NOAA Fisheries Responses to Comments from the Sovereign Review of the 2013 Draft Supplemental Biological Opinion

Introduction

On September 9, 2013, NOAA Fisheries issued the 2013 Draft Supplemental Biological Opinion for the FCRPS for sovereign review and accepted information, comments, and suggestions for consideration in our final 2014 FCRPS Supplemental Biological Opinion (NMFS 2014, *hereafter* 2014 Supplemental Opinion).

NOAA Fisheries accepted comments on the draft Supplemental Opinion between September 9 and October 7, 2013. We received comments from 16 organizations, agencies, and tribes, and eight individuals. In addition, we received approximately 400 form letters. While NOAA reviewed all of the comments submitted and considered all of the submissions in its decision-making process, many of the comments were general in nature or duplicated other comments. These generalized comments do not lend themselves to a specific response, but were nevertheless considered. NOAA's decision documents, the 2008 FCRPS Biological Opinion (NMFS 2008a, *hereafter* 2008 BiOp), the AMIP (BPA et al. 2009), the 2010 FCRPS Supplemental Biological Opinion (NMFS 2010a, *hereafter* 2010 Supplemental BiOp), and the 2014 Supplemental Opinion are the primary documentation of NOAA's scientific and legal opinion and are also relevant in response to these comments.

This document summarizes comments received and responds to those comments to provide more specific information about NOAA's evaluation and opinion on the relevant topics. This Response to Comments supplements previous Response to Comment memoranda issued concerning comments on the 2008 BiOp and the 2010 Supplemental BiOp. Comments raised for this Draft of the 2014 Supplemental Opinion that also were raised regarding previous BiOps may be addressed by the earlier responses to comments.

A. Status of Salmon and Steelhead Species

Comment A-1 The state of Oregon commented [p.6] that it disagrees with NOAA Fisheries' conclusion that species status has not significantly changed because productivity (returns-per-spawner [R/S] and median population growth rate [lambda]) point estimates declined for most populations, and the BRT abundance trend declined for some populations.

Response A-1 NOAA Fisheries continues to conclude that species status has not significantly changed. NOAA Fisheries considered three sources of information in determining if species status has changed: recovery status reviews (i.e., a report to Congress on population and species trends and the most recent 5-Year Status Review); updated population-level jeopardy indicator metrics; and recent aggregate-population dam counts, aggregate-population smolt-to-adult returns (SARs), and forecasts of future aggregate-population returns. NOAA's determination was based on a combination of all three sources of information.

Specific to the indicator metrics, Section 2.1.1.1.1 *Method of Evaluating Continuing Relevance of Base Period Population-Level Jeopardy Indicator Metrics* and the subsection titled *How Does NOAA Fisheries Evaluate Whether the Extended Base Period Estimates Have Changed From the 2008 BiOp's Base Period Estimates?* describes the three factors that NOAA Fisheries evaluated in determining that the Base Period indicator metrics have not changed significantly with the addition of several new years of data.

The first was a comparison of point estimates, which in addition to indicating that average productivity has been lower than estimated in 2008 for most populations, as referenced in Oregon's comment, also showed that extinction risk was unchanged or lower than in 2008 for nearly all populations; abundance trend was higher for most populations; and the related measure of average abundance had increased for all Chinook and nearly all steelhead populations.

Second, statistically, both the indicator metrics that were higher and the metrics that were lower than 2008 estimates were within the range of uncertainty described in the 2008 BiOp for nearly all populations.

Finally, the need to explain why abundance and overall extinction risk improved for most populations, but average productivity decreased, led to a formal statistical analysis of density dependence, which was described in the 2008/2010 BiOps and predicts that interference and competition at high spawner abundance levels leads to lower survival during early life stages and lower overall productivity for those specific brood years. An analysis by the Northwest Fisheries Science Center (Appendix C in the 2014 Supplemental Opinion) demonstrated statistically significant density-dependent relationships for most populations. For Chinook, those tests provided "no support for the hypothesis that recent conditions are less productive than those experienced during the Base Period," and for steelhead they provided "little support" for that hypothesis.

When NOAA Fisheries evaluated all sources of information (2.1.1.8 *Discussion—Relevance of Updated Status of Interior Columbia Basin Salmon and Steelhead to the*

2008/2010 BiOps' Analyses), including the three considerations relevant to indicator metrics, we determined that the overall evidence led to a conclusion that the species status has not changed significantly.

Comment A-2 NWF/SOWS expressed skepticism that density dependence actually is occurring in any listed populations because of small population sizes.

Response A-2 Please see discussion of this comment in Section 2.1.1.5.3 Results—*Comparison of Extended Base Period Metrics with Estimates in the 2008 BiOp*, subsection *The Influence of Density Dependence*. The analysis in Appendix C speaks for itself in refuting this comment. Additionally, the ISAB (2013a) reviewed the June 2013 AMIP model documentation, which included similar analyses for many of the same interior Columbia basin populations, and noted that:

> Several statistical models provide strong empirical support for density dependent survival (Sections 2.1, 2.4, Chapter 4). This evidence provides support for the need to increase capacity and productivity of tributary habitats as a means to enhance salmon survival and abundance. As noted in previous ISAB/ISRP documents (e.g., ISAB 2011-4, ISRP 2011-14, ISRP 2013-11), evidence of strong density dependence in watersheds experiencing low population abundances relative to historical levels can be used to guide restoration efforts. For example, populations expressing steep density-dependent relationships at relatively low population densities could be targeted for potential restoration efforts. Likewise, a reduction in density dependence following restoration efforts may provide evidence of progress.

Comment A-3 NWF/SOWS, the Nez Perce Tribe, and Oregon commented that Base-to-Current survival changes identified in the 2008 BiOp, as well as some effects of RPA implementation, should be detectable in the Extended Base Period indicator metrics. This means that NOAA Fisheries should have compared the Extended Base Period indicator metric estimates to a level higher than the original Base Period estimates. The commenters refer to NOAA's decision not to do this as "shifting the baseline." NWF/SOWS, in a related comment, state that the Sovereign Draft BiOp makes no effort to determine whether the predicted population-level survival improvements for either the Base Period or the prospective actions (RPA) have materialized and are reflected in changes in population metrics.

Response A-3 Please see discussion of this comment in Section 2.1.1.1.1 *Method of Evaluating Continuing Relevance of Base Period Population-Level Jeopardy Indicator Metrics*, subsection titled *How Does NOAA Fisheries Evaluate Whether the Extended Base Period Estimates Have Changed From the 2008 BiOp's Base Period Estimates?*, and sub-subsection *Other Considerations*.

Effects of Base-to-Current survival changes are clearly resulting in survival changes for certain life stages, as reviewed in Section 2.2 (especially for the significant hydro and harvest changes, which are quantified through monitoring). However, detection of

Base-to-Current changes in the indicator metrics is very uncertain at this time.

This is in part because, even for Base-to-Current management changes that have already occurred, some associated survival changes may be achieved quickly (e.g., in response to a change in a dam structure that immediately affects the survival of migrating juveniles) while others may take years to be fully achieved (e.g., in response to a tributary habitat action involving revegetation).

There is also a lag (up to 3-4 years) in completing all adult returns for a particular brood year that has been affected by a life-stage survival change. As described in Section 2.1.1.4.2, the most recently completed brood year that is currently available is 2005, 2006, or 2007, depending upon species and population. This means that the "current" management practices in place at the time the 2008 BiOp was prepared will only be partially reflected in the most recent indicator metrics.

Additionally, as described in *Consideration of Natural Variability and Uncertainty*, a sufficient number of new observations must accumulate to change the indicator metrics, which are calculated from all observations, including 20 or more Base Period observations.

Finally, natural variability creates background variation in other survival factors, which may mask or artificially enhance the effects of the current and prospective management actions. For these reasons, we rely primarily on evidence indicating survival changes in particular life stages to evaluate the continued validity of the 2008 BiOp's Base-to-Current survival change estimates. The information supporting these estimates is reviewed in Section 2.2 *Environmental Baseline*.

NOAA Fisheries also disagrees that survival changes associated with implementing the RPA should be detectable in the Extended Base Period metrics. No changes resulting from RPA implementation are expected to be reflected in available BiOp indicator metrics. This is because the most recently-completed brood year is 2005, 2006 or 2007, depending upon population (Tables 2.1-3 and 2.1-4), most RPA actions primarily affect juvenile survival, and the juvenile rearing and migration years contributing to the most recent brood year returns generally precede 2008 BiOp RPA implementation. At most, the first year of 2008 BiOp implementation would be relevant for some populations. The 2008 BiOp's implementation expectations at this point in time are best described in the 2013 Comprehensive Evaluation reporting requirements (RPA 3 and throughout the RPA for each action) and do not include expected changes in 2008 BiOp indicator metrics.

Comment A-4 Oregon claims that NOAA Fisheries changed the initial year of the SR fall Chinook baseline from 1977 in the 2008 BiOp to 1990 in the Sovereign Review Draft, thereby "shifting the baseline" and introducing bias into the status assessment.

Response A-4 This assertion is not correct. Please see 2.1.1.1.1 *Method of Evaluating Continuing Relevance of Base Period Population-Level Jeopardy Indicator Metrics* subsection *What Are Base Period and Extended Base Period Estimates of the Indicator Metrics?* Because of unique considerations relevant to SR fall Chinook (ICTRT 2007a), we relied on both a shorter and longer-term period for this species' Base Period analysis in both the 2008

BiOp and in this Supplemental Opinion. Contrary to Oregon's comment, we did not "shift" from analyzing a Base Period beginning in 1977 in the 2008 BiOp to a Base Period beginning in 1990 in this Supplemental Opinion. We included a Base Period analysis that was based both on brood years 1977–2001 and 1990–2001 for the reasons the ICTRT (2007a) presented for doing the same in their recovery survival gap analysis:

> By definition, the longer series captures more of the potential year-to-year variations in survival rates, but it also bridges across two distinctly different sets of in-river conditions and hydropower operations. The more recent period (1990-2001) corresponds to a period of relatively consistent harvest and hydropower operations with reduced impacts on Snake River fall chinook. It is difficult to separate variations in ocean survivals from potential changes in hydropower impacts without comparative measures of juvenile passage survivals under current operations or a representative measure of ocean survival rates. ...At this time, it is reasonable to assume that the current A/P [abundance and productivity] Gap falls within the range defined by the two recent scenarios.

Comment A-5 NWF/SOWS state that NOAA has done a "sleight-of-hand" by shifting from emphasis on point estimates to an emphasis on confidence intervals.

Response A-5 No – NOAA Fisheries considers both point estimates and confidence intervals, as well as other factors, in making its determination. Please see Section 2.1.1.1.1 *Method of Evaluating Continuing Relevance of Base Period Population-Level Jeopardy Indicator Metrics*, subsections titled *How Is Uncertainty of the Estimates Treated?* and *How Does NOAA Fisheries Evaluate Whether the Extended Base Period Estimates Have Changed From the 2008 BiOp's Base Period Estimates?*

The primary method that NOAA Fisheries uses to evaluate Base Period vs Extended Base Period indicator metric estimates is whether point estimates for the various metrics have changed. This is a simple approach analogous to the 2008 BiOp's comparison of indicator metrics to the prospective goals, as described previously.

While the comparison of point estimates is important, it does not provide a complete picture of the current status relative to the estimates in the 2008 BiOp. Two factors that also must be considered are natural variability (uncertainty) and the process of density dependence, which can result in reduced productivity when spawner abundance is high. The 2010 Supplemental BiOp evaluated each of these factors, which played a significant role in reaching conclusions. The 2014 Supplemental Opinion also evaluates these factors, including a more formal statistical analysis of the effects of density dependence.

Uncertainty in the estimates can result from high variability in spawner numbers, which is a hallmark of Columbia basin salmon populations (e.g., Hinrichsen 2001), and natural variability in the freshwater and marine environments that influence salmon survival (see review of recent climate factors in Section 2.1.4). The point estimates calculated for the 2008 BiOp Base Period indicator metrics tended to have wide statistical confidence intervals, reflecting this variability and uncertainty, as do the new

Extended Base Period estimates. Statistical tests can determine if a new estimate of a BiOp indicator metric has changed significantly. If there is little or no overlap in the confidence limits for each estimate (i.e., if they are relatively narrow and distinct), a statistical test such as a t-test is likely to indicate that there is a statistically significant difference between them and identify the probability that this conclusion could be wrong (usually 5% or less). If there are wide confidence intervals and overlap, particularly if the second point estimate falls within the confidence interval of the first estimate, the test would not indicate that the metric has changed. This approach is useful for identifying when a significant change in a BiOp metric has occurred and is therefore relevant to the analyses in this Supplemental Opinion. We describe whether a new estimate is within or outside of the 2008 BiOp's confidence intervals for each metric.

While this approach is a useful way of describing if a statistically significant change in a BiOp indicator metric has occurred, it may be of limited utility in determining that a change has not occurred. If the sample size is too small or if variability in the data is too high, it may not be possible to detect a true change, even if one has occurred. This is referred to as the statistical "power" of the analysis, which is generally weak for BiOp analyses because of the relatively few years of observations and the high variance in those observations. Additionally, because of the method of calculating the Base Period and Extended Base Period metrics, each period has a high percentage of common observations (20+), which also makes it difficult to detect a difference between estimates. For these reasons, we do not rely solely on results based on the relation of new means (i.e. point estimates) to the confidence intervals of the previous estimates.

In summary, high variability and relatively few observations makes it difficult to prove statistically whether a new indicator metric estimate represents a change from the previous estimate. We calculate and consider relevant statistical information, but rely on a combination of several sources of information (including comparison of point estimates and consideration of density dependence). Additionally, as described in Response #1, NOAA Fisheries considered information additional to the population indicator metrics in reaching its determination of whether species status has changed. Other factors include recovery status reviews (i.e., a report to Congress on population and species trends and the most recent Five-Year Status Review), recent aggregate-population dam counts, aggregate-population SARs, and forecasts of future aggregate-population returns.

Comment A-6 NWF/SOWS recommends that NOAA Fisheries require the lower end of the confidence intervals to be above the goal in order to conclude that the goal has been, or is likely to be, met. This would essentially require 95% certainty of meeting the goal.

Response A-6 NWF/SOS has previously raised this issue in litigation and NOAA Fisheries has responded. We incorporate all previous responses by reference. For example, Response 2-L in the 2008 Response to Comments (AR C.1155) stated:

> The ESA does not specify a particular risk level for making an ESA § 7(a)(2) decision. The metrics NOAA Fisheries considered in this analysis are means or medians, which have at least a 50% probability of being above 1.0. NOAA Fisheries continues to display 95% confidence intervals where possible and, as discussed in Chapter 8 for each species, variability in the observed data leads to the lower 95% confidence interval generally being below 1.0 and the upper limit generally being above 1.0. As discussed in Section 7.1.1.2, NOAA Fisheries has included the probability that lambda will be above 1.0 in the Aggregate Analysis Appendix, in response to Oregon's and others' comments regarding uncertainty of estimates. It was calculated, using the methods in (McElhany and Payne 2006). NOAA Fisheries did not adopt a particular statistical standard and displays this metric [probability that lambda will be above 1.0] only for comparison with alternative goals recommended by others. This metric was calculated only for lambda estimates [although it is also calculated for BRT trend in trend in the Supplemental Opinion], but because of the range of hatchery assumptions in the lambda calculations, the results are similar to those expected from both the R/S and BRT trend estimates.

