Comments of the Oregon Department of Fish and Wildlife
NOAA Fisheries Technical Memoranda
January 30, 2004

Below are the Oregon Department of Fish and Wildlife (ODFW) comments on the four draft Technical Memoranda provided by the Northwest Fisheries Science Center. Similar to November 10, 1999 comments we submitted on White Papers developed by NOAA Fisheries for the Section 7 consultations on the 2000 Biological Opinion (ODFW 1999), the technical memorandums lack an explicit description on how this information will be used to make management decisions related to the survival and recovery of fish stocks covered under the opinion. Again, this context should describe the historical and current impacts of the Federal Columbia River Power System (FCRPS) on these stocks and how management actions (flow, spill, transportation, estuary and freshwater habitat improvements, hatchery and harvest reforms, etc) being considered under the opinion meet survival and recovery standards.

Specifically, the Technical Memoranda should describe how changes from a natural (prior to development of the FCRPS) free flowing river to an impounded system have influenced survival of salmon and steelhead and assess the effects of management actions on survival and recovery thresholds. Without this assessment, it will not be possible to determine the adequacy of potential Reasonable and Prudent Actions being considered for the revised opinion necessary to insure survival and recovery of the listed salmon and steelhead.

Comments are provided separately for each Technical Memorandum. Complete citations for all references are provided in the final section of this document.

<u>Effects of the Federal Columbia River Power System on Salmon Populations</u>

Although the stated purpose was to determine "the extent to which direct and indirect effects of the hydropower system negatively affect salmon populations, in the context of all other factors influencing salmon populations…", the paper was extremely narrow in scope focusing largely on hypotheses related to differential post-Bonneville ("D") mortality between transported and in-river spring/summer Chinook and steelhead. The paper needs to first address (as acknowledged in the Introduction) how the FCRPS has directly and indirectly affected salmon populations and then determine the direct and indirect effects of transportation and how well transportation (contrasted to other actions) meet survival and recovery standards. As discuss below, we are especially disappointed on the lack of a balanced assessment on the potential benefits of flow and spill and other management actions that are being implemented to improve survival of in-river migrants.

Page 5 (Delayed or "Extra" Mortality)- As discussed in Budy et al. 2002 and comments submitted by Oregon on NOAA Fisheries' draft 2000 Biological Opinion (Oregon 2000), considerable analytical and empirical evidence exist to suggest that extra mortality is related to passage through the hydrosystem. See additional comments below on this issue (Page 51 Delayed Mortality).

Page 36 (Relationships among flow, temperature, travel time and survival- Yearling migrants)- The paper needs to provide a more thorough assessment of available data related to the effects of flow, temperature, travel time and survival. As discussed in the March 19, 2002 Joint Technical Staff comments by state and tribal fishery agencies on the draft NOAA Fisheries report "Survival Estimates for the Passage of Spring Migrating Juvenile Salmonids Through Snake and Columbia River Dams and Reservoirs, 2001" (Zabel et al. 2001) (Joint Technical Staff Memorandum 2002a) and March 19, 2002 comments on the report "Mainstem Passage Strategies in the Columbia River System: Transportation, Spill, and Flow Augmentation" (Giorgi et al. 2002) (Joint Technical Staff Memorandum 2002b) for the Northwest Power and Conservation Council, considerable evidence exists to support the survival benefits of flow and spill. The lack of a flow-survival relationship cited was confounded by use of short-reach (per-project survivals) and earlier (freeze brand) data that obscures a flow-survival relationship demonstrated over the entire hydrosystem on survival per-mile basis for both spring/summer Chinook and steelhead.

Page 36 (Flow-Travel Time)- The close relationship between flow and smolt travel time has been thoroughly documented (Joint Technical Staff Memorandum 2002a and 2002b, ODFW 1999, and Oregon 2002); the lack of relationship shown for spring/summer chinook in the report (Figure 11 for 1998, 2002-2003) may have been driven by degree of smoltification in hatchery fish; however this trend is not seen later in the migration nor with both hatchery and wild steelhead.

