3.3 Chum ESU

3.3.1 Lower Columbia River Chum ESU

This section provides an overview of the Columbia River Chum ESU. It contains a general description of the ESU, fisheries, habitat limitations and hatchery programs that affect it. Overall recommendations for ESU-wide hatchery program changes are summarized as are the results of implementing these changes on conservation and harvest goals. Detailed conclusions and recommendations for each population in the ESU can be found in Appendix E. Populations in this ESU extend from the Grays and Chinook rivers near the estuary, upstream to tributaries in the Columbia River Gorge, Hood and Wind rivers, and Fifteenmile Creek.

3.3.1.1 HSRG Population Guidelines

In order to meet conservations goals for the ESU, numerous threats to these populations need to be addressed, including risks from hatchery programs. The key to controlling genetic and ecological risks due to straying and fitness loss is to manage hatchery broodstock and 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) integrated programs where the proportion of natural-origin adults in the broodstock (pNOB) exceeds the proportion of hatchery-origin fish on the spawning grounds (pHOS); or (b) segregated programs where the contribution of hatchery fish to natural spawning is kept low (pHOS <5% to <10% depending on the population designation). The HSRG developed criteria for hatchery influence for three population types based on the importance of the population to the recovery of the ESU. This was done to provide a consistent method of reviewing populations and programs across the Columbia River Basin. The population designations used by the HSRG (Primary, Contributing, or Stabilizing) were adopted after discussions with managers and followed those developed in the Lower Columbia River Salmon Recovery Plan (LCFRB 2004). These designations are meant to reflect the conservation importance of a population within the ESU from most important (Primary), to moderately important (Contributing), to least important (Stabilizing). HSRG recommendations show how hatchery programs can be operated consistent with these designations based on the following standards:

HSRG criteria for hatchery influence on Primary populations

- The proportion of effective hatchery-origin spawners (pHOS) should be less than 5% of the naturally spawning population, unless the hatchery population is integrated with the natural population.
- For integrated populations, the proportion of natural-origin adults in the broodstock should exceed pHOS by at least a factor of two, corresponding to a proportionate natural influence (PNI) value of 0.67 or greater and pHOS should be less than 0.30.

HSRG criteria for hatchery influence on Contributing populations

- The proportion of effective hatchery-origin spawners (pHOS) should be less than 10% of the naturally spawning population, unless the hatchery population is integrated with the natural population.
- For integrated populations, the proportion of natural-origin adults in the broodstock should exceed pHOS by at least a factor of one, corresponding to a PNI value of 0.50 or greater and pHOS should be less than 0.30.

HSRG criteria for hatchery influence on Stabilizing populations

- The current operating conditions were considered adequate to meet conservation goals. No criteria were developed for proportion of effective hatchery-origin spawners (pHOS) or PNI.

3.3.1.2 Current Conditions

Conservation

The Columbia River chum salmon ESU was originally listed as endangered in 1999 under the Endangered Species Act. The ESU includes all naturally-spawned populations of chum salmon in the Columbia River and its tributaries as well as one current artificial propagation program. There were 16 historical populations in three major population groups (MPGs) in Oregon and Washington between the mouth of the Columbia River and the Cascade crest. Most populations (88 percent) in this ESU are extirpated or nearly so (NMFS 2008e). Core populations include Grays, Elochoman, Youngs Bay, Big Creek, Cowlitz, Lewis, Clackamas, and the Lower Gorge. Grays and Lower Gorge are both genetic legacy populations (NMFS 2005b, Myers et al. 2006). For the purposes of the HSRG analysis, 17 populations were identified, including all the populations from the TRT/Lower Columbia River Recovery Plan plus the Columbia Estuary Chum identified by the HSRG (Table 1). The risk of extinction is "high" or "very high" for all populations except the Washington portion of the Lower Gorge. The Upper Gorge population, and all four populations on the Oregon side of the Columbia in the Coastal MPG, are extirpated or nearly so (McElhany et al. 2007).

The managers' objectives for chum are primarily focused on conservation. While there are no current harvest goals or expectations for chum salmon, there is concern about the effects of incidental harvest of chum salmon in commercial coho fisheries.

For the purposes of this review, the HSRG defined eight populations as Primary, seven as Contributing, and two as Stabilizing (Table 1).