Additionally, in response to the second reply declaration of Edward Bowles, which stated that estimates of recovery prong metrics for which the lower 95% confidence interval was less than 1.0 indicate that "it is uncertain" whether the standard has been met, Point 12 in the 2008 Reply Declaration of Christopher Toole states:

> Mr. Bowles' Paragraph 7 states that estimates of recovery prong metrics for which the lower 95% confidence interval was less than 1.0 indicate that "it is uncertain" whether the standard has been met. This statement appears to acknowledge that unless there is 100% statistical certainty, a quantitative estimate is "uncertain," which is not particularly informative. However, it leaves the impression that there must be 95% certainty for the estimate to be valid for the recovery prong of the jeopardy standard, which is not true. Oregon raised this point during the public comment period for the BiOp and NOAA Fisheries responded to it in its Response to Comments. See Response 2-L of NOAA AR C.1155. Briefly, NOAA Fisheries did not base its decision solely on quantitative estimates, nor on a pass/fail criterion associated with meeting indicator metric goals with 95% confidence. NOAA Fisheries based its conclusions, in part, on quantitative estimates (means, medians[2]) for the survival and recovery metrics, while additionally considering the uncertainty associated with those estimates. 95% confidence limits were calculated and displayed for all metrics and the probability of the metric being above 1.0 was calculated and displayed for lambda under both the HF=0 and HF=1 hatchery assumptions3, which yield similar results to the BRT trend and R/S estimates, respectively (BiOp pages 7-24 and 7-25). These uncertainty estimates allowed NOAA Fisheries to understand the range of uncertainty associated with the

quantitative estimates when reaching its conclusions.

[2] See also 2008 Declaration of Rich Hinrichsen at Paragraph 8: "But, the estimates developed for the BiOp use maximum likelihood estimation, which is standard in statistical practice. The point estimates represent the most accurate estimates possible for comparison with the standard (e.g. 1.0 for trend, or 5% for extinction probability)."

Comment A7 National Wildlife Federation and Save Our Wild Salmon (NWF/SOWS) and the state of Oregon criticize the analysis for emphasizing average abundance and de-emphasizing the 2008 BiOp indicator metrics, such as returns-per-spawner (R/S). They also state that there are shortcomings in the average abundance metric, calling it a "snapshot" and that changes in abundance merely reflect annual variation.

Response A7 NOAA Fisheries does not place greater emphasis on abundance than on R/S, but does consider it important to report spawner abundance when describing the current status of the species. Spawner abundance is the starting point for calculation of all other metrics. The 2008 BiOp included calculations of the most recent 10-year geometric mean of natural-origin spawners as one of the descriptors of the status of species (e.g., see Table 8.3.2-1 and associated narrative in Section 8.3.2.1 for Snake River spring/summer Chinook). The 10-year geomean abundance reported in the 2008 BiOp were taken from ICTRT (2007a) and the use of 10-year geomeans to describe current abundance follows the ICTRT convention. The most recent Five-Year Status Review for interior Columbia River salmon and steelhead (Ford 2011) also included 10-year geometric mean abundance estimates. Both the 2010 Supplement and the 2014 Supplemental Opinion update those mean abundance estimates and compare them to the ICTRT recovery abundance thresholds and to the previous estimates in the 2008 BiOp. Section 7.1.1.2 of the 2008 BiOp also described discussions with Nez Perce Tribal staff, who stated that they were interested in tracking abundance during implementation of the RPA.

As stated in Section 2.1.1.1.1 *Method of Evaluating Continuing Relevance of Base Period Population-Level Jeopardy Indicator Metrics*, subsection *How Are the Base Period and Extended Base Period Metrics Calculated? -Spawners*,

> "average abundance is important to track as an element of species status because it indicates current status relative to recovery abundance goals and because we can determine if a population is getting closer to the recovery goals over time. (Note that the trend in abundance and prospective adjustment in that trend is captured in the BRT abundance trend indicator metric described below). Population-level jeopardy indicator metrics are quantitative metrics (calculated numbers) indicative of the 2008 BiOp's application of the jeopardy standard, as described in Section 1 of this Supplemental Opinion and Section 7.1 of the 2008 BiOp, and in the following subsections. The 2008 BiOp considered the quantitative metrics and other relevant data in making a qualitative judgment on whether the RPA is likely to jeopardize six interior Columbia species or adversely modify critical habitat. Each metric and consideration—like average abundance—shows something relevant to the inquiry. All factors, including abundance data, inform a

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> qualitative assessment of the survival and recovery prongs of the jeopardy standard."

The 2014 Supplemental Opinion focuses primarily on the indicator metrics and whether or not they have changed from the 2008 BiOp estimates. Response #1 above addresses how NOAA Fisheries made that determination. Abundance was particularly important in this analysis, primarily as a means of interpreting the significance of new estimates of mean R/S productivity, which declined for most populations. A statistical analysis of the relationship between R/S and total abundance showed that density dependence largely explained these results. In this analysis, abundance is not more important than R/S, but it is important for understanding the pattern of R/S and whether it was within the expectations of the 2008 BiOp.

Regarding variation in spawner abundance, the 2014 Supplemental Opinion, as well as the 2008/2010 BiOps, describes the uncertainty associated with the abundance estimates in the same manner as it is described uncertainty for the indicator metrics (confidence intervals). One need only look at Figures 2.1-22 and 2.1-24 to see that there is considerable variation in both abundance and in indicator metrics such as R/S. The main difference is that geomean abundance is estimated from a 10-year period of observations, consistent with the ICTRT and Five-Year Review estimates, while the other metrics are estimated from observations over a longer period beginning in approximately 1980. The BRT abundance trend indicator metric reflects abundance over the longer period and shows an improvement over the point estimates in the 2008 BiOp for most populations, consistent with the increase in geometric mean abundance.

Comment A8 Oregon and NWF/SOWS suggested adding a new SAR metric to the BiOp analysis. It was recommended as a hydro performance metric and Oregon recommended that the SAR target be linked to an estimate of smolts-per-spawner in order to achieve a goal of adult-to-adult survival of 1.0 or greater.

Response A8 Please see the discussion in 2.1.1.6.4 *Results - Smolt-to-Adult Return Ratios*. Smolt-to-adult return ratios represent the survival of salmon from the smolt stage at a particular location in the freshwater environment through adults returning to either the same location, or to another location selected to factor out certain mortality sources (e.g., smolts at Lower Granite Dam to adults returning to the mouth of the Columbia River to remove inriver harvest and upstream passage mortality [Petrosky et al. 2001]). Depending upon the exact reference location(s), it represents survival through at least a portion of the juvenile freshwater migration corridor, the estuary, the ocean, and (generally) at least a portion of the adult freshwater migration corridor.

The state of Oregon recommended that NOAA Fisheries "add a SAR metric to measure the full effects of the FCRPS" and suggested a method of setting SAR goals by linking them to estimates of smolts-per-adult estimated at the same reference location. The basic idea of the suggested goal is that if, for example, 100 smolts are produced for each adult, survival from the smolt to adult stage (SAR) must be at least 1% for R/S=1 (i.e., 100 smolts * 0.01 = 1 returning adult). If there are only 50 smolts/adult, SAR would have to be 2% for R/S=1.0, and the SAR would have to be increasingly higher as

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smolts/adult declined below 50. Grande Ronde MPG population data provided an empirical interior Columbia basin example of combinations of smolts/adult and SARs, relative to a curve of combinations resulting in adult-to-adult replacement of 1.0 at the reference location (similar to R/S = 1.0 if survival to and from the spawning ground is constant).

NOAA Fisheries has not adopted SAR as a hydro performance standard (see Section 3.3.3) because most of the mortality in this life stage occurs in the estuary and ocean, outside of the FCRPS. The degree to which mortality in the estuary and ocean is caused by the prior experience of juveniles passing through the FCRPS (i.e., delayed or latent mortality) is unknown and hypotheses regarding the magnitude of this effect vary greatly (e.g., ISAB 2007a). Our decision not to treat SAR as a hydro performance standard is consistent with its use as a basinwide biological objective by the Northwest Power and Conservation Council (NPCC 2009 p. 39; Hydrosystem improvements are to "Contribute to achieving desired smolt-to-adult return rates (SARs) described in the basinwide biological objectives") and with the original recommendation of the PATH analytical group (Marmorek 1996, p. 6–23):

> We suggest an interim smolt-to-adult return (SAR) of 2-6%, which includes direct and delayed hydro mortality, as well as mortality unrelated to hydro effects. Because this goal includes effects of other human activities and environmental variability, it is not defined as a hydro goal.

However, SAR can be a useful indicator of the status of a species and for that reason we present Base Period and more recent estimates of SAR in the 2014 Supplemental Opinion. SAR essentially depicts a significant component of the R/S survival metric and can illuminate the degree to which changes in R/S correspond to changes in migration corridor and estuary/ocean survival versus changes in tributary spawning and rearing survival.

NOAA staff met with ODFW staff to better understand the Grande Ronde MPG example in their comments and determined that it is not feasible to make similar estimates for most other populations at this time. In that example, the site for assessing smolts and adults is a weir in the lower Grande Ronde Basin and a time series of smolts/adult and population-specific SARs exist for that site. Similar information does not currently exist for most interior Columbia basin populations, so we decided to use generic SARs for aggregate populations of SR spring/summer Chinook and SR steelhead. Figure 2.1 of Oregon's comments presented aggregate SAR estimates from the mid-1960s to about the 2006 migration year, adopted from Tuomikoski et al. (2013). We present the original figures from Tuomikoski et al. (2013), which include preliminary SARs through 2010, as Figures 2.1-30 and 2.1-31. These SARs are based on estimates of smolts arriving at the upper-most dam (Ice Harbor initially and Lower Granite since 1975) and adults returning to the Columbia River mouth, so they do not include mortality between the river mouth and the upper dam associated with in-river harvest, marine mammal predation, and adult dam passage. Therefore, additional information is needed to relate these SARs to smolt production and R/S goals. However, they are useful for showing the pattern of combined survival through juvenile migration, the estuary, and ocean.

The pattern of SR spring/summer Chinook SAR's corresponds closely to the pattern of

survival and ocean conditions described in Section 2.1.1.5.3 *Results - Comparison of Extended Base Period Metrics with Estimates in the 2008 BiOp - Overview of Patterns of Abundance and Productivity*, particularly the poor ocean entry conditions in 2003–2005, the good entry conditions in 2008, and the poor conditions in 2010. An exception is 2002, when fish experienced good ocean entry conditions but had a more intermediate SAR level. For SR steelhead, SARs are considerably higher than for SR spring/summer Chinook, including during the Base Period in the 1980s and late 1990s, as well as in some of the more recent years. The steelhead SAR pattern is similar, but not identical, to that of Chinook.

Comment A9 Oregon questioned the validity of the Tucannon River SR spring/summer Chinook abundance data used in the BiOp calculations because of potentially skewed sex ratios reported in one study (Gallinat and Ross 2012).

Response A9 Please see Section 2.1.1.5.1 *Results - New Information in Northwest Fisheries Science Center Salmon Population Summary Database*. Brick (2013) explains that:

> NOAA Fisheries uses data directly out of this report [Gallinat and Ross 2012] as published by WDFW each year. In the 2012 WDFW report, Table 11 (Estimated spring Chinook salmon run to the Tucannon River, 1985-2011) provides estimated abundance as 'total run size' with broodstock and pre-spawning mortalities removed. NOAA Fisheries data in SPS reflects the data in this table for abundance, which is calculated by expanding redd counts through weir mark recapture to obtain a fish per observed redd count. WDFW does not report a sex ratio for total spawner abundance because they do not have the data to provide confidence in an estimate of that.
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> For fecundity calculation purposes, WDFW also reports 'number of natural females in river' based solely on redds observed (Table 19. Estimates of natural in-river produced Tucannon spring Chinook salmon (both hatchery and natural origin parents) abundance by life stage for 1985-2011 broods). The average number of natural females in the river, which is what ODFW brings up, is not based on the expanded total run size, but only on redd counts. They are not intended for use as total abundance numbers and are not directly comparable to the estimated abundance WDFW reports and NOAA Fisheries uses.

Comment A10 The state of Idaho commented that the assumption that hatchery-origin natural spawners are ineffective (HF=0) is outside the range of reasonable assumptions when calculating the median population growth rate (lambda) indicator metric, citing a review of recent literature in the draft 2014 Supplemental Opinion.

Response A10 Please see Section 2.1.1.1.1 *Method of Evaluating Continuing Relevance of Base Period Population-Level Jeopardy Indicator Metrics - How Are the Base Period and Extended Base Period Metrics Calculated?- Median Population Growth Rate (Lambda).* NOAA Fisheries evaluated a range of assumptions regarding the effectiveness of hatchery-origin spawners when calculating the lambda indicator metric. One end of the range assumes that the hatchery-origin spawners are not contributing to the subsequent generation, either because they are unable to reproduce successfully or because their progeny do not survive. We denote this assumption as HF=0 (hatchery-origin spawner reproductive effectiveness is zero). We also calculated lambda under the assumption that hatchery-origin spawners contribute just as much to the next generation as natural-origin spawners (HF=1). We do not know how effective hatchery-origin spawners are compared with natural-origin spawners for most populations, so these assumptions bookend the possibilities and we include lambda estimates under both assumptions to capture the complete range. Idaho's contention that HF=0 is outside the range of probability is based on the discussion in Section 3.4.3.1. The review in Section 3.4.3.1 does not cover all literature or represent expected effectiveness of hatchery spawners for all populations. We rely on the full range of assumptions (0% to 100% effectiveness), which is consistent with the calculation of lambda in NOAA Fisheries' status reviews (Good et al. 2005; Ford 2013).

Comment A11 The state of Idaho commented that NOAA Fisheries should have included indicator metrics for five additional steelhead populations.

Response A11 Please see Section 2.1.1.5.1 *Results - New Information in Northwest Fisheries Science Center Salmon Population Summary Database*. Empirical information for SR steelhead is restricted to three populations (Table 2.1-4), which was also the case for the 2008 BiOp. Idaho's comment on the draft Supplemental Opinion indicated that NOAA Fisheries did not report existing population information for additional SR steelhead populations. Three of the data sets mentioned (Crooked River, Red River, and Rapid River) do not correspond to populations defined by the ICTRT. NOAA Fisheries did not include estimates for the Pahsimeroi and Upper Salmon steelhead populations because those datasets represent only a subset of the populations, as explained by Cooney (2013):

> Both the ICTRT population status reviews and the most recent five year NWFSC reviews focused primarily on data series representative of spawning escapements at the ICTRT population level. The population level data sets used in those reviews, updated to include additional years information and any changes to the historical series that may be appropriate, are maintained in the NWFSC Salmon Population Summary data base. As noted above, there were insufficient data to construct series for most Snake River steelhead populations. In some cases escapement or spawner abundance series

representing a portion of a population can be obtained. When the ICTRT constructed the population level data sets for Snake River steelhead, consideration was given to the potential for expanding from a subarea series to the aggregate population level. We specifically considered the weir count series in the Pahsimeroi River and the Sawtooth weir data series in the Upper Salmon River. In both cases we decided not to expand the series to represent the populations they were components of given evidence that the escapements above those weirs may not be representative of population as a whole due to the potential for large differences in subarea hatchery contributions and differences in habitat conditions between the areas above the weir and the remaining areas in each of those populations. It may be possible to incorporate those data series (and other similar sets) into population level data series in future assessments by combining them with additional information gained from the newly initiated genetic and PIT tag based annual monitoring efforts. We will be specifically exploring that possibility as we work to compile updated population level or population subgroup estimates for use in the next five year review.

Comment A12 Oregon commented that NOAA Fisheries' analysis does not consider demographic risk associated with low population abundance.