Page 37 (Annual SARs for Spring Migrants)- Based on comparison of 95% CIs of SARs for transported hatchery and wild marked fish above Lower Granite and in-river (non-detected) migrants for 1993-2000 (Tables 15 and 16), transportation does not provide a survival advantage over in-river migration for wild spring/summer Chinook and hatchery and wild steelhead; and only provides a slight advantage for hatchery spring/summer Chinook but not every year. The paper should elaborate on these results based on their significance to management decisions and discuss discrepancies in results for fish PIT tagged above vs at Lower Granite.

Additionally, the paper needs to assess the overall issue of the appropriateness of using aggregated non-detected fish as the "standard" to judge the effectiveness of transportation. Non-detected fish include an unknown proportion of fish that have passed through "fish friendly" passage routes such as conventional and modified spillways and sluiceways, but also includes fish that have passed through "not so fish friendly" passage routes like turbines. As discussed in the Ferguson et al. paper, spillway passage has consistently been shown to provide the highest survival of any route of passage, averaging about 98% for most projects compared to about 85% for fish passing through turbines. This higher survival combined with the effectiveness of spill and surface bypass systems in reducing forebay delay and providing a more "natural" passage route for fish is why the fishery agencies and tribes have long given spillway passage the highest priority for in-river passage of fish. In the last several years, because of concern with increased mortality of fish passing through multiple bypass systems and the long standing concerns with high turbine mortality, priority is currently being given to operational and structural improvements that reduce powerhouse (turbine and bypass) passage and increase passage of fish through conventional and modified spillways (i.e. Raised Spillway Weirs tested at Lower Granite and proposed for testing at other projects) and sluiceways (i.e. Corner Collector at Bonneville Dam). Given this, the standard to compare the effectiveness of transportation should be non-detected fish that passed through conventional and modified spillways and sluiceways but excludes turbine passed fish. Although it is not possible to distinguish fish passing through the various non-detected routes, there is route specific survival data that can be used to adjust non-detected survival to reflect the higher survival of spillway and sluiceway passed fish. Such an adjustment could eliminate any survival advantage of transporting fish and may show an advantage of maximizing in-river passage through spillways and sluiceways especially in years of high flow and spill.

Page 45-46 (Annual Estimates of Differential Post-Bonneville Dam Survival "D Mortality")- Probably one of the most important findings from the differential post-Bonneville survival (D) for Snake River wild and hatchery spring/summer Chinook (Table 21) is that the D value for wild fish is substantially less than hatchery fish. For example, for 1998-2000 (years that had highest sample sizes and lowest CIs), D values for wild fish ranged from .336-.656 compared to .638 for hatchery fish, indicating that transported wild fish have lower post-Bonneville survival than transported hatchery fish. This would explain the higher transport/in-river survival ratios observed for hatchery fish.

Page 50 (Temporal SARs for Spring Migrants)- The management implications of these findings should be discussed. Based on the finding that transport (compared to in-river) survival is low for both hatchery and wild spring/summer Chinook prior to May 1, managers have delayed initiation of transportation until May 1 when flows and in-river passage conditions are favorable.

Page 51 (Temporal D Within Season-Upper Columbia River Subyearling Migrants)- The observation of higher survival for transported than in-river migrants for subyearlings when flows exceeded 225,000 cfs (as occurred in 1996) was not observed in 1995 (generally no difference between transport/in-river survivals despite flows varying from 140,000-260,000 cfs). Current transportation procedures under the 2000 Biological Opinion recognize the lack of definitive and uncertain information regarding the benefits of transportation for subyearling migrants. Based on this uncertainty, Oregon continues to support a "spread the risk" transportation strategy where no more than 50% of each of the migrations are transported coupled with improved passage conditions to increase survival of in-river migrants.