Table 1. Population designations for the Lower Columbia River Chum ESU and HSRG broodstock criteria achieved for each population under current conditions and the HSRG recommended hatchery management solution.

Population	Designation[1]	HSRG Criteria Met[2]	
		Current	HSRG Solution
Columbia Estuary: Grays-Chinook River Chum	Primary	Stabilizing	Contributing
Columbia Estuary: Mill-Aber-Germ Chum	Primary	Primary	Primary
Columbia Estuary-Youngs Bay Tribs Chum	Primary	Contributing	Contributing
Elochoman Chum	Primary	Primary	Primary
Lewis Chum	Primary	Primary	Primary
Lower Columbia-Duncan Creek Chum	Primary	Contributing	Primary
Sandy Chum	Primary	Stabilizing	Contributing
Washougal Chum	Primary	Primary	Primary
Columbia Estuary-Big Creek Chum	Contributing	Stabilizing	Stabilizing
Columbia Estuary-Clatskanie Creek Chum	Contributing	Stabilizing	Stabilizing
Cowlitz Chum	Contributing	Primary	Contributing
Kalama Chum	Contributing	Primary	Stabilizing
Willamette-Clackamas Chum	Contributing	Primary	Primary
Columbia Gorge-Tributaries Chum (Lower Gorge)	Contributing	Primary	Primary
Columbia Gorge-Tributaries Chum (Upper Gorge)	Contributing	Primary	Primary
Columbia Estuary-Chum (Sea Resources)	Stabilizing	Primary	Stabilizing
Salmon Creek Chum	Stabilizing	Contributing	Stabilizing

[1] Using the naming protocol of the Lower Columbia River Salmon Recovery Plan (LCFRB 2004), populations were classified based on information provided to the HSRG as Primary, Contributing, or Stabilizing. These designations are meant to reflect the conservation importance of a population within the ESU from most important (Primary- bold, red), to moderately important (Contributing-bold, blue), to least important (Stabilizing).

[2] The HSRG developed criteria for hatchery influence for the three population designations from low influence (Primary), moderate influence (Contributing) to high influence (Stabilizing).

Current Harvest

Due to severe population declines, commercial chum salmon fisheries have been closed. Harvest of chum salmon is incidental, occurring primarily in the lower Columbia River commercial coho fishery. Sport harvest of chum in the Columbia and tributaries has been closed since 1992 in Oregon and since 1995 in Washington. The presumption is that chum salmon are not harvested in the ocean or in the Columbia River above Bonneville Dam. Fishery managers set a five percent maximum incidental harvest mortality on Columbia River chum. Recent harvest rates are reported to have averaged about 1.6 percent annually (FCRPS 2008).

Current Habitat

Widespread development and land use activities have severely degraded stream habitats, water quality, and watershed processes affecting anadromous salmonids in most lower Columbia River subbasins, particularly in the low to moderate elevation habitats most often used by chum. In the lower Columbia River and its tributaries, major factors

affecting chum survival are altered channel morphology and stability; lost/degraded floodplain connectivity; loss of habitat diversity; excessive sediment; degraded water quality; increased stream temperatures; reduced stream flow; and reduced access to spawning and rearing areas (LCFRB 2004, ODFW 2006, PCSRF 2006). Another important factor has been the inundation of historical spawning areas by reservoirs in all three MPGs. In the Coastal MPG, tide gates, dikes, culverts, and hatchery weirs all impede passage of chum salmon. The Bonneville Dam impoundment eliminated mainstem and lower tributary habitat for the Upper Gorge MPG (WLCTRT et al. 2004).

In the Cascade MPG, chum salmon habitat was inundated by Mayfield Lake in the Cowlitz River and by Lake Merwin in the North Fork Lewis River. The Cowlitz River Project FERC license requires minimum flows to be released from Mayfield Dam to protect chum habitat during spawning, incubation, and emergence, and to implement gravel augmentation projects below the dam (NMFS 2004a). The Lewis River Project FERC licenses stipulate that PacifiCorp may fund projects to benefit chum salmon (NMFS 2007a).

The HSRG notes that 13 of 16 historical populations of Columbia River chum salmon are severely depressed even though Washington's Lower Columbia River Recovery Plan indicates habitat is available to support much larger populations. Under current habitat conditions, managers estimate an ESU abundance of 24,000 chum salmon can be supported. With habitat improvements to tributaries, much larger populations of chum salmon are possible (LCFRB 2004).