Response A12 The extinction risk indicator metric that informs the survival prong of the jeopardy standard for interior Columbia basin species explicitly considers demographic risk associated with low abundance. Extinction risk was the same or lower than the risk estimated in the 2008 BiOp for most populations (2.1.1.5.2 *Results – Extended Base Period Productivity and Extinction Risk Indicator Metrics Calculated From Updated Population Information - 24-Year Extinction Risk*). The extinction risk estimates presented in Tables 2.1-7 and 2.1-8 consider extinction to occur at a quasi-extinction threshold (QET) of 50 fish, which the ICTRT (2007b) recommended for long-term (100-year) extinction risk analysis. The ICTRT chose this level, in part, to capture uncertainty of population performance at low population abundance, such as random effects and processes that can drive a small population to zero (demographic stochasticity) and an inability to find mates at low density (Allee effects). As noted in the 2008 BiOp Section 7.1.1.1, NOAA Fisheries relied primarily on a QET of 50 fish, but also considered a sensitivity analysis to alternative lower QETs (presented in Appendix B of the 2014 Supplemental Opinion) because some populations (e.g., Sulphur Creek) have dropped below 50 spawners over four years and have not gone extinct, so lower QETs may be appropriate for estimation of short-term extinction risk. The extinction risk estimates also assume that supplementation ceases immediately, which the 2008 BiOp identified as a conservative assumption for populations influenced by continuing supplementation. The 2008 BiOp included sensitivity analyses that showed that short-term extinction risk was extremely low in these circumstances, so qualitatively considered the presence of safety-net hatcheries in reaching conclusions for affected populations.

B. Climate Change

Comment B-1 NWF/SOWS commented that NOAA Fisheries refuses to consider climate impacts beyond 2018.

Response B-1 The 2008/2010 BiOps and this Supplemental Opinion considered climate effects on the future status of habitat and species, taking into account an appropriate time period consistent with the duration of effects of the RPA.

Qualitatively, the 2008/2010 BiOps and the 2014 Supplemental Opinion reviewed and considered climate literature based on past observations as well as predictions through the end of the 21st century. The conclusion of this review is clear: climate change is occurring and will continue, further impairing critical habitat and reducing survival of listed salmon and steelhead in the Columbia basin. Most projections are summarized for time periods in the 2020s, 2040s, 2060s, and 2080s, with progressively greater changes from past averages projected for each successive time period.

Qualitative treatment of climate change in the 2008 BiOp is described in Section 7.1.2 *Population-Level Qualitative Analytical Methods for all Thirteen Columbia Basin Species*, subsection 7.1.2.1 *Climate Change Considerations for Both the Survival & Recovery Prongs of the Jeopardy Analysis*. Briefly, the primary qualitative method NOAA Fisheries uses to evaluate the RPA is to determine the degree to which the RPA implements recommendations by the ISAB (2007b) to reduce impacts of climate change on anadromous salmonids. The specific recommendations against which the RPA is evaluated are described in Table 7.1.2.1-1 and include approaches such as implementing habitat actions that will minimize temperature increases in tributaries by implementing measures to retain shade along stream channels and augment summer flow, as well as monitoring actions (including additions in the AMIP). The Supplemental Opinion reviewed recent scientific literature that addresses actions that support salmon and steelhead adaptation to climate change (e.g., Beechie et al. 2012; Section 2.1.4.3 *Updated Climate Change Information Since the 2010 Supplemental BiOp*) and reviewed the Action Agencies' implementation of RPA actions that support climate change adaptation (3.9 RPA *Implementation to Address Effects of Climate Change*). NOAA Fisheries continues to conclude that sufficient actions consistent with the ISAB's (2007b) recommendations for responses to climate change have been included in the RPA and are being implemented by the Action Agencies as planned. Section 2.1.1.2 of the Supplemental Opinion previously concluded that the ISAB (2007b) recommendations are consistent with new scientific literature regarding climate change adaptation for Pacific salmon and steelhead.

Climate change was considered quantitatively for six interior Columbia basin species. The survival "gaps" for indicator metrics take into account that future ocean climate will be worse for salmon and steelhead survival than historical climate conditions have been. We primarily relied upon a climate scenario of 1980-2001 ocean conditions that was considerably less favorable to salmonid survival than the longer-term historical average (1946-2001; 2008 BiOp Sections 7.1.1 and 7.1.1.3). The Supplemental Opinion reviews actual ocean conditions over the years subsequent to 2001 (Section 2.1.4.1 *Recent Climate Observations*) and demonstrates that ocean conditions have generally

been similar or more favorable to salmon and steelhead survival than the 2008 BiOp's ocean climate scenario.

The 2008 BiOp did not quantitatively model freshwater survival because of uncertainty in the available analysis and relevance of predictions of survival changes in the 2040s to the RPA (2008 BiOp Section 7.1.1). An updated analysis continues to support this determination (Crozier and Zabel 2013; see discussion in Section 2.1.4.5 *Biological Effects of Climate Change on Salmonids*). The most recent climate downscaling and hydrological models predict that, although summer stream temperatures will increase, fall precipitation may also increase in the Salmon River basin, reducing some of the impact from rising air temperatures. The Crozier and Zabel (2013) analysis found that four of the nine populations evaluated responded negatively to warmer historical temperatures, four had neutral or slightly positive responses, and one population in a very cold stream showed a positive response in warmer years. In model projections that included climate change, abundance declined in five of the populations, but the remaining populations stayed about the same on average across models, or increased. The impact of population declines on the extinction risk within 25 years was minor for all but one population. The study concluded that "there are still many unknowns at both the individual and community level. So our results should not be used as predictions for final decision making." Therefore, the 2014 Supplemental Opinion treats freshwater effects of climate change qualitatively, as described above.

Temporal considerations in the 2008 BiOp and the Supplemental Opinion are reviewed in Section 2.1.1.1.1 *Method of Evaluating Continuing Relevance of Base Period Population-Level Jeopardy Indicator Metrics*, under the questions *What Are Base Period and Extended Base Period Estimates of the Indicator Metrics?* and *How Are Base Period Indicator Metrics Adjusted to Reflect Expected Survival Changes?* The short-term extinction risk indicator metric has the most straightforward temporal period: 24 years, which clearly extends beyond 2018. Climate change is explicitly incorporated into these estimates by assuming that 1980–2001 ocean conditions continue to reduce survival, compared to ocean survival over a longer historical period, during that full time period. As described above and in Section 2.1.4.1, a review of ocean conditions from 2001-2013 indicates that has been a conservative assumption to date. Although the extinction risk analysis did not quantify freshwater climate change, even if it had been it would likely have had little effect on 24-year extinction risk because Crozier and Zabel (2013) reported minor changes in extinction risk within 25 years for eight of nine populations of SR spring/summer Chinook.

For the recovery prong estimates, it is more difficult to identify an exact time period associated with the effects of the RPA as represented by the productivity indicator metrics. As described in Section 2.1.1.1.1:

> The 2008 BiOp's simpler proportional survival change method does not predict a specific change in a BiOp metric at a particular date in the future. Base-to-Current and Current-to-Prospective survival ratios each represent a single aggregate change that would be expected once an action is completed and its biological effects on the species have occurred. Although the survival ratio essentially represents a single time step (Section 1.1 of the 2008 BiOp, p. 7-12), there is not one specific date at which this change actually will occur because of the RPA action implementation schedule (through 2018) and

> because, even for Base-to-Current management changes that have already occurred, some associated survival changes may be achieved quickly (e.g., in response to a change in a dam structure that immediately affects the survival of migrating juveniles) while others may take years to be fully achieved (e.g., in response to a tributary habitat action involving revegetation). The BiOp reduced its reliance on longer-term survival changes by including in Current-to-Prospective estimates only tributary habitat survival improvements that are expected to accrue on a time frame of 10 years or less (see discussion of "Pessimistic Assumptions" in the analysis on page 7-31 of the 2008 BiOp), but this still precludes predicting exactly when a survival change will occur.
>
> The 2008 BiOp productivity estimates represent the initial productivity following achievement of the expected survival rate changes resulting from RPA implementation (and, as described above, the proportional change method does not predict exactly when this will occur). As described in the 2008 BiOp Section 7.1.1.2, there is a relationship between abundance and productivity, such that abundance will increase following a change in survival and productivity. However, as abundance increases, density-dependent interactions will also increase, which will reduce average productivity over time. Therefore, the estimates of average prospective productivity calculated in the 2008 BiOp analysis are not expected to be maintained indefinitely and over time will be reduced to a lower rate as abundance of spawners increases.

While the exact time periods associated with the productivity metrics are not explicit, ocean climate change is considered during that full period, just as it is in the extinction risk estimates, since continuing poor 1980–2001 ocean conditions are reflected in the estimates. Because the RPA is being implemented through 2018, so that some associated survival changes won't occur until 2018 or later, the metrics represent productivity (including climate assumptions) that extends beyond 2018.

Comment B-2 NWF/SOWS commented that climate change impacts are "greater and more immediate" than considered in the 2008 BiOp, not "generally consistent with expectations of the 2008 BiOp."

Response B-2 We disagree with the commenters' opinion. NOAA Fisheries reviewed climate and climate change information in the 2014 Supplemental Opinion (Section 2.1.4 and Appendix D), the 2010 Supplement BiOp (Section 2.2.1), and the 2008 BiOp (Sections 5.7, 7.1.1, and 7.1.2) and responded to that information in crafting an RPA that takes the continuing effects of climate change into account (both by quantitative methods per 7.1.1 and qualitative per 7.1.2 and 8.1.3). Based on this review, NOAA Fisheries concluded that the RPA adequately addresses climate change concerns.

Comment B-3 NWF/SOWS commented that the climate analysis in the Sovereign Review Draft was incomplete, in part because the 2012 literature review (Crozier 2013) was not available and because "there is no indication that NOAA has or will complete a similar review of literature published in 2013."

Response B-3 Although the 2012 literature review was not ready for distribution with the Sovereign Review Draft, NOAA Fisheries staff had access to a preliminary draft that informed the discussion of climate change in the document. That final version of that review is included in the 2014 Supplemental Opinion, Appendix D. As described in Section 2.1.4.3, NOAA Fisheries will continue to update annual literature reviews as an element of AMIP implementation (see AMIP III.F), with a full review of 2013 literature available by summer 2014. NOAA Fisheries reviewed available 2013 scientific literature, examples of which are referenced in Section 2.1.4.3.

Comment B-4 NWF/SOWS commented that NOAA Fisheries double-counts the climate adaptation actions. That is, "NOAA continues to assume that RPA actions intended to mitigate for current and ongoing harm caused by the FCRPS may also be credited to mitigate for the ongoing and future impacts of climate change."

Response B-4 As described in Sections 2.1.4.5 and 3.9, new scientific literature since 2008 describes how some habitat restoration actions can have an impact on reducing the impacts of climate change while others are less likely to have that effect. For example, Beechie et al (2012) show that placing structures in streams may be beneficial restoration actions but, except in limited circumstances, they are unlikely to ameliorate effects of climate change. On the other hand, re-establishing lateral connectivity between floodplains and stream channels or revegetation to restore riparian processes are restoration actions that are beneficial under current conditions and they are also likely to ameliorate some effects of climate change. In other words, RPA actions such as improving tributary habitat by installing instream structures is beneficial and contributes towards meeting 2008 BiOp survival improvements (if identified as addressing a limiting factor), but other types of RPA actions have an additional benefit of ameliorating impacts of climate change.

Comment B-5 NWF/SOWS commented that, "while vaguely asserting that the Action Agencies will implement projects to be consistent with the ISAB's 2007 recommendations and this more recent evidence, NOAA does not propose any specific guidelines or criteria for doing so. Thus, for example, while the Beechie study demonstrates that in-stream restoration measures provide no climate benefit, NOAA continues to double-count such actions as mitigation for climate change. See Draft BiOp at 407."

Response B-5 The 2008 BiOp did describe criteria for determining if RPA actions would be likely to reduce impacts of climate change on listed species. The 2008 BiOp p. 7-32 stated: "The primary qualitative method NOAA Fisheries uses to evaluate the Prospective Actions is to determine the degree to which the Prospective Actions implement

recommendations by the ISAB (2007b) to reduce impacts of climate change on anadromous salmonids. The specific recommendations against which the Prospective Actions are evaluated are described in Table 7.1.2.1-1." Table 7.1.2.1-1 of the 2008 BiOp clearly described the ISAB (2007b) recommendations for the types of actions that are likely to reduce impacts of climate change on salmon and steelhead. This table was a component of the Population-Level Qualitative Analytical Methods for All Thirteen Columbia basin Species (Section 7.1.2 of the 2008 BiOp). In the 2008 BiOp Section 8.1.3, NOAA Fisheries described RPA actions that addressed ISAB (2007b) recommendations that the 2008 BiOp relied upon to reduce impacts of climate change on salmon and listed species, and concluded that "sufficient actions have been adopted to meet current and anticipated climate changes and that sufficient flexibility is available to ensure that those projects yet to be satisfied (2010 to 2018 habitat projects) will take advantage of any new information that may become available, including climate change effects."

In the 2010 Supplemental BiOp (Section 2.2.1.3.3) and the 2014 Supplemental Opinion (Sections 2.1.4.5 and 3.9), NOAA Fisheries reviewed new literature that informs our understanding of actions that can reduce impacts of climate change on listed salmon and steelhead, including Beechie et al. (2012). See also response to Comment B4 above. Section 3.9 reviewed RPA implementation relative to climate change effects and did not identify or discuss any instream structure projects as contributing to amelioration of climate change effects. A phrase in the introduction to the *Tributary Habitat and Climate Change* (Section 3.9.2 of the Sovereign Review Draft) describing miles of restored of stream complexity along with the other total tributary habitat RPA performance metrics has been removed to avoid confusion.

Comment B-6 NWF/SOWS commented that NOAA Fisheries did not consider high river temperatures in 2013 or additional mitigation to address them in the Sovereign Review Draft.

Response B-6 The Supplemental Opinion includes additional information regarding both effects and responses to high river temperatures in 2013 in Sections 2.1.4.1 Mainstem Columbia River Temperatures, 2.1.4.5 Biological Effects of Climate Change on Salmonids, 2.1.4.6 Relevance of Climate Information to the 2008/2010 BiOp's Analysis, and 3.3.3.1 Adult Passage Blockages at Lower Granite Dam in 2013.

C. Tributary Habitat

Comment C-1 The state of Oregon commented that the survival improvements from the tributary habitat program of the RPA are described as reasonably certain to occur "based on a fully self-referential analysis where all of the key methods have been invented by NOAA or the action agencies."

Response C-1 NOAA Fisheries disagrees. As described in the 2014 Supplemental Opinion (see Section 3.1.1), the method used for most populations in the 2008 BiOp and the 2014 Supplemental Opinion to estimate tributary habitat quality improvements and associated survival improvements was developed by the Remand Collaboration Habitat Work Group (CHW), which was convened in 2006 at the request of the Policy Work Group formed as part of the court-ordered remand of NOAA Fisheries' 2004 FCRPS BiOp. Members of the CHW represented the state, tribal, and Federal agencies (including NOAA Fisheries) involved in the remand collaboration process and were selected for their technical expertise. The group met regularly in 2006 to review and update the "Appendix E" method NOAA Fisheries used to estimate the potential improvement from tributary habitat mitigation actions in the 2004 FCRPS BiOp (as also noted in Section 3.1.1, a number of populations have been evaluated using only the Appendix E method). In developing its method, the CHW considered multiple approaches, additional analysis, and information from recovery plans and other efforts that had become available after the 2004 BiOp was issued (USACE et al. 2007b, Appendix C, Attachment C-1, and Annexes 1-3). Section 3.1.1.8.1 of the 2014 Supplemental Opinion describes refinements that have been made, and that will continue to be made, to tributary habitat analytical methods. Oregon Department of Fish and Wildlife staff members participate in some of these efforts (e.g., the Expert Panels and the "Atlas" process in Catherine Creek).