Page 51 (Delayed or "Extra" Mortality)- The finding that wild spring/summer Chinook and steelhead did not consistently show lower return rates for multiple bypassed fish as was observed for hatchery spring/summer Chinook and steelhead does not override the weight of evidence presented in Budy et al. (2002) and Oregon (2000) that indicates the hydrosystem is the most likely explanation of delayed mortality of transported and in-river migrants.

Page 53 (PIT Tag Effects)- This section should be moved to the results section and data needs to be presented to support the conclusion that survival rates of PIT tagged fish are not representative of composite (unmarked) populations.

Page 55-57 (Survival of Transported Fish)- The hypothesis that survival of transported fish is influenced by time of ocean entry and could be increased by delaying their ocean entry time is not supported by the data presented. It is true that there is a large difference in lower river arrival time for transported (1.5 days) vs. in-river spring/summer Chinook (3-4 weeks for early and 2 weeks for late migrating fish); and that seasonal increases in D are regularly observed for several populations of spring/summer Chinook. However, the longer migration time for early migrating fish is in part due to lower flows (typically <85 kcfs in April prior to snow melt compared to >100 kcfs in May) and if flows were consistently higher their migration timing would be similar. Prior to hydro development, because of the close relationship between water particle and smolt travel time, it is likely that smolts migrated to the lower river in +/- a week, or not much longer than transported fish. An alternative explanation of the seasonal increase in D may be stock differences or that post-Bonneville survival of late migrating transported fish maybe enhanced by higher flows in May that may improve condition of fish collected and transported.

Page 57 (Flow-Travel Time)- As discussed above, the finding that there is “little relationship between migration rates and flow” for spring/summer Chinook needs to be qualified because this finding may have been confounded by the degree of smoltification in hatchery fish for those years; however, this trend is not seen later in the migration nor with both hatchery and wild steelhead. The preponderance of scientific data strongly supports a flow-travel time relationship for both spring/summer chinook and steelhead (Joint Technical Staff Memorandum 2002a and 2002b, ODFW 1999, and Oregon 2002).

Page 57 (Differential Guidance)- The fact that fish that are collected and transported are smaller than non-detected fish may influence transport/in-river SAR comparisons because of the influence of fish size on survival (smaller fish have lower survivals); however this is unavoidable because of the selective nature of screen bypass systems towards collection of smaller fish. These fish, however are representative of that passage route and not necessarily a "biased" sample of the population of fish that are transported (as are fish that pass through non-detected routes).

Page 61 (Diversity)- We also agree with the Independent Scientific Advisory Board's recommendations for "spreading the risk of negative outcomes among alternative routes of hydroelectric passage...is advisable...in the face of uncertainties associated with potential negative effects of transportation on genetic and life history diversity." This recommendation is contrary to the current transportation strategy under the opinion with the exception of McNary dam during spring, all collected fish are transported that results in exceptionally high proportion of fish being transported (i.e. 70.4-99.0% of wild Chinook, 61.5-97.3% of hatchery Chinook, 72.9-99.3% of wild steelhead, and 68.4-96.7% of hatchery steelhead for 1993-2003 reported on Page 37).

Page 62 (Steelhead Transport Benefits)- This section contains contradictory statements regarding the benefits of transporting steelhead: In the first paragraph it is concluded that "...transporting juveniles provides large benefits for steelhead." In the following paragraph it is concluded that "There are too few data to predict whether increased transportation of wild steelhead would lead to higher return rates." Based on our review of the data, similar to wild Chinook, there is no conclusive evidence that transporting wild or hatchery steelhead improves survival compared to in-river migration. In only one year (1999 for hatchery and wild steelhead PIT tagged at Lower Granite) was transport survival statistically greater than inriver (non-detected) survival.