Hatchery Programs

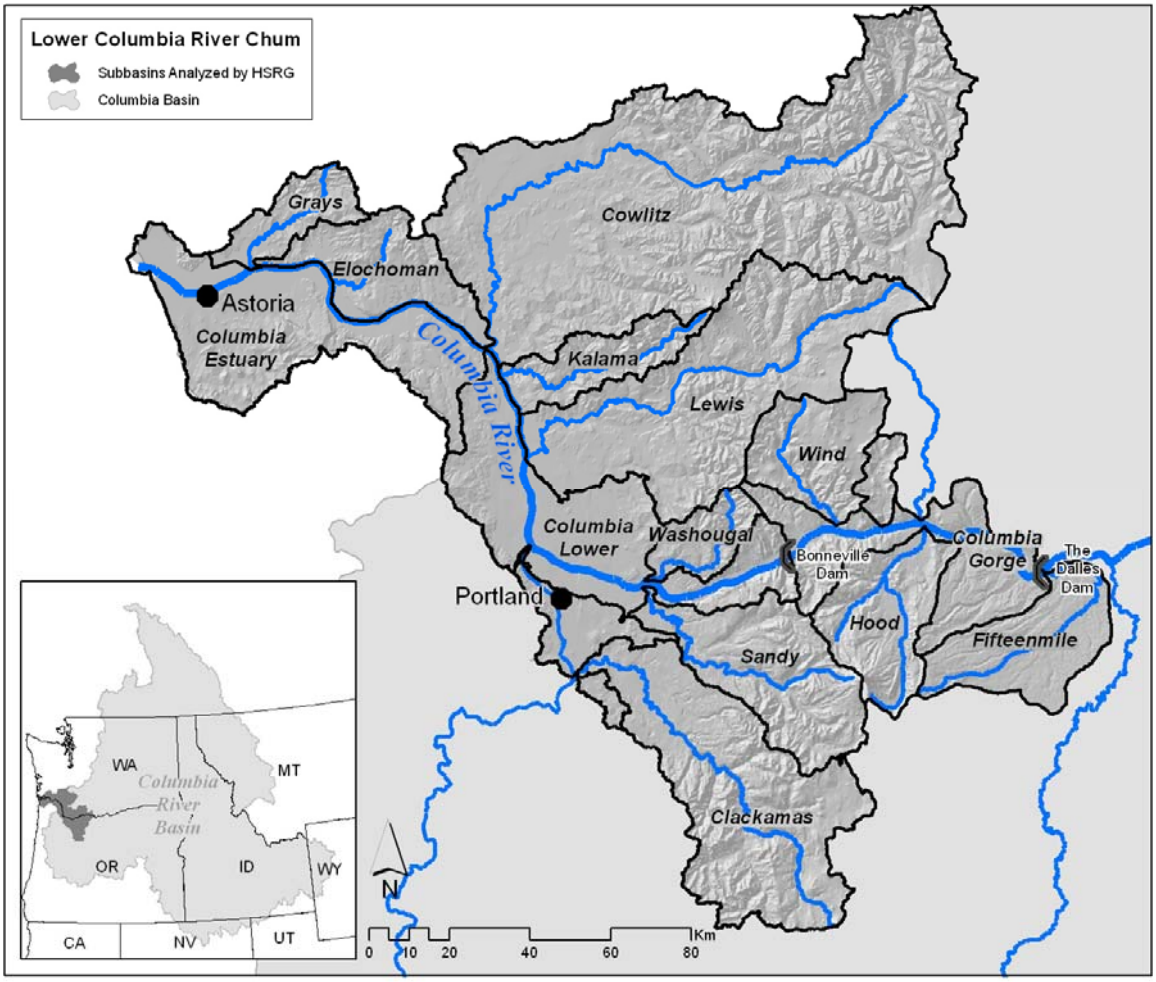
Two artificial propagation programs produced chum in recent years, but one has recently ended (Duncan Creek). The currently operated program is designed to augment natural production in the Grays River and to reintroduce chum to the Chinook River. These are integrated programs that release a total of about 299,000 juvenile chum salmon annually (Table 2). Hatchery influence on populations in this ESU is low.