Comment C-2 The National Wildlife Federation/Save Our Salmon coalition (NWF/SOS) commented that there has been no independent scientific review of the methods employed for predicting benefits of habitat actions. They also state that "the only so-called independent review of tributary habitat actions in the 2008/2010 RPA (the brief and decidedly un-independent review of the draft 2010 RPA organized by NOAA's then Administrator) concluded that the predicted survival benefits from habitat actions were problematic to detect, unreliable in their precision, and uncertain to occur."

Response C-2 In the 2014 Supplemental Opinion (Section 3.1.1), NOAA Fisheries describes the rationale for our conclusion that the tributary habitat analytical methods continue to represent the best available science for assessing the effects of actions occurring across the diverse watersheds of the Columbia River basin and affecting multiple ESUs and DPSs. There has been and continues to be independent scientific input into the tributary habitat program, and NOAA Fisheries and the Action Agencies have considered and will continue to consider that input.

For example, as described in Appendix 1 of the AMIP, in 2009, the Obama

Administration solicited input from regional technical personnel and from independent and agency scientists on the science upon which the 2008 BiOp was based. As also noted in Appendix 1 of the AMIP, the Administration reviewed the methods used to estimate survival benefits from habitat projects and determined that "they are sound and retain the needed flexibility to respond to evolving scientific data as well as to implementation challenges and opportunities." (NWF/SOS has not provided a citation for their comment regarding this science review, so a more direct response is difficult.) Issues raised in the Obama Administration's review of the 2008 BiOp were considered in the development of the AMIP, which was incorporated into the RPA in the 2010 Supplemental BiOp.

In addition, tributary habitat improvement actions being considered for implementation under the BiOp undergo independent scientific review through the expert panels described in Section 3.1.1.6 of the 2014 Supplemental Opinion, and, if being considered for funding by BPA, through review by the Independent Scientific Review Panel. As described elsewhere in this response to comments, the tributary habitat RME program has also undergone independent science review. And in October 2013 the Independent Scientific Advisory Board (ISAB) published its Review of NOAA Fisheries' Life-Cycle Models of Salmonid Populations in the Interior Columbia River basin (ISAB 2013a), which will inform the continued development of models that can be used to further inform the CHW method described in Section 3.1.1 of the 2014 Supplemental Opinion. Further, NOAA Fisheries anticipates that as additional RME data become available and enhance our understanding of fish–habitat relationships and action effectiveness, those data will also be used to further inform the application of the method described in Section 3.1.1 of the 2014 Supplemental Opinion.

Although there is no requirement under ESA Section 7 for an independent peer review of analytical methods, NOAA Fisheries is open to exploring options for additional independent science review of tributary habitat analytical methods that would inform future FCRPS biological opinions.

Comment C-3 The state of Oregon commented that Oregon representatives who participated in the expert panel process reported that they were not given data they requested so they could make informed assessments, that meetings were poorly facilitated, and that basic ground rules about how habitat quality should be assessed—including guidance on how to judge the level of guarantee that the benefits of an action would actually occur, the time frame for when benefits would become measurable, and assurances that the benefits would be maintained through time—were lacking.

Response C-3 In the 2014 Supplemental Opinion (see Sections 3.1.1.6.4 and 3.1.1.8.1), NOAA Fisheries describes information that the Action Agencies made available to the expert panels and our conclusion that the panels' decisions were based on best available information. In addition, we describe (see Section 3.1.1.8.1) ways in which the Action Agencies have refined the expert panel process over time and will continue to refine it in the remaining term of the 2008 RPA. Oregon staff participating in the panels did not express their concerns to NOAA Fisheries during the 2012 expert panels (a time frame in which it would have been possible to investigate and address the concerns), nor do

the Action Agencies' notes from the expert panel meetings reflect these concerns. Nonetheless, NOAA Fisheries has considered Oregon's comments in Section 3.1.1.8.1 of the 2014 Supplemental Opinion.

Comment C-4 The state of Oregon and the Nez Perce Tribe commented that the expert panel process should be more transparent and better documented so that others can follow and reproduce the methods and results, and more easily trace the logical chain of reasoning that led to the final conclusions.

Response C-4 Section 3.1.1.8.1 of the 2014 Supplemental Opinion addresses this comment: "The Action Agencies will continue the process of improving the documentation of expert panel decisions that began in 2007 and continued in 2009 and 2012 as a means of continuing to promote consistency, transparency, efficiency, and learning among panels. The Action Agencies will ensure that staff designated as note-takers and who are familiar with salmon habitat biology and with the expert panel methods attend all expert panel meetings and take notes. Documentation (in the form of summary notes) will be incorporated into the expert panel spreadsheets and, to the extent practicable, will describe how panels considered factors such as results of similar actions reported in published or unpublished literature; the extent of area being treated by a set of actions; the level of certainty that the benefits of an action will occur; the time frame in which benefits will become measurable; assurances that benefits will be maintained through time; the logical chain of reasoning that led to the final conclusions; and the factors that weighed most heavily in the decision. NOAA Fisheries also urges the Action Agencies to evaluate notes from previous and future expert-panel meetings to review consistency among panels and to evaluate the extent to which decisions are transparent and supported by available literature. Based on this review, the Action Agencies should consider developing additional guidance or information for the expert panels as a way to facilitate learning among panels and to enhance consistency, rigor, and transparency of the process."

Comment C-5 The Nez Perce tribe commented that transparency was lacking with respect to the specifics, certainty, and funding of the actions NOAA relied upon to produce habitat quality improvements. The tribe stated that the Draft 2014-2018 Implementation Plan and the Draft 2013 Comprehensive Evaluation provided truncated information about actions, precluding meaningful review and analysis, and that rather than ensuring that fundamental information was provided to allow meaningful review and analysis, the draft 2013 Supplemental Opinion relies upon the Action Agencies' projections and evaluations to reach its conclusions.

Response C-5 With regard to the specificity of actions that NOAA Fisheries relied upon in its evaluation of the 2014–2018 Implementation Plan and additional information, the 2014 Supplemental Opinion notes (see section 3.1.2.2.2) that Appendix A of the 2014-2018 IP summarizes by population the actions for implementation through 2018 that contribute to meeting or exceeding the RPA Action 35 Table 5 HQI performance standards, including limiting factors addressed and metrics expected to be achieved. We also note in Section 3.1.2.2.2 of the 2014 Supplemental Opinion that instead of

reporting each specific action evaluated by the expert panels, the metrics for the actions are summarized at the population level, and the table shows the projects in BPA's program management system under which the action will be implemented.

As also described in Section 3.1.2.2.2, NOAA Fisheries' evaluation is not based on the 2014–2018 Implementation Plan alone. NOAA Fisheries staff attended expert panel meetings at which specific habitat improvement actions were discussed. NOAA Fisheries staff also reviewed spreadsheets assembled from the database in which the Action Agencies record the results of the expert panel deliberations. These spreadsheets document the expert panels' weighting of assessment units, their identification and weighting of limiting factors by assessment unit, their assignment of values for current function of each limiting factor by assessment unit, and their estimates of how the function of each limiting factor would change as a result of implementation of actions through 2018. The spreadsheets and additional materials also contain notes documenting the expert panels' deliberations and details on specific actions evaluated by expert panels that is not found in the 2014–2018 Draft IP (see Spinazola 2013). NOAA Fisheries' review of these materials was not exhaustive, nor was it a reanalysis of the expert panels' assessments. Rather it was a means for NOAA Fisheries staff to expand understanding of the Action Agencies' implementation of the tributary habitat program, spot-check information for certain assessment units and populations, provide constructive feedback to the Action Agencies, and, ultimately, increase our confidence that the Action Agencies' are implementing the tributary habitat program in a manner likely to achieve the RPA Action 35 Table 5 HQI performance standards.

As noted in Section 3.1.2.9 of the 2014 Supplemental Opinion, actions for implementation through 2018 have been identified in a significant level of detail, including identification of populations to benefit; type of work to be accomplished; limiting factors addressed; extent of area to be treated, volume of water protected, or other relevant metrics; and location of work (e.g., river mile, local jurisdiction, address, or road access). This represents the same or greater level of detail with which specific actions for implementation from 2010 to 2013 were identified in the Action Agencies' 2010–2013 Implementation Plan (BPA et al. 2010), which Judge Redden referred to as "specific, identified projects scheduled to occur between 2008 and 2013" in his Opinion dated August 2, 2011 (BPA et al. 2010).

With regard to NOAA Fisheries' confidence that the Action Agencies will implement and fund the actions identified in their 2014–2018 IP, in their 2008 and 2010 Records of Decision for the 2008 FCRPS BiOp (BPA 2008, USBR 2008, USACE 2008) and the 2010 Supplemental FCRPS BiOp (BPA 2010, USBR 2010, USACE 2010), the Action Agencies state that they intend to implement the RPA (see http://www.salmonrecovery.gov/BiologicalOpinions/FCRPSBiOp.aspx). Also, as noted in the 2014 Supplemental Opinion, the Action Agencies have established a track record of implementation (see response to Comment C9, below). Furthermore, the Action Agencies' 2014–2018 Implementation Plan lays out the Action Agencies' strategies for continuing to implement the RPA through 2018. NOAA Fisheries has no information that contradicts these commitments by the Action Agencies to implement the RPA's tributary habitat program.

Comment C-6 Oregon commented that the habitat quality improvement values for each population "were ultimately developed by the Action Agencies in a closed process and panel members were not given the opportunity to review final products," and that the HQI results in the draft 2013 BiOp, "although numerical, are neither transparent as to their derivation, nor are they reproducible."

Response C-6 Expert panels evaluate changes in limiting factors expected from implementation of tributary habitat improvement actions, as described in Section 3.1.1.6 of the 2014 Supplemental Opinion. After the expert panels completed these evaluations in 2012, the Action Agencies distributed spreadsheets documenting the results to panel members so they could review them for accuracy. Thus, the panel members were asked to review the results of the workshops for accuracy.

The Action Agencies then derive the habitat quality improvements (HQIs) using the results of the expert panel process and an algebraic formula that is clearly documented, transparent as to its derivation, and reproducible (see Section 3.1.1.7 in the 2014 Supplemental Opinion; Appendix C, Attachment C-1 in the 2007 CA; and Appendix C in Milstein et al. 2013). The method the Action Agencies use was developed by the CHW, which was formed as part of the remand collaborative process (described in Section 3.1.1.6.3 of the 2014 Supplemental Opinion and in the 2007 CA, Appendix C, Attachment C-1, and in Milstein et al. 2013, Appendix C). While the work of the expert panels does require the use of best professional judgment, the Action Agencies work to ensure that the best available information informs the panels' deliberations. As described in Section 3.1.1.8.1 of the 2014 Supplemental Opinion, the Action Agencies will take steps to continue to enhance the transparency of the expert panel process.

Comment C-7 NWF/SOS and Oregon commented that the benefits ascribed to tributary habitat actions are not reasonably certain to occur. In support of this view, NWF/SOS quoted the Independent Scientific Advisory Board (ISAB) March 2013 review of the Northwest Power and Conservation Council's (NPCC) 2009 Fish and Wildlife Program:

> "It is also highly uncertain that habitat restoration will be successful as presently configured. . . . quantitative objectives for habitat, an unambiguous assertion of biological potential, and a route to achieve the potential through habitat restoration actions, are not yet available. . . . it is important to further state that the biological potential is uncertain . . . and that scope of restoration and improvement required to achieve the vision remains unknown. . . . [i]t is important to keep the limited success of past efforts [to improve survival through habitat restoration] clearly in mind . . . .there is still insufficient evidence that the 'most common habitat protection and improvement activities implemented under the [2009 Fish & Wildlife Program]' are actually producing important biological benefits. This conclusion is unlikely to change in the immediate future because the core of the Program's habitat improvement activities is unlikely to change, and strategies for comprehensive and consistent monitoring of fish populations and habitat are still being developed" [ISAB pp. 40–41]

Referring again to this ISAB review, NWF/SOS also commented that "at no point does the ISAB suggest that we have the ability to identify and predict with any level of scientific certainty the specific numeric survival benefits of habitat restoration actions, the precise amount of benefits particular actions may provide, or the ability to monitor for and detect any such benefits if they occur."

Response C-7 In the 2014 Supplemental Opinion (Section 3.1), NOAA Fisheries describes the basis for our conclusion that it is reasonably certain that the RPA Action 35 Table 5 HQI performance standards will be met. The ISAB's review (ISAB 2013b) was of the NPCC's 2009 Fish and Wildlife Program, not the BiOp Tributary Habitat Program, and while the two programs are related (for instance, in that many BiOp tributary habitat improvement actions are implemented through the NPCC's Fish and Wildlife Program), there are also important distinctions between the two. NOAA Fisheries offers the following comments in response to the ISAB statements quoted by the commenters:

Regarding the ISAB's statement that quantitative objectives are not yet available, the BiOp tributary habitat program does have quantitative objectives--i.e., the RPA Action 35 Table 5 HQI performance standards.

Regarding the ISAB's statement that an assertion of biological potential is not yet available, the BiOp tributary habitat program goes beyond the subbasin plans the Fish and Wildlife Program is based upon in that estimates of the benefits of BiOp habitat improvement actions are informed by an analysis by the Interior Columbia Technical Recovery Team (ICTRT) of the intrinsic habitat potential of each population (see ICTRT 2007b, Appendix C). The Action Agencies and the expert panels used the ICTRT's analysis of intrinsic habitat potential in weighting the assessment units (with the end result that the estimates of habitat benefits of actions are weighted by the TRT's estimates of the historical production potential of each assessment unit).

Regarding the ISAB's statement that the scope of restoration and improvement required to achieve the vision remains unknown, the BiOp tributary habitat program goes beyond the subbasin plans of the Fish and Wildlife Program in terms of its method for quantifying the estimated impacts of limiting factors and actions, as well as the estimated habitat changes resulting from implementation of actions, and therefore of the scope of improvement required to achieve the RPA Action 35 Table 5 HQI performance standards.

Regarding the statement that there is insufficient evidence that improvement activities implemented under the 2009 Fish and Wildlife Program are producing important biological benefits because strategies for comprehensive and consistent monitoring of fish populations and habitat are still being developed, the ISAB also notes (ISAB 2013b, pp. 41-42) that

> the substantial investment in the ISEMP and CHaMP projects [which were developed to monitor the effectiveness of the BiOp tributary habitat program] to develop consistent and comprehensive monitoring and analytical assessment is promising. These kinds of projects are needed to effectively evaluate and guide habitat restoration, and they have the potential to revolutionize the generally ineffective and inconsistent approaches that have existed in the past. …The ISAB believes that it will be important to see these projects through to their logical conclusions and to require a full and critical

> evaluation of the results. If these projects are successful, new opportunities for technology transfer, analytical support, and coordination of monitoring across similar ecological settings may be possible. If they are not, the reasons for failure will reveal the next steps. Either way, future efforts will build on a stronger foundation in this critical area of the program.

Moreover, as discussed in the 2014 Supplemental Opinion (see Section 3.1.1.4.2), preliminary results from the BiOp tributary habitat RME program appear to be supportive of the working hypothesis of the program that habitat improvement actions are addressing limiting factors and leading to changes in fish population abundance and productivity.

Finally, regarding the commenters' statement that the ISAB does not suggest that we have the ability to identify and predict the numeric survival benefits of habitat improvement actions or the ability to monitor for and detect any such benefits if they occur, NOAA Fisheries notes that the ISAB is not explicitly evaluating these questions, nor, as noted above, are they evaluating the BiOp tributary habitat program and its analytical methods or its research, monitoring, and evaluation component.

