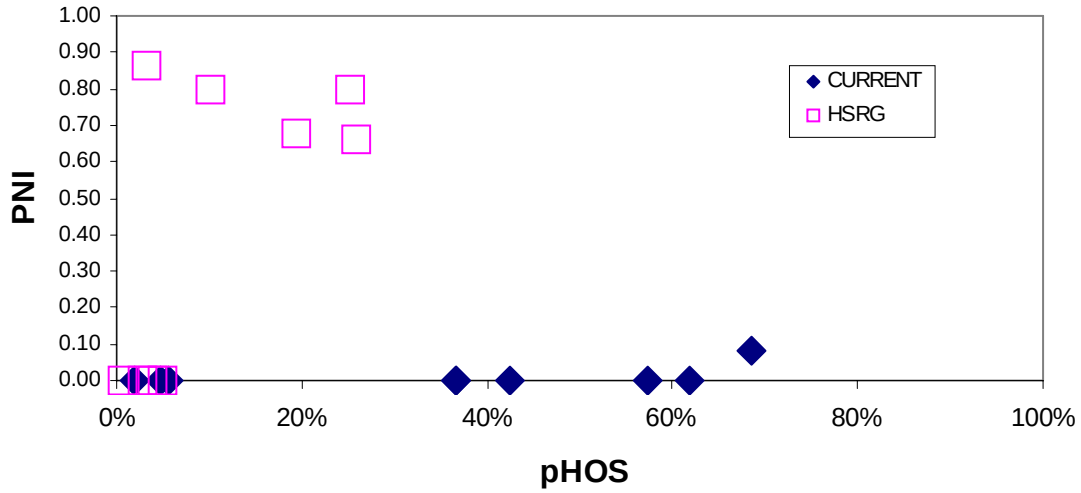

Figure 1. Relationship of the proportion of fish on the spawning grounds that are of hatchery origin (pHOS) and the proportionate natural influence index (PNI) for primary Chinook populations in the lower Columbia River.
Note: Solid diamonds represent values for current programs and open squares represent values for the HSRG scenarios.

The key to controlling 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 populations as primary, contributing or stabilizing, depending upon their importance to the recovery of the ESU.

For **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 (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 (PNI is greater than 0.67).

For **contributing populations**, broodstock management goals are somewhat less restrictive. Options for these populations 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 maintain harvest benefits while achieving stock conservation goals, 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 are inconsistent with available habitat information. The HSRG agrees with most population designations in the plan, but in some cases, these designations appeared inconsistent with the population potential and the HSRG has offered alternative designations. Some populations were upgraded and some downgraded.

Estimates of PNI and pHOS under current conditions (for hatchery operations and harvest regimes) reveal that no primary or contributing Chinook populations in the lower Columbia currently meet the broodstock goals described above. Therefore, current hatchery and harvest programs are not compatible with conservation needs for these populations. However, the HSRG was able to design scenarios where the conservation standards are met while maintaining or increasing harvest benefits.

Figure 2 describes spawner abundance and productivity relationships for current as well as HSRG-proposed scenarios for the nine primary Chinook populations in the lower Columbia River. In all cases, population productivity and spawner abundance showed an increase under the HSRG scenarios.