Four of the eight Primary populations currently meet the criteria for this population designation, although abundance is critically low. In addition, a number of the populations designated as Contributing also meet the standards for a Primary population (Table 1).

Table 2. Hatchery releases and types of programs in the Lower Columbia River Chum ESU.

	Current (1,000s)			HSRG Solution (1,000s)		
Population/Program Name	Type	Purpose	# Released	Type	Purpose	# Released
Columbia Estuary: Youngs Bay Tribs Chum	None	NA	-	Int	Cons	96.1
Columbia Estuary: Big Creek Chum	None	NA	-	None	NA	-
Columbia Estuary: Chum (Sea Resources)	None	NA	-	Int	Cons	64.0
Columbia Estuary: Grays-Chinook River Chum	Int	Cons	200.1	Int	Cons	115.3
Columbia Estuary: Mill-Aber-Germ Chum	None	NA	-	Int	Cons	61.4
Columbia Estuary: Clatskanie Creek Chum	None	NA	-	None	NA	-
Elochoman Chum	None	NA	-	Int	Cons	182.0
Cowlitz Chum	None	NA	-	None	NA	-

Population/Program Name	Current (1,000s)			HSRG Solution (1,000s)		
	Type	Purpose	# Released	Type	Purpose	# Released
Kalama Chum	None	NA	-	None	NA	-
Willamette-Clackamas Chum	None	NA	-	None	NA	-
Sandy Chum	None	NA	-	Int	Cons	96.1
Washougal Chum	None	NA	-	Int	Cons	217.9
Salmon Creek Chum	None	NA	-	None	NA	-
Lower Columbia: Duncan Creek Chum	Int	Cons	99.9	Int	Cons	99.9
Lewis Chum	None	NA	-	Int	Cons	256.4
Columbia Gorge: Tributaries Chum (Lower Gorge)	None	NA	-	None	NA	-
Columbia Gorge: Tributaries Chum (Upper Gorge)	None	NA	-	None	NA	-
Total all Populations/Programs			299.9			1,189.0



3.3.1.3 *HSRG Solutions*

Hatchery intervention can reduce demographic risk by boosting abundance. Additional conservation propagation programs should be promptly initiated within each of the ESU's three geographic strata to reduce this risk. Existing and candidate populations for hatchery conservation programs are identified in Table 2. Chum conservation programs can be implemented at existing facilities at modest cost, should be sized at 100,000 to 200,000 fry releases, and last up to three generations. Broodstock should be selected from the target population, or in the case of reintroductions, from the most suitable available population.

Conservation Outcomes under the HSRG Solutions

Figure 1 compares the proportion of hatchery-origin fish on the spawning grounds (pHOS) and the proportionate natural influence (PNI) for current and proposed (HSRG) scenarios for Primary and Contributing populations. Some reduction in PNI is estimated due to an increase in pHOS, caused by initiating new hatchery programs. These are recommended in order to overcome the high demographic risk associated with critically low abundance for many of these populations. Little or no loss in productivity results from increasing the number of hatchery-origin fish (pHOS) due to the high PNI maintained in the new programs (Figure 2).

Harvest Outcomes under the HSRG Solutions

None of the hatchery programs (current or proposed) has harvest as an identified goal. While estimated harvest increases slightly under the HSRG solutions, it is based on the current incidental catch rates and does not include any directed harvest (Figure 3).

Hatchery Program Changes under the HSRG Solutions

The HSRG had no recommendations to improve on the Grays River program and recommends its continued operation as an important safety net in the lower Columbia. In addition, planning should be initiated leading to one or two additional safety net programs in each of the three strata.