In the 2014 Supplemental Opinion, NOAA Fisheries describes the rationale for our conclusion that the tributary habitat analytical methods continue to represent the best available science for assessing the effects of actions occurring across the diverse watersheds of the Columbia River basin and affecting multiple ESUs and DPSs. In addition, the assumptions upon which the tributary habitat program is based are clearly identified, and a rigorous research, monitoring, and evaluation program is in place for the program, along with an adaptive management approach that allows incorporation of new tools and response to new information. The 2014 Supplemental Opinion also describes preliminary RME findings (see Section 3.1.1.4.2), which appear to be supportive of the working hypothesis of the program, as well as ways in which the tributary habitat program has been refined and will continue being refined (e.g., through the development of life-cycle modeling tools) to enhance the ability to predict survival benefits of habitat improvement actions.

Comment C-8 NWF/SOS commented that NOAA Fisheries has failed to address in a systematic and detailed fashion the fact that the restoration efforts under the RPA occur in a landscape of other activities and that any benefits may be offset by other harmful actions, as well as by harmful effects of climate change.

Response C-8 A fundamental assumption in the 2008 BiOp analysis is that conditions of the Base Period will remain unchanged, except for the survival changes (+ or -) we have identified. We described this as a "neutral assumption" in the 2008 BiOp (p. 7-30) because of our choice of the base period years per the Interior Columbia Technical Recovery Team and the likelihood that the base period captures ongoing management actions and their effects for most life stages. If a negative change occurred from base period conditions that we had not anticipated, then it could offset some estimated improvements. However, we attempted to account for all predictable changes with an

extensive review of environmental baseline factors in the 2008 BiOp (including a request to the states for information on anticipated changes) and with our review of the environmental baseline for the 2014 Supplemental Opinion (see Section 2.2), which indicates no change from our descriptions in the 2008 BiOp except for cormorant predation.

NOAA Fisheries has also previously noted (see Kratz 2008), that the RPA Action 35 strategy is to "protect and improve" habitat. The process developed by the CHW for estimating habitat improvement potential explicitly incorporated the protection objective. The CHW's guidance to local biologists ("Guidance from the Habitat Technical Subgroup of the BiOp Remand Collaboration for Providing Columbia Basin Tributary Habitat Action Information" – see Kratz 2008, p. 4, Footnote 1) was to estimate the degree of change for each individual attribute that can be expected from the entire set of actions intended to affect the attribute. Estimates are to take the following variables into consideration:

Any existing estimates from recovery or subbasin plans or other sources;
Context and location of actions;
Extent of the action and resulting treatment of limiting factors;
Effectiveness of methods used in implementing the actions;
Interdependence of limiting factors treated by the actions with other factors and extent to which these other factors are also treated;
Degree of certainty that actions will have the expected effect on limiting factors; and
Risk of effects from other threats that would confound or reduce the positive effects of the actions.

In addition, one purpose of the habitat status and trends monitoring program that has been established under the 2008 FCRPS BiOp is to be able to evaluate long-term trends in habitat condition and function. The commenters appear to assume that most of the watersheds in which the BiOp tributary habitat program is being implemented are undergoing overall habitat degradation. Most of these watersheds are rural in nature, and it is conceivable that the intensity of agricultural and resource extraction uses has declined over the past 50 or 60 years. Meanwhile, much effort has been put into habitat protection and improvement. To NOAA Fisheries' knowledge, there has been no comprehensive assessment of relatively recent habitat change for the Interior Columbia basin, and more information is needed before it is possible to confirm regional long-term trends.

As we stated in the 2008 BiOp (p. 7-31), our assumption about effects of climate change on ocean conditions is pessimistic, since we primarily rely on an assumption that the mostly bad ocean conditions of the Base period will continue (and our climate review in the 2014 Supplemental Opinion confirms that ocean conditions in the last decade have generally been better than what we assumed). We were not able to estimate quantitatively effects of climate change on freshwater habitat. Our expectation is that tributary habitat improvement actions include actions that assist with adaptation to climate change and qualitatively address uncertainty about effects of climate change on freshwater life stages for a time period consistent with the duration of the effects of the RPA (see Response B-1 also) .

Comment C-9 Oregon commented that NOAA Fisheries should not rely on off-site measures since the anticipated benefits are highly uncertain: they note that actions may not be implemented, or may not be implemented as planned, and that the outcome may not be as expected, or that natural or other unrelated events may affect the population independent of the action, and, finally that the biological response to the action may not be as expected.

Response C-9 With regard to NOAA Fisheries' confidence that the Action Agencies will implement and fund the actions identified in their 2014–2018 Implementation Plan, see response to Comment C-5, above. Also, as noted in the 2014 Supplemental Opinion, the Action Agencies have established a track record of implementation. For instance, as discussed in Section 3.1.2.2.1 of the 2014 Supplemental Opinion, NOAA Fisheries agrees with the Action Agencies' analysis, using the CHW method and based on expert panel evaluations of tributary habitat improvement actions implemented through 2011, that those actions were sufficient to either met or exceed the HQI performance standard for 35 of the 56 populations in Table 5 of RPA Action 35. These same analyses also indicate that the Action Agencies have implemented actions through 2011 sufficient to make significant progress toward achieving the HQI performance standards for another 13 populations. For the remaining 8 populations, including some with large HQI performance standards, the Action Agencies have made limited progress but have described how they have laid the groundwork for moving forward with implementation. For all populations, as described in Sections 3.1.2.2.2 and 3.1.2.2.3, NOAA Fisheries has concluded that it is reasonably certain that implementation of actions through 2018 will achieve the Table 5 HQI performance standards.

The commenters are correct that some actions may not be implemented as planned. As described in the 2014 Supplemental Opinion (Section 3.1.1.6.3 and footnotes 20 and 35), expert panels evaluate actions prospectively as they are planned for implementation and then reevaluate actions as implemented. This allows adjustment of benefits for actions completed with modifications from what was originally planned, actions planned but not implemented, and actions that were added subsequent to expert panel workshops and thus not evaluated in advance of implementation.

In terms of unrelated events affecting populations, such scientific uncertainty is inherent in almost any resource management activity, and observations of external factors are incorporated into our discussion of conditions under the environmental baseline in the 2008/2010 BiOps and the 2014 Supplemental Opinion. In terms of biological response not being as expected, again, such scientific uncertainty is a factor in mitigation for almost any action undergoing ESA Section 7 consultation, and one that the comprehensive RME program and adaptive management framework for the BiOp has been established to address.

Comment C-10 NWF/SOS commented that NOAA pays inadequate attention to the fact that few if any priority populations have achieved even 50% of their habitat quality improvement performance standard, and that most have achieved less than 33%. They also

comment that NOAA's response is to "double-down on still more vaguely described habitat actions in the coming years, all of which face all of the problems we, the ISAB, and others have identified."

Response C-10 NOAA Fisheries disagrees. The 2014 Supplemental Opinion includes a thorough analysis of the extent of progress toward meeting the RPA Action 35 Table 5 HQI performance standards.

As noted in Section 3.1.2.1.1 of the 2014 Supplemental Opinion, the Action Agencies' analysis, using the CHW method and based on expert panel evaluations of tributary habitat improvement actions implemented through 2011, indicates that those actions were sufficient to meet or exceed the performance standard for 35 of the 56 populations in RPA Action 35 Table 5, and to achieve ≥50% of the HQI performance standard for an additional seven populations. We also describe in the 2014 Supplemental Opinion the rationale for our conclusion that the tributary habitat analytical methods continue to represent the best available science for assessing the effects of actions occurring across the diverse watersheds of the Columbia River basin and affecting multiple ESUs and DPSs. The ≥50% benchmark is significant because the year 2011 is roughly 50% of the 2008 BiOp implementation timeframe of 2007–2018. Therefore, having implemented actions by 2011 sufficient to achieve ≥50% of the survival improvement standard is a good indicator that the Action Agencies are on track with implementation of the tributary habitat program for those populations and that achieving the HQI performance standard, and associated survival improvement, for those populations is reasonably certain, where the Action Agencies' analysis using CHW methods and based on expert panel results also indicates that implementation of actions through 2018 will meet the HQI performance standard.

In addition, the Action Agencies have made significant progress (i.e., analysis indicates that actions implemented through 2011 were sufficient to achieve ≥33% of HQI performance standard) on 6 other populations. The benchmark of ≥33% to define significant progress, while somewhat subjective, is reasonable because it indicates that the Action Agencies have demonstrated the ability to implement habitat improvement actions with significant benefits, and, where the Action Agencies' analysis using CHW methods and based on expert panel results also indicates that implementation of actions through 2018 is projected to meet the HQI performance standards, it is reasonably certain that the Action Agencies will achieve those performance standards.

NOAA Fisheries made a detailed evaluation of the Action Agencies' strategies for achieving the performance standards for populations for which <33% of the performance standard was estimated to have been achieved based on implementation of actions through 2011 or for which the Action Agencies identified supplemental actions (see Sections 3.1.2.1 through 3.2.1.7 of the 2014 Supplemental Opinion). Based on this evaluation, NOAA Fisheries is reasonably certain that the Action Agencies will meet the 2018 population performance standards for these populations.

NOAA Fisheries also disagrees that the actions for these populations are "vaguely defined." As noted in Section 3.1.2.9 of the 2014 Supplemental Opinion, actions for implementation through 2018 have been identified in a significant level of detail, including identification of populations to benefit; type of work to be accomplished;

limiting factors addressed; extent of area to be treated, volume of water protected, or other relevant metrics; and location of work (e.g., river mile, local jurisdiction, address, or road access). This represents the same or greater level of detail than the Action Agencies provided in their 2010–2013 FCRPS BiOp Implementation Plan actions, which Judge Redden referred to as "specific, identified projects scheduled to occur between 2008 and 2013" in his Opinion dated August 2, 2011.

Comment C-11 NWF/SOS and the state of Oregon commented regarding the ability to verify whether habitat quality improvements and associated population survival improvements would be achieved by 2018. NWF/SOS stated that there is a high likelihood of being unable to reliably identify actual population survival improvements as a result of tributary habitat improvement by 2018, and the state of Oregon commented that NOAA Fisheries needs to demonstrate that the predicted "Prospective" metric values are, in fact, accomplished before crediting the benefits to fish populations, and that the habitat benefits reported in Table 3.1-1 are hypotheses that have not been empirically demonstrated to have occurred.

Response C-11 These comments indicate an expectation that the Action Agencies and NOAA Fisheries would, by the end of 2018, be able to demonstrate through empirical data (for example, on egg to smolt survival or fish–habitat relationships) whether the changes in habitat function, and associated survival improvements, identified in RPA Action 35, Table 5, had occurred. This expectation represents a misinterpretation of the temporal considerations in the 2008 BiOp analysis.

NOAA Fisheries' expectations are that by 2018 the Action Agencies will have implemented tributary habitat improvement actions that, based on analysis using the methods described in Sections 3.1.1.6 through 3.1.1.8 of the 2014 Supplemental Opinion, are projected to meet the RPA Action 35 Table 5 HQI performance standards and associated survival improvements; that they will have implemented an RME program consistent with the RPA; that they will have evaluated and incorporated, as appropriate, data from the RME program into tributary habitat analytical methods; and that they will have considered and utilized new tools, such as habitat assessments and life-cycle modeling, as appropriate. Preliminary RME data, as it becomes available, will also allow the Action Agencies and NOAA Fisheries to confirm or modify assumptions and evaluate needs for additional or alternative actions. Preliminary RME results related to action effectiveness and fish-habitat relationships do in fact appear to be confirming that implementation of tributary habitat improvement actions under RPA Actions 34 and 35 is contributing to improvements in fish population abundance and productivity (see 2014 Supplemental Opinion, Section 3.1.1.4.2, and Sections 3.1.2.3. through 3.1.2.7), but more data are needed to determine with statistical significance whether changes in habitat status and trends and corresponding changes in fish production are occurring.

To expect empirical validation of habitat quality or survival improvements by 2018 is unrealistic. First, implementation of habitat improvement actions is not date certain, due to factors including weather conditions, permitting delays, and the logistics of coordinating construction projects with contractors. Habitat improvement actions will

be implemented sometime before the end of 2018, but the exact date of implementation of some actions is uncertain. Also, depending on the type of tributary habitat improvement action, there may be a lag between completion of the action and the projected change in habitat function (e.g., riparian treatments and restoration of the riparian zone, including tree planting , fencing, and removal of invasive species, may take years to achieve their full benefits). This will result in a lag in any corresponding survival change for the affected life stage (i.e., egg to smolt survival). Even after the life-stage survival change occurs, it may not be immediately detectable because of natural variability in abundance and productivity. Additionally, as described in the overview of the habitat RME program (see 2014 Supplemental Opinion, Section 3.1.1.4.1), life-stage survival is not being monitored for every population and every tributary, but rather through representative studies that will be applied to other populations through a modeling framework. Finally, there will be an additional lag in detection of the corresponding changes in the 2008 BiOp's life-cycle metrics for the reasons described in Section 2.1.1.1.1 of the 2014 Supplemental Opinion[1] (e.g., 3- to 5-year lag in completing brood-cycle returns that reflect an earlier life stage survival change, the need for several years of new observations to modify a 25-year or more average). Thus, NOAA Fisheries will use the best available estimates of habitat benefits and survival changes (see 2014 Supplemental Opinion, Sections 3.1.1.6 through 3.1.1.8), coupled with the RME program, to support our confidence in the effects of the tributary habitat program.

Also, while expert panels estimate benefits that would accrue within these timeframes of 2018 and 2033, they do not know exactly when an action will be implemented over the term of the RPA, and timing of implementation affects when benefits will accrue. For instance, it is unlikely that full benefits of an action implemented in 2016 or 2017 would have accrued by 2018. Also, as noted elsewhere in the 2014 Supplemental Opinion (see, for example, Section 3.1.1.3.1), benefits of some kinds of actions (e.g., restoring access to habitat) occur relatively quickly, while for other kinds of actions (e.g., riparian area restoration involving tree planting, fencing, and removal of invasive species) benefits are less direct or occur over a longer time period. For these reasons, it is most accurate to think of the expert panels' estimates as providing near-term and longer-term estimates of change in limiting factor function as a result of implementation of habitat improvement actions. Finally, NOAA Fisheries notes that the habitat improvements being made are long-term investments that will provide ongoing benefits in terms of sustaining natural fish production into the future, regardless of the exact date at which benefits begin to accrue.

[1] See Section 2.1.1.1, *How are Base Period metrics adjusted to reflect survival changes?* and *How does NOAA Fisheries evaluate whether the extended Base Period estimates have changed from the 2008 BiOp's Base Period estimates—Other considerations*, in the 2014 Supplemental Opinion.

Comment C-12 The Nez Perce Tribe commented that no additional funding has been identified or allocated for the supplemental actions identified for six populations, and that with respect to timing of implementation of these actions, the Draft 2014–2018 Implementation Plan states that supplemental projects will be reviewed by expert panels in 2015, "which means it would be 2016 before the projects would move forward to steps like planning, design, NEPA, etc. - much less being implemented." The

Tribe believes that these projects should move toward implementation now, and that NOAA must be transparent with respect to describing the status of funding, implementation timing, and when the benefits are expected to begin accruing.

Response C-12 With regard to NOAA's confidence that the Action Agencies will fund and implement the supplemental actions, as noted above, in their 2008 and 2010 Records of Decision for the 2008 FCRPS BiOp and the 2010 Supplemental FCRPS BiOp (BPA 2008 and 2010, USBR 2008 and 2010, USACE 2008 and 2010), the Action Agencies state that they intend to implement the RPA (see http://www.salmonrecovery.gov/BiologicalOpinions/FCRPSBiOp.aspx). Also, as noted in the 2014 Supplemental Opinion, the Action Agencies have established a track record of implementation (see response to Comment 9, above). Furthermore, the Action Agencies' 2014–2018 Implementation Plan lays out the Action Agencies strategies for continuing to implement the 2008 FCRPS BiOp RPA through 2018. NOAA Fisheries has no information that contradicts these commitments by the Action Agencies to implement the RPA's tributary habitat program.