Passage of Juvenile and Adult Salmonids Past Columbia and Snake River Dams

Page 91-92 (Operation of Turbines Outside 1% Peak Efficiency)- The paper needs to acknowledge the May 29, 2003 Joint Technical Staff review of research (Joint Technical Staff Memorandum 2003) related to a proposal by the Bonneville Power Administration to discontinue operation of turbines at McNary within 1% peak efficiency as required by the 2000 Biological Opinion. This review concludes that the available research, including the summary of research by Skalski et al. (2002), indicates that operation of turbines outside 1% would decrease survival of juvenile fish due to increased mortality in turbines as well as in juvenile bypass systems (due to higher gatewell flow and associated debris that increases injury on intake and vertical barrier screens).

Page 113 (Zero Flow Operations)- We reviewed Bjornn et al. (1998) and Liscom et al. (1985) related to the effects of zero flow operations on adult passage. The Liscom et al. (1985) research is not specifically relevant to current zero flow operations (limited to 6-8 nighttime hours) because their zero flow treatment included not only continuous 24 hour zero flow on weekends but 9 hr nighttime zero flow on weekdays. Temperature effects and low sample sizes also confounded the study (study was conducted July-September for both chinook and steelhead when fish migrations can be greatly delayed due to high temperatures) that affected results. We do not agree with Bjornn's and the paper's conclusion that there was "no clear evidence that reducing flows to near zero at night affected migration rate, proportion of fish passing the dams, proportion of fish captured in the fishery, or proportion of fish returning to hatcheries." Although not statistically significant, our review of Bjornn's data provides some evidence that fish were delayed by zero flow vs. normal flow operations. From Table 1 of Bjornn et al. (1998), excluding the last (late Oct/early Nov) Normal flow blocks in 1991 and 1992 (had low recoveries that the authors attributed to slowing of migration that normally occurs late fall), the Mean Migration rate from Ice Harbor to Lower Granite, 1991-93, for spaghetti tagged fish was 14.3 days for Zero and 12.7 days for Normal flows. Additionally, although the authors reported no significant differences were detected in proportion of fish recovered in fisheries and hatcheries between Zero and Normal flow treatments, the proportions recovered (0.10- 0.31 total) were very small and were not adequate to rule out whether Zero flow operations impacts upriver harvest, returns to hatcheries, and spawning escapement. However, we also need to keep in mind that Bjornn's study was done in September and October when fish are migrating to a greater extent than fish in December-January-early February (months when current zero flow operations occur) making it perhaps more difficult to estimate potential impacts.

A Review of Relative Fitness of Hatchery and Natural Salmon

This paper has a very specific focus and narrow objectives of summarizing available information on relative fitness of hatchery and natural Pacific salmon and steelhead in the natural environment and to determine if there are patterns related to origin and history of hatchery broodstock. The paper is a cautious, well-written review of the literature on this subject.

The paper has clearly stated objectives with important relevance to population productivity and viability analysis. The stratification of the origin and history of the hatchery broodstock management is logical and provides a sound basis for looking at the influence of different management strategies on the relative fitness.

The authors have reviewed almost all of the relative fitness studies currently available and they have placed each study in the right strata. The results of all studies reviewed are accurately reported. The conclusions are consistent with the results, and the authors accurately describe the paucity of studies pertinent to Chinook salmon and to the most prevalent types of hatchery supplementation programs, those that use local natural broodstock on an annual basis.

The relative reproductive success values presented in the paper will be useful in the interim for viability analysis until additional more relevant data can be obtained.

Some minor comments follow:

It may be possible to make some more estimates of relative fitness in some other Columbia Basin populations, such as the Umatilla and Yakima and maybe some other areas, using available data sets.

Throughout: Kostow (2003) should be Kostow et al. (2003).

Page 10, Local, natural broodstock. The authors may find a new paper, Kostow (in press CJFAS) "Differences in juvenile phenotypes and survival between hatchery stocks and a natural population provide evidence for modified selection due to captive breeding" to be useful for this section.

Page 11, Discussion of the Sheep Creek steelhead study. The definite conclusion that the fitness differences between the hatchery stock and natural fish is environmental simply because they are still similar at neutral genetic markers may not be warranted. They share a common origin as confirmed by the neutral markers, but they may have diverged at other traits that were under selection while remaining similar at these markers.