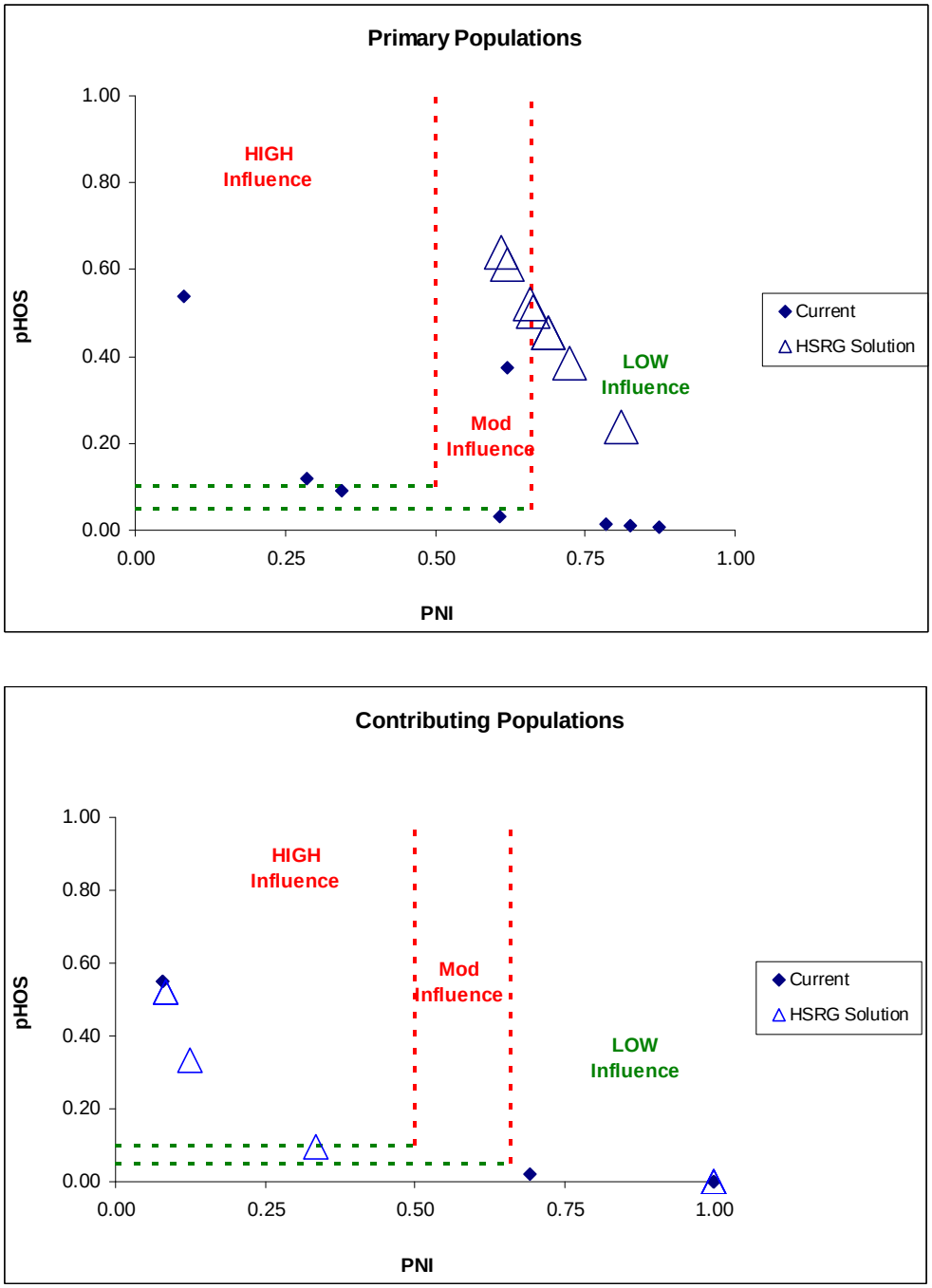
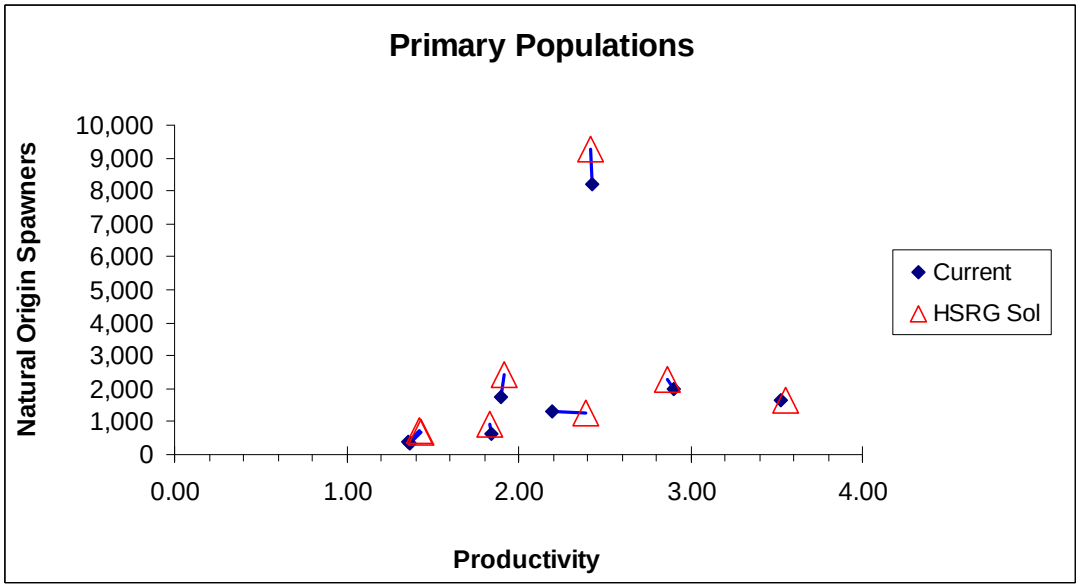