With regard to timing of implementation, the Action Agencies have outlined plans for tributary habitat improvement actions in appendices to the 2014-2018 IP. Appendix A includes a summary of actions that were evaluated by 2012 expert panels. Appendix B includes a menu of supplemental habitat actions identified by the Action Agencies and their tribal and watershed partners for populations for which projects in addition to those evaluated by expert panels were needed to meet the RPA Action 35 Table 5 performance standards. The expert panels will evaluate these projects in when they next meet. Appendix C describes the Tributary Habitat Adaptive Management Plan and the steps the Action Agencies are taking to keep tributary habitat improvement projects on track. Appendix D outlines a strategy for "replacement projects" in the event that any population is determined to require additional improvements to meet the BiOp requirements as described in RPA Action 35. The Northwest Power and Conservation Council's (NPCC) Independent Scientific Review Panel (ISRP) reviews all projects proposed for funding under BPA's Fish and Wildlife Program. The NPCC then makes recommendations regarding project implementation based on consistency with the Fish and Wildlife Program, BiOp priorities, and satisfactory science review by the ISRP. Following ISRP review and NPCC recommendations, BPA makes multiyear funding decisions.

The Action Agencies are treating supplemental actions the same as actions that have already been reviewed by expert panels—that is, they are working with tribal and other local implementing partners to move all actions forward in the implementation process. Any action, including any supplemental action, can be implemented prior to the next expert panel workshops (assuming the action has received a favorable review by the ISRP and that a contract has been issued for its implementation), and the expert panel would then evaluate the action as implemented. (Expert panels evaluate all actions as implemented in what is referred to as the "look back" process, which allows adjustment of benefits for actions completed with modifications from what was originally planned, actions planned but not implemented, and actions that were added subsequent to expert panel workshops and thus not evaluated in advance of implementation.)

Comment C-13 NWF/SOS commented that there has been no systematic audit of what habitat actions actually have occurred.

Response C-13 The RPA requires the Action Agencies to submit to NOAA Fisheries Annual Progress reports that describe the status of implementation of all actions as of the end of the previous calendar year as well as the status of monitoring. The RPA also requires the Action Agencies to submit to NOAA Fisheries a Comprehensive Evaluation in 2013 and 2016. The Comprehensive Evaluations must compare implementation to scheduled completion dates and describe the status of progress toward reaching the RPA Action 35 Table 5 HQI performance standards.

As described in the 2014 Supplemental Opinion (see Section 3.1.2.1 and 3.1.2.2), for RPA Actions 34 and 35, the Action Agencies' reporting has included annual accomplishments for the tributary habitat actions identified in the 2007 FCRPS Biological Assessment (USACE et al. 2007b), which served as the 2007–2009 Implementation Plan, plus any additional actions or actions implemented in place of those that proved infeasible (2013 Draft CE, Section 2), as well as tributary habitat actions identified in the 2010–2013 Implementation Plan. In addition, the Action Agencies' 2013 Draft CE, Section 3, Attachment 2, Tables 1 through 3, displays summary information on actions completed from 2007–2012. Table 1 summarizes metrics for all completed actions by population in the 2007–2009 implementation period (i.e., RPA Action 34); the 2010–2012 implementation period; and total cumulative completed metrics by population for the implementation period of 2007–2012. Rather than being reported at the action scale (i.e., at the scale of specific tributary habitat improvement actions implemented on the ground), metrics are summarized in this table under BPA projects used to fund the actions. (In some cases, these projects include a number of contracts, each with detailed work elements and associated metrics. In essence, multiple specific "actions" are implemented on the ground under each of these "projects." This system allows BPA to track progress in addressing limiting factors as well as other details related to contract administration.)

Table 1 of the 2013 Draft CE, Section 3, Attachment 2, includes hyperlinks to BPA's contract management system, where BPA tracks and records planned and actual work administered under BPA contracts. The "Pisces" and "Taurus" databases that BPA uses in its contract management system house data for each of the specific actions identified in the 2007 Biological Assessment (i.e., for implementation of RPA Action 34) and the 2010–2013 Implementation Plan and managed under a BPA contract. Information available in the contract management database includes project summaries, annual progress reports, timelines, implementation metrics, and budget information. The work elements section displays start and end dates of project milestones. Additional detail on projects supported or funded entirely by Reclamation and completed in 2007–2012 is displayed in Tables 2 and 3, respectively, of the Action Agencies' 2013 Draft CE, Section 3, Attachment 2 (2013 Draft CE, Section 2; also see Milstein et al. 2013, Appendix D).

In addition, all actions completed from 2007–2011 that affect a population in Table 5 of RPA Action 35 have been evaluated by an expert panel to estimate resulting

changes in habitat function, and the Action Agencies have converted those habitat changes into HQIs (i.e., survival improvements). The Action Agencies' conclusions regarding HQIs estimated to result from actions implemented through 2011 are shown in the 2013 Draft CE, Section 2, Table 35, and summarized below in Table 3-1.

Further, the BiOp RPA also requires monitoring of the effectiveness of tributary habitat actions (RPA 57), as well as efforts to coordinate monitoring efforts with other regional entities and efforts to coordinate and standardize data management (RPAs 71 and 72) and implementation and compliance monitoring (RPA 73).

Comment C-14 NWF/SOS commented that there has been no independent review of the monitoring plans for the BiOp

Response C-14 The Northwest Power and Conservation Council's Independent Scientific Review Panel (ISRP) and Independent Scientific Advisory Board (ISAB) have reviewed the BiOp's overall RME strategy and specific components of it multiple times over the past decade.

In terms of reviews of the tributary habitat components, the ISRP first reviewed the Integrated Status and Effectiveness Monitoring Program (ISEMP) in 2003, when it reviewed the ISEMP Wenatchee study plan (ISRP 2003). Subsequently, the ISRP reviewed the ISEMP Upper Salmon study plan (ISRP 2006a). In addition, the ISRP's recommendation on the ISEMP FY 2007–2009 proposal was "Fundable (Qualified)" (ISRP 2006b). A response to questions raised by the ISRP in that review and a study plan for habitat restoration work in Bridge Creek in the John Day subbasin was reviewed in 2007 (ISRP 2007). The ISRP found that the project met scientific review criteria and commented that the ISEMP team provided a detailed response to the ISRP's questions that included well-reasoned explanations of how the ISEMP effort was integrated into existing John Day monitoring programs and a reasonably complete study plan for the Bridge Creek Intensively Monitored Watershed (IMW) study. The ISRP noted that the project results should be helpful in designing restoration programs for other streams in semi-arid subbasins, particularly where land management practices had resulted in incised channels, elimination of habitat complexity, and loss of pool habitat.

In 2004, the ISAB and ISRP jointly reviewed the Draft Research, Monitoring, and Evaluation Plan for the NOAA Fisheries 2000 Federal Columbia River Power System Biological Opinion (ISAB and ISRP 2004). This review set in motion the implementation and development of several tributary habitat strategies, some still in development today.

The ISRP reviewed the ISEMP again in the Research, Monitoring, and Evaluation and Artificial Production Category Review (ISRP 2010). In that review, the ISRP also reviewed an important component of the ISEMP – the Columbia Habitat Monitoring Program (CHaMP). That review was expanded to include an in-depth follow-up review and a workshop with the CHaMP team, NPCC, and regional habitat monitoring practitioners in February 2011. In its review, the ISRP found the ISEMP and CHaMP proposals met scientific review criteria (qualified) (ISRP 2011). Based on information

from that review, the ISRP made a number of recommendations:

> CHaMP should continue its dialog with other monitoring groups to resolve differences in approaches and should consider designing rigorous field tests of various protocols.
> CHaMP should devote additional attention to case-by-case inclusion of "non-standard" metrics (e.g., agricultural chemicals) and to developing and testing methods of scaling up site-specific habitat conditions to watershed- and subbasin-scale indicators of habitat quality.
> CHaMP should use simulations to examine the properties and sensitivity of large-scale metrics of habitat change, as well as to compare and contrast the conclusions of CHaMP analytical tools with other widely used habitat models.
> CHaMP should develop robust, accurate relationships between population parameters for target fish species and changes in habitat condition that are related to restoration, or continued habitat degradation, in CHaMP watersheds.
> CHaMP should be implemented at a pilot scale. The ISRP believed that some CHaMP protocols needed additional refinement and testing, and therefore recommended that project partners focus initial activities on a subset of CHaMP watersheds at geographically diverse locations in the Columbia basin where restoration was occurring and where both habitat and fish population monitoring were sufficiently developed so that CHaMP could build on existing RME efforts, such as in intensively monitored watersheds.
> The ISRP should review CHaMP again after 1 to 2 years of data collection to see how field and data management protocols have been modified and how monitoring results are being incorporated into establishing restoration priorities.

Most recently, the ISRP reviewed documents describing three related programs intended to provide a basinwide approach to habitat monitoring and evaluation (ISRP 2013):

> Integrated Status and Effectiveness Monitoring Program (ISEMP): Lessons Learned Synthesis Report 2003-2011 (ISEMP 2011). ISEMP is a research and development project to test and develop fish and habitat monitoring methods, data management tools, and data analysis methods for general use by Fish and Wildlife monitoring projects across the interior Columbia River basin.
> Columbia Habitat Monitoring Program's (CHaMP): 2011 Pilot Year Lessons Learned Project Synthesis Report (CHaMP 2012). This report summarizes data and results from 2011, the first year of implementation for the CHaMP pilot program. CHaMP's purpose is to implement a habitat monitoring protocol for fish habitat status and trends throughout the portion of the Columbia basin that is accessible to anadromous salmonids using a programmatic approach to standardized data collection and management that will allow effective data summarization at various spatial scales important for the management of fish and habitat.
> Action Effectiveness Monitoring of Tributary Habitat Improvement: A Programmatic Approach for the Columbia Basin Fish and Wildlife Program (Roni et al. 2013). This document was developed to respond to ISRP and NPCC recommendations to move toward a standardized, programmatic approach to evaluate the effectiveness of habitat restoration actions.

The ISRP was also provided with "Columbia Basin Tributary Habitat Improvements: A Framework for Research, Monitoring and Evaluation" (BPA 2013) to give context and background for the three above documents. The intent of these documents and the 2013 review was to address the NPCC's recommendations related to programmatic issues with habitat effectiveness monitoring and evaluation that were placed on numerous projects as part of the Research, Monitoring, and Evaluation and Artificial Production Category Review in June 2011 (ISRP 2011).

In addition, the Independent Science Advisory Board (ISAB) has noted (ISAB 2013b, pp. 41-42) that "the substantial investment in the ISEMP and CHaMP projects to develop consistent and comprehensive monitoring and analytical assessment is promising. These kinds of projects are needed to effectively evaluate and guide habitat restoration, and they have the potential to revolutionize the generally ineffective and inconsistent approaches that have existed in the past. Many in the Basin have already taken note and are beginning to follow or implement some of the methods. The ISAB believes that it will be important to see these projects through to their logical conclusions and to require a full and critical evaluation of the results. If these projects are successful, new opportunities for technology transfer, analytical support, and coordination of monitoring across similar ecological settings may be possible. If they are not, the reasons for failure will reveal the next steps. Either way, future efforts will build on a stronger foundation in this critical area of the program."

Comment C-15 The states of Oregon and Washington commented on the importance of incorporating into the BiOp a comprehensive RME program that includes effectiveness monitoring to empirically demonstrate the level of benefits and fish population improvements that occur, population status and trend monitoring, assessment of life-cycle effects, and an adaptive management plan. These entities, along with the Nez Perce tribe, also commented that the BiOp needs to ensure that the Action Agencies provide sufficient support to ensure full implementation of the RME program, and that RME commitments necessary to evaluate BiOp progress, as measured by population trends and survival benefits associated with hydro, habitat, harvest, hatchery, and predation, stay on track and are not rolled back.

A related comment from the Nez Perce tribe was that the Adaptive Management and Implementation Plan (AMIP) stated that by December 2011, the Action Agencies would expand habitat status and trend monitoring to at least one population or watershed per MPG and support updated modeling of the expected benefits of habitat actions, but that the Draft 2013 FCRPS BiOp does not reveal areas where this requirement has not been implemented. Specifically, the tribe noted that although the Lolo Creek, South Fork Clearwater, and Imnaha populations had been identified [by the BiOp tributary habitat RME work group] as important for CHaMP monitoring, CHaMP monitoring had not yet begun for these populations, and NOAA Fisheries needs to ensure that these projects are implemented since the RME is important for multiple reasons.

Response C-15 NOAA Fisheries has determined that the BiOp tributary habitat program includes a comprehensive RME program, described briefly in the 2014 Supplemental Opinion (see

Section 3.1.1.4.1) and in more detail in the Action Agencies 2013 CE, as well as in BPA 2013 and BPA and USBR 2013. The program includes effectiveness monitoring, population status and trend monitoring, assessment of life-cycle effects, and an adaptive management plan.

As noted in the 2014 Supplemental Opinion (see Section 3.1.1.8.3), the AMIP, which was incorporated into the RPA by the 2010 Supplemental BiOp, required that by December 2011, the Action Agencies would be monitoring habitat status and trends for at least one population per MPG in a manner strategically paired with adult and juvenile abundance monitoring. To support the AMIP requirements, the NOAA/Action Agency Tributary Habitat RME Workgroup recommended monitoring within 7 Chinook salmon MPGs and 11 steelhead MPGs (RME Workgroup 2010). Fish population and CHaMP habitat status information is now being collected for 9 Chinook salmon populations and 11 steelhead populations, which includes sampling in 5 of the 7 Chinook salmon MPGs and 5 of the 11 steelhead MPGs recommended by the RME Workgroup.

Full implementation of the program to at least one population per MPG was deferred, primarily due to recommendations in the ISRP's review of IMWs, CHaMP, ISEMP, and status and trends monitoring (ISRP 2010) and the NPCC's subsequent recommendations in its Research, Monitoring, and Evaluation and Artificial Production Category Review (NPCC 2011). Based on the ISRP review of the CHaMP program, the NPCC recommended an initial focus on a subset of CHaMP watersheds. The ISRP asked to review CHaMP after 1 to 2 years of data collection to see how field and data management protocols had been modified and how monitoring results were being incorporated into establishing restoration priorities.

In addition, the Action Agencies, based in part on input from the ISRP (ISRP 2010 and 2013), began exploring the potential to improve collaboration with other habitat monitoring efforts to improve sampling efficiencies and promote coordination (e.g., with the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program). Implementing the tributary habitat RME program in a manner that achieves the objectives laid out in the AMIP, while also ensuring use of best available information and adaptive management, is extremely important. Decisions regarding expansion of the program should be made within a strategic framework that considers peer review results, efforts to coordinate programs, and lessons learned from implementation to date. To that end, NOAA Fisheries recommends, in Section 3.1.1.8.3 of the 2014 Supplemental Opinion, that the Action Agencies reconvene the Action Agency/NOAA tributary habitat RME workgroup in 2014 to review and update recommendations made by that work group in 2010 (see RME Workgroup 2010), and that they also seek input from co-managers before making decisions about long-term implementation of the program.

Section 3.1.1.8.3 of the 2014 Supplemental Opinion notes that as the Action Agencies continue these efforts, they will ensure that the objectives established for habitat status and trends monitoring in the AMIP of the 2010 BiOp are met, including

> status and trend monitoring of habitat condition coupled with adult and juvenile monitoring to allow the agencies to assess fish survival and habitat productivity improvements expected from FCRPS actions (including monitoring of at least one

population per MPG);
improved modeling of the expected benefits of habitat actions;
ensure monitoring of appropriate habitat metrics (e.g., flow and temperature) across a diversity of ecological regions and habitat types to assess responses to climate change; and
clarify the connections between restoration actions and freshwater survival of salmonids.