Page 15, Genetic Introgression: Another paper to review on this subject is: Utter, F. 2001. Patterns of subspecific anthropogenic introgression in two salmon genera. Reviews in Fish Biology and Fisheries. 10: 265-279.

The authors might try to track down some of the studies in Russia that have focused on chum salmon.

Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of Limiting Factors

This paper adds to our understanding of the importance of the estuary in salmon recovery. The paper analyses recent findings in estuary science on the lower Columbia River, and applies it toward a more complete understanding of how river flow, habitat, toxics, and Caspian tern predation (potential limiting factors) may act as limiting factors in salmonid viability and recovery. The approach taken is to characterize salmonids populations by life history types and use of habitats, and evaluate the potential estuary limiting factors for each. Missing from this approach is a description of when major estuary changes occurred, to help put potential limiting factors in perspective with observed patterns of population performance. The paper does recognize that the estuary is one of the most modified and degraded portions of the Columbia River system, and that it experiences the cumulative impact of flow regulation, habitat modification, and changes in temperature, sediment, and nutrient regimes. The paper promotes a holistic approach to salmon recovery; describing that only by moving towards an ecosystem approach will we be able to recover salmon populations.

As an ecosystem based approach to salmon recovery emerges, new questions about whether salmon passage through the Columbia River estuary and plume is essential in determining the numbers of returning adults. This is an important recognition since historically the focus has been on salmon in riverine environments with the view of the estuary as simply something that salmon need to transit through. The paper moves beyond “whether” the estuary contributes to salmon viability, and focuses more on defining “what” the role of the estuary is.

The paper more broadly defines what constitutes “the estuary” to include the tidally influenced sections of the river to Bonneville Dam. The NMFS Biological Opinion (BiOp) on the operation of the Federal Columbia River Power System originally focused on defining the estuary as reaching River Mile 46. The new delineation is in keeping with the Lower Columbia River Estuary Partnership’s study area. The expansion allows for a greater flexibility for the Action Agencies when implementing the BiOp, particularly with regards to habitat restoration credits. The paper also adds considerable weight to the importance of the estuary in salmon recovery efforts.

As previously described, a primary focus of the paper is to evaluate and then rank four factors potentially limiting to salmon in the estuary: river flow, habitat, toxics, and Caspian tern predation. The factors were ranked low, moderate, or high with regards to their potential to improve salmon population status by changing or improving current conditions. The paper found that the role of river flow in creating, shaping and sustaining salmon habitats is essential. In particular, spring freshets and their corresponding habitat forming/sustaining processes and timing with relationship to downstream migration are identified as critical to salmon recovery.

With regards to habitat as a limiting factor, the paper found that the twin anthropogenic factors of flow regulation and the separation of the floodplain and tidal wetlands from the river via diking significantly reduced the amount of shallow water habitat available to juvenile salmonids.

The evaluation of toxics in the estuary focused on the relationship of toxic and salmonid usage of shallow water habitats. The paper concluded that toxic contaminants have a likely medium to high impact on recovery potential for salmon populations.
The role of the recently established Caspian tern on salmon recovery focused more on both the estuary and plume than the other three factors. The paper concluded that Caspian tern predation has a likely high to medium impact on recovery potential for salmon life history strategies that exhibit a stream type life history pattern and medium to low for salmon that exhibit an ocean type life history strategy.

In summary, the limiting factors analyzed in this paper are the least limiting for stream-type life histories that more regularly utilize the deep channel habitats of the estuary. The paper stresses the importance of river flow and shallow water habitat and the need for more regularly "wetting" of shallow water habitats to create conditions more likely to facilitate salmon recovery, particularly salmon with an ocean-type life history type. The most substantial role the estuary will play in salmon recovery is its contribution of structural complexity of habitats that are available to salmon and their range of life history diversity.

References

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