Figure 1. Relationship of the proportion of the fish on the spawning grounds that are of hatchery origin (pHOS) and the proportionate natural influence index (PNI) for Primary (top panel) and Contributing (bottom panel) chum populations in the Lower Columbia River Chum ESU. Solid diamonds represent values for current programs and open triangles represent values for the HSRG recommended hatchery management solution.



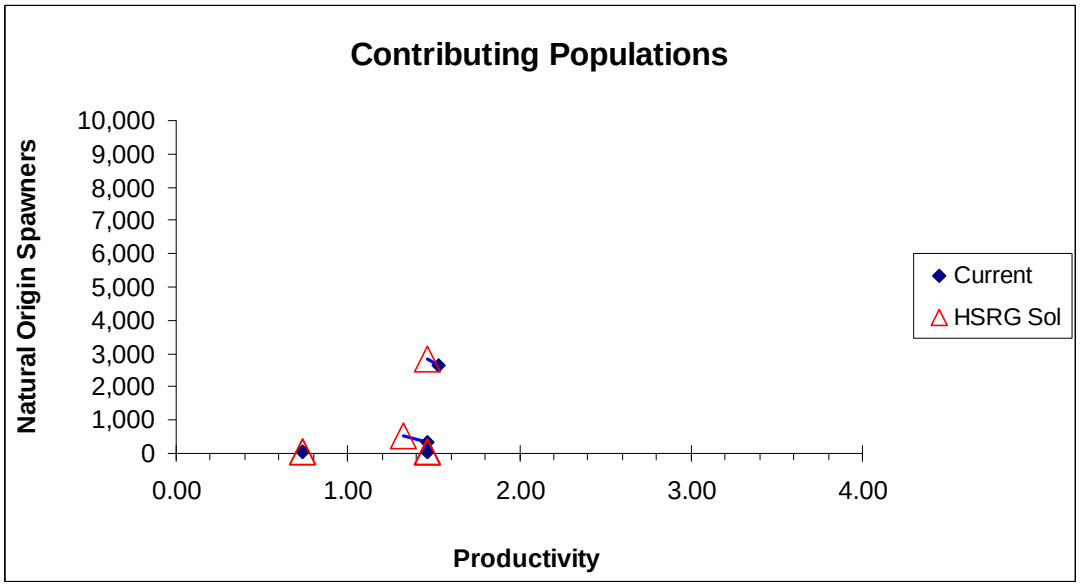


Figure 2. Productivity and spawner abundance for Primary (top panel) and Contributing (bottom panel) chum populations in the Lower Columbia River Chum ESU. Solid diamonds represent existing productivity and spawner abundance levels, and triangles represent the HSRG recommended hatchery management solution. Lines connect current with HSRG solution for a particular population.