Comment C-16 Washington noted that the Action Agencies and NOAA Fisheries should take advantage of fish monitoring programs in place in much of the basin and supported by multiple funding sources to supplement the RME needs of the BiOp.

Response C-16 NOAA Fisheries agrees that it is important to take advantage of monitoring efforts supported by multiple funding sources to supplement the RME needs of the BiOp. Such efforts are ongoing (for example, through the use of Northwest Power and Conservation Council resources such as the ISAB and ISRP to facilitate regional standardization and integration. NOAA Fisheries and the Action Agencies will continue to participate in these efforts to coordinate monitoring data and programs with state, federal, and tribal co-managers in all aspects of the BiOp tributary habitat RME program.

Comment C-17 Washington and Oregon commented that is important to continue funding and commitment to the Coordinated Assessment Project. They note that Federal, state, and tribal fish managers have identified a standardized Columbia Basin Regional Reporting Database through the Coordinated Assessments Project to report on indicators to assess population status, which are important to the BiOp, and that continued funding of the Coordinated Assessment Project will improve the information used in adaptive management forums and the timeliness of this information (RPA 72).

Response C-17 RPA Actions 71 and 72 are designed to implement RME Strategy 8, Coordination and Data Management Research, Monitoring, and Evaluation. RPA Action 71 requires the Action Agencies to coordinate RME activities with other federal, state, and tribal agencies on an ongoing basis. RPA Action 72 requires the Action Agencies to ensure that the information obtained under the auspices of the FCRPS RME program is archived in appropriate data management systems. NOAA Fisheries agrees that the standardized Columbia Basin Regional Reporting Database that has been identified through the Coordinated Assessment Project has the potential to improve the information used in adaptive management forums and the timeliness of the information and anticipates that the Action Agencies will continue funding of and engagement in the Coordinated Assessment Project. In particular, the use of the data exchange templates developed by the Coordinated Assessments Project will greatly facilitate the sharing and interchange of fish population data. However, additional work is required to ensure that metadata standards are developed for the communication of data capture and reduction methods.

D. Estuary Habitat

Estuary habitat projects project selection and scoring

Comment D-1 The Lower Columbia Estuary Partnership (LCEP) suggests a number of improvements to the project selection process. These include a focus on smaller projects across the eight estuary reaches (filling geographic gaps); addressing key limiting factors at each location; protecting cold water refugia for returning adults (especially at the mouths of tributaries above Portland); expanding the ERTG membership; increasing interactions between ERTG and restoration partners during and after the scoring process; expanding the focus of the program to more native species; integrating toxic contaminant reduction activities into project selection; and integrating toxics assessments into the RME program.

Response D-1 The LCEP provided thoughtful comments on the estuary-habitat project selection process for RPA actions 36 & 37. NOAA and the Action Agencies will discuss these ideas with the ERTG and will implement those that will improve the project selection and scoring process.

Comment D-2 NWF/SOS commented that after the ERTG scores a project, there is no independent review of how NOAA or the Action Agencies use those estimates. They note that the ISAB (2012), in its review of the 2012 CEERP documents, emphasized the need for an independent scientific review of the method and process for estimating survival benefits.

Response D-2 We describe the composition of the ERTG and the group's role in assigning survival benefit units (SBU) to estuary habitat projects in Section 3.2.1.3 of the 2014 Supplemental Opinion. We will use the ERTG's final SBU scores to confirm that the Action Agencies are complying with the RPA's estuary performance standards: a 9% relative survival improvement for ocean-type fish and a 6% improvement for stream-type fish. The ISAB has initiated a review of the ERTG process for assigning survival benefit units at the request of the Northwest Power and Conservation Council (Bradbury 2013). Specifically:

> Are the ERTG Scoring Criteria used to assign survival benefits for habitat restoration based on sound science?
>
> Do the ERTG Scoring Criteria have the ability to differentiate and/or prioritize those projects that will succeed in increasing the survival of salmonids through their residence and migration in the Columbia River estuary?
>
> Do the processes identified in the ERTG Scoring Criteria reflect a landscape approach to restoring estuarine habitat through landscape ecology, resilience, and adaptive capacity?
>
> Are there systematic and repeatable methods for quantitatively assessing the net changes in the Columbia estuary ecosystem that would produce data and analysis

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to validate the ERTG's survival benefit estimates?

Are there other data available to complement the ERTG's approach or additional analysis that would make better use of available information to prioritize habitat restoration?

The Council requested this review because the ERTG process is linked to the Columbia Estuary Ecosystem Restoration Program (CEERP) that the ISAB reviewed in 2012 (ISAB 2012). The CEERP documents were created partly in response to a recommendation from the ISAB to the Council in July 2011 as part of the ISAB's Review of Research, Monitoring, and Evaluation and Artificial Production Projects for additional discussion of how survival benefit units (SBU) are estimated by the ERTG and are used to estimate the potential effectiveness of habitat restoration work. The ISAB wanted to know if CEERP scientists were generally in agreement with the current method of estimating SBUs or if they saw a need to replace the current process in the near term.

NOAA Fisheries expects the ISAB to complete this review in early 2014. In the Council's request to the ISAB to conduct this review, Bradbury (2013) noted that, "there seems to be strong evidence that reasonable science review and expertise, from the ERTG, has been well-applied during the projects' development and implementation." NOAA Fisheries agrees with this assessment, but looks forward to gaining additional insight from the ISAB. We will discuss any recommendations for near- or long-term changes with the Action Agencies and the ERTG and will ensure that the Action Agencies document any resulting changes to the process for estimating survival benefits as part of the RPA's adaptive management process.

Comment D-3 The LCEP commented that NOAA Fisheries should expand the focus of the FCRPS BiOp to other native species in the Columbia River estuary including lower Columbia ESUs of salmon and steelhead, eulachon, and green sturgeon. They note that "FCRPS operations have been well documented to impact lower Columbia River species. In particular, changing flow patterns have reduced mean annual flows, changed the timing and reduced the magnitude of the spring freshet, nearly eliminated overbank flows, and altered the timing of other ecologically important flow events ... These changes from historical flow conditions have greatly impacted habitat forming processes in the lower Columbia River – decreasing floodplain connections, promoting the spread of invasive species, impacting species migrations patterns, and altering food webs. Furthermore, FCRPS operation impacts on lower Columbia River species exacerbate other changes in the lower Columbia River such as floodplain development and diking, deforestation, and widespread hatchery releases which increase competition for already limited resources."

Response D-3 We have considered these effects of FCRPS flow operations on lower Columbia salmon and steelhead, eulachon, and green sturgeon in the 2008 FCRPS BiOp (and the 2008 Supplemental Comprehensive Analysis, especially Section 5.3.1 in NMFS 2008b), the 2010 Supplemental BiOp, and the 2014 Supplemental Opinion. In the case of lower Columbia and Willamette salmon and steelhead, we concluded the 2008/2010 RPA would not jeopardize them and that the RPA, even though it was designed to satisfy the jeopardy standard for the interior Columbia basin species, would provide a number of benefits to the lower Columbia species. We also recognized that the poor status of

these ESUs/DPSs is primarily the result of other limiting factors and threats such as habitat degradation, tributary hydropower impacts, historical harvest rates, and hatchery production practices (see Introduction to Lower River Species, p. 8.8-61 in NMFS 2008b). In the 2014 Supplemental Opinion, we reaffirm that the effects of the RPA, considered in the context of the rangewide status of these species, the environmental baseline, and any cumulative effects, do not jeopardize the continued existence of lower Columbia and Willamette basin salmon and steelhead or result in the destruction or adverse modification of their designated critical habitat (see Section 4.2 for a summary of the analysis in this Supplemental Opinion). Chief among the factors we consider as mitigating for effects of the hydrosystem are the habitat improvement actions that reconnect estuarine floodplains with mainstem flow (RPA Actions 36 & 37). Efforts to reduce avian predation in the estuary (RPA Actions 45 & 46) are also expected to improve the survival of these species.

With respect to green sturgeon, we have determined that implementation of the RPA is not likely to adversely affect this species, which spawns and rears in the Sacramento River Delta, or its designated critical habitat (see Section 10 in NMFS 2008a, Section 7 in NMFS 2010a, and Section 6 in this 2014 Supplemental Opinion for effects on the Southern DPS of North American green sturgeon; see Section 6 in this 2014 Supplemental Opinion for effects on its designated critical habitat).

We have addressed effects of the RPA on eulachon and its critical habitat in Section 7 in this 2014 Supplemental Opinion. Adverse effects include flow management under the RPA (see Section 7.4.1 in this 2014 Supplemental Opinion). The available evidence indicates that shifts in the timing, magnitude, and duration of the hydrograph of the Columbia River, through implementation of the RPA, significantly diminish freshwater inputs to the estuary-plume environment, which could in turn affect phytoplankton production, the primary food source for eulachon larvae. However, decreases in freshwater inputs to the estuary and plume should not be considered proportional effects (e.g., a 10.4% decrease in freshwater inputs into the estuary–plume environment in the month of May does not translate into a 10.4% decrease in phytoplankton production or a commensurate level of eulachon mortality). Many external factors such as predation, ocean-forcing factors, and climate-ocean shifts determine the overall fitness and survival potential of eulachon in the estuary–plume. Therefore, we expect the magnitude of adverse effects to be significantly less than the corresponding decreases in river discharge. In this 2014 Supplemental Opinion we conclude that implementation of the RPA is not likely to jeopardize the continued existence of Southern DPS eulachon or result in the destruction or adverse modification of their designated critical habitat.

Comment D-4 The LCEP commented that NOAA should amend the project scoring criteria under RPA 37 to include restoration actions that protect or restore cold-water refugia, which are needed by adults returning to the Columbia River. LCEP also suggested that NOAA amend the RPA to develop a regional assessment of sea level rise, because rising Columbia River water levels could “wash out” habitat gains from the RPA habitat restoration program.

Response D-4 The ISAB (2007b) recommended management actions in the estuary that would allow habitat to adapt to the effects of climate change. We cited these in Section 8.1.3 in the 2008 FCRPS BiOp ("remove dikes to open backwater, slough, and other off-channel habitat to increase flow through these areas and encourage increased hyporheic flow to cool temperatures and create thermal refugia"). The ISAB's recommendations are very close to the ERTG's focus on large projects that reconnect fragmented portions of the historical tidally influenced floodplain and restore natural ecological processes, the type of project the Action Agencies are emphasizing in their estuary habitat improvement program. In addition, the Corps has facilitated a series of interdisciplinary workshops with regional scientists and planners to consider climate change science relevant to the Action Agencies' habitat work in the Columbia River estuary. As an outcome, the Corps is conducting a pilot study to evaluate additional elements for their estuary habitat improvement projects that would allow these sites to maintain habitat function over time (USACE 2012).

With respect to thermal refugia, the Corps sponsored a study (USACE 2013) to identify cool water areas for adult Chinook and steelhead in the lower Columbia and Snake rivers in response to AMIP Amendment #1 (NMFS 2010a). The authors concluded that in the reach below Bonneville Dam, there are confirmed or potential thermal refugia sites at the confluences of the Cowlitz, Lewis, Washougal, and Sandy rivers; Cascade Range snowmelt or glaciers feed these streams. NOAA and the Action Agencies will provide the ERTG with this study and any emerging information on cold-water refugia in the Columbia River below Bonneville Dam.

Comment D-5 The state of Idaho suggested that we clarify our statement that the ERTG's SBU method for scoring the survival benefits of habitat improvement projects is more conservative than the RPA (or "BA") method. "That logic does not prove that the estimates from the RPA method are conservative, only that one method tends to produce lower estimates than the other. No assessment that would determine if both methods were conservative, accurate, or overly optimistic was referenced. This should be clarified."

Response D-5 A scoring method that produces lower SBU scores is more conservative because it requires the Action Agencies to implement additional estuary habitat projects to reach the ocean- and stream-type SBU performance standards for RPA Actions 36 & 37.

Note: The NWF/SOS made several comments about their lack of confidence in the Action Agencies'

Comment D-6 "To make up for the remainder of the shortfall, NOAA relies on projects that are not yet initiated and were not scored by the ERTG to provide another 24.4 SBUs for ocean-type fish and 8.06 SBUs for stream-type fish. It is not possible to assess the feasibility or merit of these projects with the limited information available in the draft BiOp" (NWF/SOS 2013).

Response D-6 NOAA Fisheries has access to all of the project templates and scoring documents generated by the Action Agencies, their restoration partners, and the ERTG. We include an example design template and the corresponding ERTG scoring document for a completed project in Appendix G of the 2014 Supplemental Opinion to demonstrate the depth of information these provide. We do not include a template for a project that is still in development because these contain landowner information that could influence the real estate transactions if made public.

NOAA does not accept every estuary project that the Action Agencies choose to implement as relevant to RPA Actions 36 and 37. The Action Agencies included SBUs for chum spawning channels in Duncan and Hamilton creeks, Washington, in early drafts of their Comprehensive Evaluation, but we determined that these projects were not designed to provide ecosystem services to the mainstem and thus would not result in survival improvements for interior Columbia basin salmon and steelhead. These projects mitigate for effects of FCRPS flow management on chum spawning habitat in the mainstem near Bonneville Dam, but Columbia River chum salmon are not a subject of RPA Actions 36 & 37.

NOAA has questioned one additional project that the Action Agencies propose for implementation during 2014 through 2018, the replacement of a culvert and removal of a water control structure to reconnect the historical floodplain at the Oaks Bottom Wildlife Refuge. Although this project offers an opportunity to improve ecosystem function in a large, tidally influenced floodplain and wetland, the ERTG (2013) noted that the site is 16 miles from the mainstem Columbia River and "FCRPS BiOp stocks." The ERTG gave this project SBU scores of 0.077 SBUs for stream-type fish and 0.159 SBUs for ocean-type fish and stated that it will be good to see genetic stock data that an Oregon State University investigator is expected to collect. NOAA Fisheries concurs with the ERTG's assessment. Unless genetic stock or other action effectiveness data demonstrate the value of the Oaks Bottom project to interior Columbia ESUs/DPSs, we expect the Action Agencies to replace this project with another before 2018 that is more likely to improve the survival of interior Columbia juvenile salmon.

Comment D-7 "NOAA derived the predicted 6% and 9% survival benefits for estuary projects in the 2008 BiOp based on the assumption that all 23 management actions in the Estuary Module would be implemented to "a reasonable degree" and that projects would be distributed throughout all segments of the lower river to achieve a degree of connectivity" (NWF/SOS 2013).

Response D-7 Implementation of all 23 management actions in the Estuary Module is expected to result in a *20%* improvement in the survival of juvenile salmonids that enter the estuary from upstream of Bonneville Dam. The RPA's estuary-habitat improvement program incorporates a subset of those actions and we expect it to result in a 6% survival improvement for stream-type fish and a 9% improvement for ocean-type fish. See ERTG Document 2011-2, Revision 1 (ERTG 2012), *Guidance on Estuary Module Actions and Subactions Relevant to the ERTG Process*, for the subactions that these projects address, but the overarching management actions are CRE-1 Protect intact riparian areas in the estuary and restore riparian areas that are degraded; CRE-6 Reduce the export of sand and gravels via dredge operations by using dredged materials beneficially; CRE-8 Remove pilings and pile dikes; CRE-9 Protect remaining high-quality off-channel habitat from degradation and restore degraded areas; CRE-10 Breach or lower dikes and levees; CRE-12 Reduce the effects of vessel wake stranding in the estuary; and CRE-15 Reduce noxious weeds.