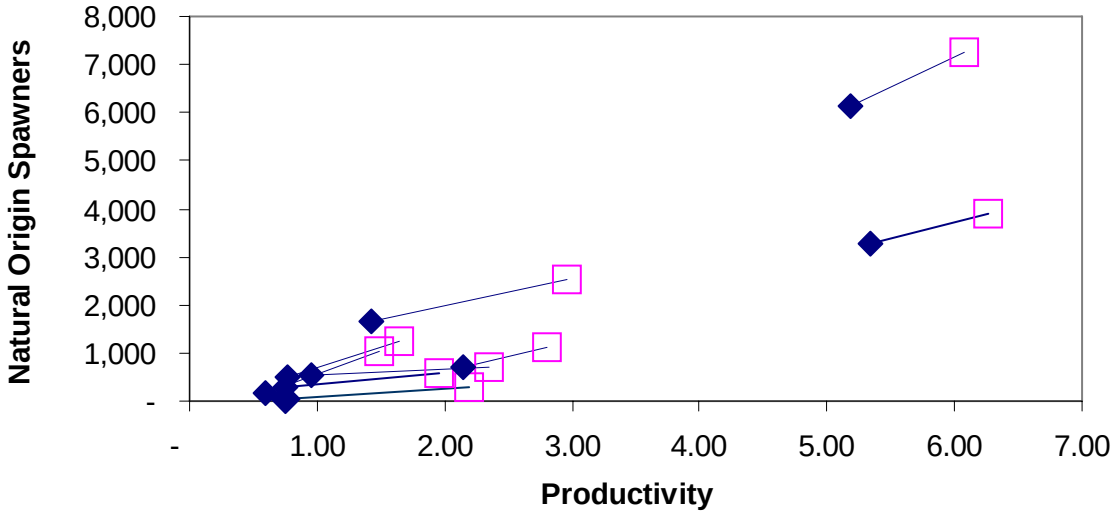

Figure 2. Productivity and spawner abundance for nine primary Chinook populations under current habitat conditions in the Lower Columbia River ESU.
Note: Solid diamonds represent existing productivity and spawner abundance levels. Lines connect current with proposed improvements achieved under HSRG scenarios.

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 scenarios proposed by the HSRG. The HSRG assumed a 20% marine non-selective harvest rate in Canadian and Alaskan waters and a 20% selective harvest rate on hatchery fish in Washington and Oregon marine waters (2:1 selective differential). In the mainstem Columbia River, the HSRG assumed a 20% selective harvest rate on hatchery fish and a 5:1 selective differential. For terminal harvest areas, the increased harvest depicted in Figure 3 primarily resulted from shifting

some hatchery production to Select Area Fisheries Enhancement programs and not from modifying harvest rates.

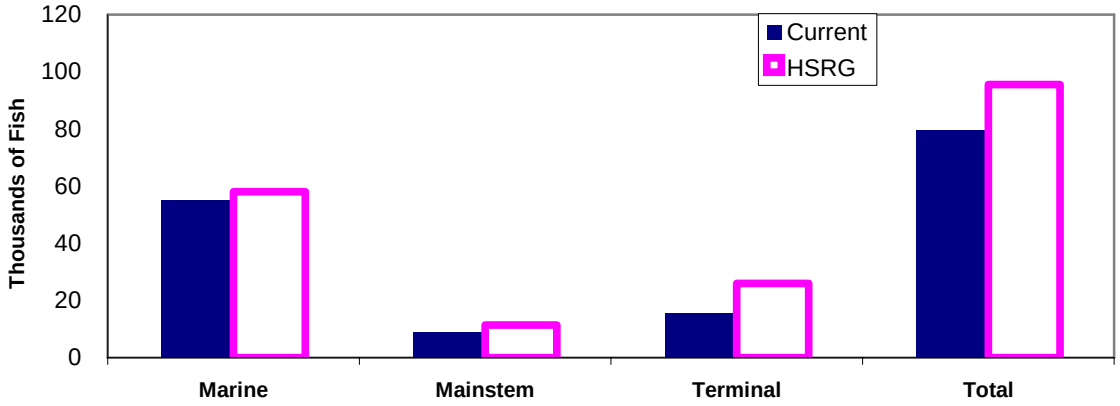

Figure 3. Estimated marine, mainstem Columbia River and terminal Chinook harvest under current and HSRG-proposed management scenarios.

Conclusions

The HSRG has concluded that, in order to achieve their stated conservation and harvest goals, the managers must implement the following reforms::

1. Implement effective integrated or segregated hatchery broodstock management practices to achieve 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 harvest methods and gear that enable selective removal of hatchery fish with low mortality of natural fish.
   - Spatially and temporally segregate 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. These goals can be accomplished only if hatchery fish can be reliably distinguished from natural-origin fish.
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 concludes that (a) hatchery and harvest reforms alone will not achieve recovery of listed populations (habitat improvements are also necessary), and (b) effectiveness of habitat actions will be greatly increased if they are combined with hatchery and harvest reforms. **The analysis of the Lower Columbia Chinook ESU suggests that the benefits of habitat quality improvements would double if combined with hatchery reforms. Unless hatchery and harvest reforms are implemented, the potential benefits of current or improved habitat cannot be fully realized.**