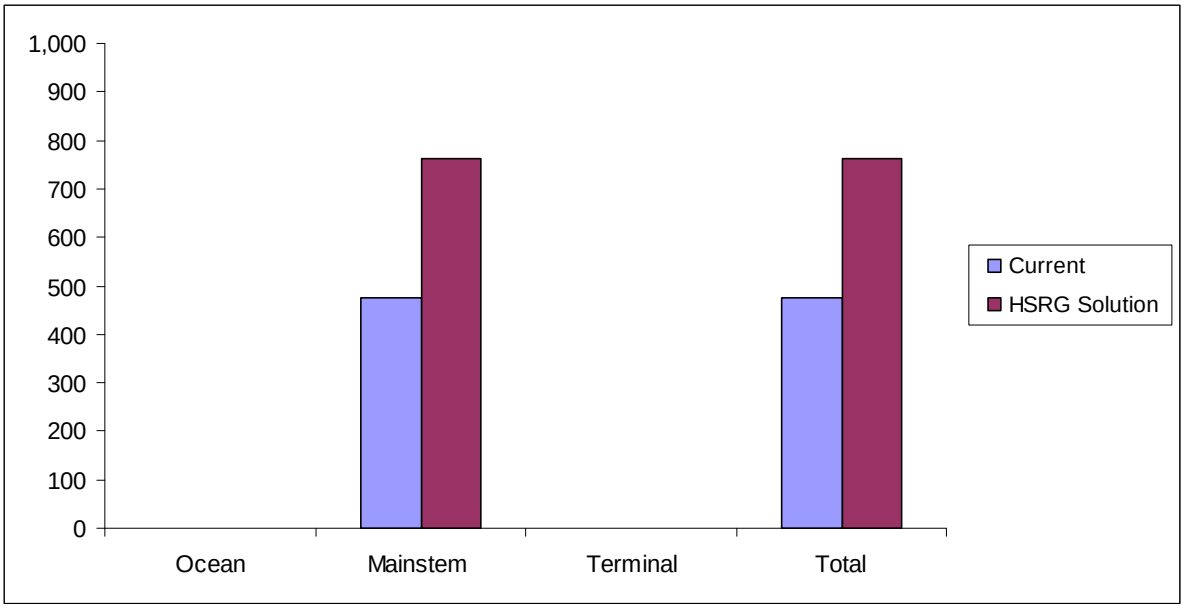


Figure 3. Estimated marine, mainstem Columbia, and terminal harvest under current and HSRG recommended hatchery management solution for Lower Columbia River Chum ESU.

3.3.1.4 Summary and Conclusions

In summary, chum conservation programs should be viewed as an important short-term risk management strategy to preserve the genetic legacy of depressed chum populations. The HSRG recommends immediately initiating planning for one or two additional programs in each stratum.

Managers also need to better understand what has caused the overall chum decline and what ecological and/or demographic factors are continuing to keep the ESU at such low abundance levels given the apparent available habitat capacity and propensity for salmon populations to be highly productive at low abundances. Managers should avoid maintaining this ESU only through artificial propagation due to long-term hatchery risks of domestication and fitness loss.

The HSRG reviewed options for chum conservation in the lower Columbia River in the context of conservation goals for other salmon and steelhead ESUs as well as the objectives of fisheries managers for Chinook and coho harvest. The HSRG notes that conservation goals for the chum population in the Youngs Bay tributaries (designated as a Primary population) may be in conflict with conservation and harvest goals for coho salmon in this area. Timing of intensive gill-net fisheries in Youngs Bay to fully harvest hatchery-origin coho overlaps with the return of adult chum salmon. Furthermore, the release of large numbers of juvenile Chinook and coho salmon from net pens in this area may also cause excessive predation on migrant chum fry. Other chum populations in the Coast stratum are more likely to achieve the status of a Primary population in a manner that is compatible with the managers' goals for Chinook and coho.

The HSRG recommends the fishery managers implement the following actions to achieve their chum conservation goals as part of a plan to meet conservation and harvest goals for all salmon species in the Columbia River Basin:

- Intensify enumeration of incidental chum harvest in the commercial coho fishery.
- Continue the current chum conservation program in Grays River.
- Programs should include a sunset clause that would suspend the hatchery program after three generations, unless evidence suggests suspending releases earlier or extending the program beyond three generations would benefit the populations.
- All hatchery-origin fish should be marked and the proportion of hatchery fish on the spawning grounds monitored.
- Investigate ecological variables that might be constraining the viability of the chum salmon in the Columbia River and develop one or more plausible hypotheses.
- Based on results of the initial propagation programs and the plausible hypotheses about the cause of decline, consider additional reintroduction programs to achieve, at a minimum, preservation of the genetic identity and reduction of demographic extinction risks.