Comment D-8 "NOAA is now predicting total survival improvements from estuary actions that approach or may even exceed the total possible survival improvements from estuary habitat restoration identified in the Estuary Module, but cannot properly ignore the status of the other module elements even if they are not part of the RPA as these are the core of the analytical underpinning of the benefits predicted from the estuary actions" (NWF/SOS 2013).

Response D-8 This comment implies that the Action Agencies' ability to achieve the 6% stream- and 9% ocean-type survival improvements is limited by the numbers in the column titled Percent of Total Improvement Target in Table 5-5 of NOAA's Estuary Module for Columbia basin recovery plans (NMFS 2011). However, as described in the ERTG's document 2010-03 (ERTG 2011, "History and Development of a Method to Assign Survival Benefit Units;" see also Appendix G.1 in the 2014 Supplemental Opinion), the method for calculating the benefits of RPA habitat projects has evolved. For example, the ERTG re-weighted the value of the various types of estuary-habitat improvement actions for scoring these projects because they found that, for example, off-channel restoration (CRE 9.4) was under-valued in total SBUs, whereas riparian restoration (CRE 1.4) was over-valued.

In addition, the method for calculating SBUs that we originally adopted in the 2008 BiOp (45 SBUs to achieve a 9% survival improvement for ocean-type fish and 30 SBUs to achieve a 6% improvement for stream-type fish) assumed that these habitat projects would deliver roughly 0.66 stream-type SBUs for every ocean-type SBU (30/45). In practice, the ERTG has been more conservative, allocating only 0.33 stream-type SBUs for every ocean-type SBU. This means that the Action Agencies will

substantially exceed the ocean-type requirement in order to meet the stream-type requirement.

Comment D-9 "The draft BiOp confirms that the Action Agencies are no longer implementing the Piling and Piling Dike Removal Program in RPA 38" (NWF/SOS 2013).

Response D-9 The Action Agencies completed feasibility studies before determining that the Piling and Piling Dike Removal Program was not likely to provide the types of survival benefits identified in their 2007 Comprehensive Analysis (see Attachment D-1 to USACE et al. 2007b) (see Section 3.2.3 in the 2014 Supplemental Opinion and the Action Agencies' 2013 Comprehensive Evaluation). Although the Piling and Piling Dike Removal Program could have contributed achieving the 6% and 9% performance standards for the estuary habitat program by responding to management action CRE-8 in the Estuary Module, the Action Agencies can achieve the required SBUs by responding to other management actions from the Module such as reconnecting floodplain areas to the mainstem and replanting riparian areas, as described above.

Comment D-10 "The ERTG process that NOAA relies on to provide preliminary estimates for the four projects with the largest predicted benefits was intended to help rank relative benefits between projects to assist the agencies in choosing among projects, not for assigning precise benefits to specific actions" (NWF/SOS 2013).

Response D-10 NOAA states in RPA Action 37 that the ERTG is "to use the habitat metrics to determine the estimated change in survival which would result from full implementation" and "to estimate the change in overall estuary habitat and resultant change in population survival." There is no implication that the purpose of the ERTG is to estimate the relative benefits among projects as stated by NWF/SOS. Instead, the Action Agencies have worked with the Estuary Partnership's Science Work Group to rank potential projects for implementation. By the time the ERTG provides the final SBU scores, they are looking at the design information in the project template, which has been developed to between 60% and construction-ready stage. See Appendix F.5 in the 2014 Supplemental Opinion for examples of final project templates and the corresponding ERTG scores.

Comment D-11 "Three of the four large projects are located in the upper two of the six reaches of the estuary and those projects contribute nearly half of the total 2007-2018 SBUs" (NWF/SOS 2013).

Response D-11 First, we would like to correct some errors in the commenter's statement. There are eight (not six) estuary reaches (A through H), and two (not three) of the four large projects we discuss in Section 3.2.2.2 are located in Reach E (Columbia Stock Ranch Phase II and Large Dike Breach Reach E). Further, Reach E is located in the middle (not

upper) estuary, between the Portland/Vancouver metro area and the City of Kalama.

It is correct that the Action Agencies expect to achieve a large proportion of the survival benefit units required to meet the stream- and ocean-type performance standards in Reach E. The habitat opportunities in this reach represent sizable, contiguous pieces of the historical tidal floodplain. Much of the shoreline in this area has become inaccessible to salmon due to diking or has become highly modified and fragmented. In addition, these projects also are part of a larger network of RPA habitat restoration projects scattered between Reach A (at the mouth of the estuary) and Reach H (closer to Bonneville Dam). We expect that the full array of projects the Action Agencies will complete by 2018 will be sufficient to meet the RPA performance standards.

Estuary habitat projects certainty of implementation and action effectiveness

Comment D-12 NWF/SOS commented that the draft BiOp did not discuss the impact of the current fiscal situation on funding for habitat improvement projects and RM&E in the estuary and stated that NOAA must independently consider the likelihood of funding in evaluating whether the Action Agencies' projects are reasonably certain to occur.

Response D-12 In his Opinion dated August 2, 2011, Judge Redden stated that NOAA must rely on specific, identified habitat projects, referencing the level of detail in the 2010-2013 Implementation Plan as adequate. The Action Agencies have provided the same or a higher level of detail for the estuary habitat projects and associated RME in the 2014-2018 Implementation Plan. Further, the BPA and the Corps have stated their commitment to implementing the RPA, specifically including the estuary-habitat improvement program, in their Records of Decision for the 2008 BiOp and the 2010 Supplemental BiOp (BPA 2008, 2010; USACE 2008, 2010). In addition, the Action Agencies have described their ongoing objectives and plans for specific estuary habitat projects in their 2007 Biological Assessment (USACE et al. 2007a), 2010-2013 Implementation Plan (BPA et al. 2010), and 2014-2018 Implementation Plan (BPA et al. 2014). Thus, NOAA has no evidence that the estuary habitat program will not be adequately funded through 2018.

Comment D-13 The LCEP recommend that NOAA Fisheries and the Action Agencies increase funding for estuary action effectiveness and ecosystem monitoring actions to more fully collect the pre- and post-project effectiveness data to determine if project objectives are met and if the ERTG scoring reflects on-the-ground results. Also, NWF/SOS commented that NOAA has not identified any actual survival increases from the estuary-habitat improvement actions that have been implemented so far and that predictions are not connected to actual habitat performance.

Response D-13 As we describe in Section 3.2.1.3.1 of the 2014 Supplemental Opinion, the Action Agencies are increasing the amount of action effectiveness monitoring for habitat improvement projects in the 2014 through 2018 period, using the Action Effectiveness

Monitoring and Research (AEMR) Plan described in Johnson et al. 2013. The AEMR Plan includes both site-specific monitoring (to confirm that project benefits are realized) and research elements (e.g., to investigate the ERTG's uncertainties; ERTG 2012). The main hypotheses are that: 1) habitat-based indicators of ecosystem controlling factors, structures, and processes show positive effects from restoration actions, and 2) fish-based indicators of ecosystem functions show positive effects from habitats undergoing restoration. Action effectiveness research will incorporate information from a suite of 48 reference sites to measure background change and variability (BPA et al. 2013). The Action Agencies have begun implementing this design as more projects are constructed, including work at five sites in 2013, and will continue to increase the amount of action effectiveness monitoring in the 2014 through 2018 period. With respect to the NWF/SOS comment that we have not identified actual survival increases from estuary habitat actions implemented so far, the Action Agencies recently developed tools for documenting action effectiveness at sites in the lower Columbia estuary (Johnson et al. 2013; BPA and USACE 2012) that will be applied during 2014 through 2018. By the end of the BiOp term (2018), we expect to be able to evaluate the extent to which estuary habitat improvement actions have been implemented and the extent to which those actions are consistent with the 6% and 9% relative survival improvement performance standards, based on physical, chemical, and biological changes in habitat quality and quantity and data on juvenile salmon density, condition, growth, genetic stock, diet, residence time, prey production, and macro-detritus export, as they become available. In addition, we have re-scoped the plume research program, which now includes an effort to examine the degree to which conditions experienced by these juvenile fish during estuary transit affect survival in the plume and early ocean (see Section 3.2.4.2 in the 2014 Supplemental Opinion). Information collected under this objective will increase our understanding of how juvenile salmon and steelhead from interior ESUs/DPSs use estuarine habitat services and the effects of those experiences on growth and survival in subsequent life stages.

Comment D-14 The Nez Perce Tribe commented that the BiOp should "reveal that certain projects have been delayed or put on hold."

Response D-14 As described in Section 3.2.2.1 of the 2014 Supplemental Opinion, the Action Agencies have replaced some of the projects identified in the BA (Corps et al. 2007) and the 2010-2013 Implementation Plan (BPA et al. 2010) with others that better respond to the ERTG's guidance to reconnect large sections of the historical floodplain and improve wetland channels in tidally influenced areas near the mainstem.

E. Hydrosystem

Project Configuration and Operation

Comment E-1 A few commenters requested that the word "experimental" be dropped from the summer draft operations at Libby and Hungry Horse reservoirs in the 2008 FCRPS BiOp RPA Table.

Response E-1 A process to formally adopt the summer draft operations has not been established. The 2014 Supplemental Opinion still contains the word "experimental". We suggest that the state of Montana work with NOAA Fisheries to develop a process by which the RIOG can review the results of the recent operation and assess whether the "experiment" is concluded.

Comment E-2 One commenter suggested that the December draft at Libby Dam be reduced by four feet (changed from the current 2426' msl to 2430' msl) in low forecast years.

Response E-2 An analysis of this effect was not conducted for the 2014 Supplemental Opinion. NOAA Fisheries suggests that the state of Montana request the U.S. Army Corps of Engineers to evaluate the effect of this proposed change on flood risk management for future consideration.

Comment E-3 Several commenters opposed using subyearling counts to determine the spring to summer spill transition dates at the Snake River mainstem dams, asserting that this would provide less protection for spring migrants.

Response E-3 The2014 Supplemental Opinion revises the spill transition proposal (Section 3.3.1.1). Counts of subyearling Chinook salmon will not be used to determine the spring to summer spill transition date. Instead, a 95% passage criteria for spring migrants will be used to determine the transition date.

Comment E-4 Several commenters indicated their opposition to ending spill operations at the Snake River dams when fewer than 300 subyearling juveniles were collected for three consecutive days because it is less protective of the ESU.

Response E-4 NOAA Fisheries responded to this issue in the 2014 Supplemental FCRPS BiOp (Section 3.3.1.1).

Comment E-5 Several commenters recommended that a uniform, rather than bulk, spill pattern be used at Lower Monumental Dam when flows exceed 60 kcfs.

Response E-5 The spill pattern currently proposed (a bulk pattern under all but the high flow conditions) has already undergone Juvenile Dam Passage Performance Standard performance testing. The results of these studies are noted in the 2014 Supplemental FCRPS BiOp (Table X.X), and indicate that direct survival under this operation at Lower Monumental Dam is relatively high, likely meeting or exceeding the performance standard.

However, performance standard tests also indicate that Spill Passage Efficiency (SPE) often declines as flow increases, causing the proportion of fish entering the bypass system at this project to increase. Smolt-to-adult returns at Lower Monumental Dam have been lower than those of upriver projects; the outfall to the juvenile bypass facility was relocated in 2011, which should have increased survival and the smolt-to-adult return rate for fish passing via the bypass system. NOAA Fisheries will continue to evaluate adult returns at this project (since the juvenile bypass facility outfall was relocated in 2011) and the effect of operations on transportation strategies for spring migrants, and work with the Action Agencies and regional co-managers through the regional forum processes to assess whether alternative operations are warranted.

Comment E-6 One commenter recommended that Ice Harbor Dam should be operated at a single, constant spill percentage (on a weekly basis) instead of the alternating 30% and 45 kcfs/gas cap spill percentage that was approved during the Court Order, and proposed by the Action Agencies.

Response E-6 NOAA Fisheries appreciates this suggestion. While initial proposed spill operations at this project will continue the 30% and 45 kcfs/gas cap operation, we agree that ultimately a single operation would be preferable. A final operation for Juvenile Dam Passage Survival performance testing has not yet been developed. Prior to testing juvenile performance standards at Ice Harbor Dam (planned for 2015 to 2017), the Studies Review Work Group (SRWG) will review available data and recommend a test operation (spill level) for meeting the BiOp specified goals. This suggested operation should be considered during those deliberations.

Comment E-7 Some commenters indicated that additional measures should be considered to meet flow targets and generally increase water velocity and decrease fish travel times. Specific measures included operating mainstem dams to Minimum Operating Pool (or to Minimum Irrigation Pool) for John Day Dam; obtaining additional water from Canada.

Response E-7 The 2008 BiOp, 2010 Supplemental BiOp, and the 2014 Supplemental Opinion continue to require operations that manage flood control and refill operations to increase flows during the spring migration period; draft storage facilities to specified elevations to increase summer flows; continue discussions with Canada regarding non-Treaty water; and specify reservoir elevation limits during the juvenile migration period to limit the negative effects of the reservoirs while maintaining project purposes. We do not agree that the proposed measures are necessary or would substantially improve reservoir conditions or survival rates beyond those observed in recent years. The installation of surface passage routes (as noted in Section 3.3.1) does appear to have substantially reduced travel times for migrating smolts through the lower Snake and Columbia Rivers.

Comment E-8 Some commenters note that the Draft BiOp fails to evaluate Lower Snake River dam

removal.

Response E-8 The Action Agencies completed a Plan of Study for Lower Snake River dams in March of 2010 as identified in the 2009 AMIP. NOAA Fisheries does not believe that further evaluations, beyond those required in the 2009 AMIP (which was incorporated into the 2008 FCRPS RPA by the 2010 Supplemental BiOp) are necessary at this time.

Comment E-9 Several commenters suggested generally that measures should not be taken to increase the proportion of smolts transported compared to recent operations; some commenters specifically suggested the proposed April 21 date to initiate the juvenile fish transportation program in order to collect a higher proportion of wild juvenile steelhead; and one commenter proposed maintaining the existing protocols, but turning off the removable spillway weir at Lower Granite Dam in parts of May to increase the proportion of steelhead transported.

Response E-9 The 2014 Supplemental Opinion revises the start date proposal in Section 3.3.3.4.

NOAA has reviewed the most recent data available and altered the proposed transport start dates to provide additional flexibility. NOAA has also acknowledged that the Technical Management Team and the Corps of Engineers can consider alternative approaches (e.g. those proposed by Idaho relating to the operation of the removable spillway weir). NOAA Fisheries believes that the proposal in the 2014 Supplemental Opinion is consistent with the ISAB's "spread the risk" recommendation.

Comment E-10 Several commenters suggested that there are substantial flaws relating to the Juvenile Dam Passage Performance standard testing.

Response E-10 All experimental designs for assessing juvenile survival have limitations. NOAA Fisheries reviewed the methodology used to perform these tests, and it was vetted through the various regional forums and was favorably reviewed by the ISRP in October, 2009 (ISRP 2009) Using their standard criteria, the ISRP found that the project is "based on sound science principles; benefits fish and wildlife; has clearly defined objectives and outcomes; and has provisions for monitoring and evaluation of results." NOAA Fisheries believes that the methodology and assessment protocol utilizes a reasonable, consistent approach to assess the survival of juvenile fish passing dams, uses the best science available, and that no alternative methodology has been shown to be substantively better.

Comment E-11 Several commenters indicated that there is insufficient justification for the lower Juvenile Dam Passage Survival standard for subyearling Chinook salmon (93% vs 96% for yearling Chinook salmon).

Response E-11 There are many reasons why subyearling Chinook salmon smolts would be expected to survive at lower rates than yearling Chinook salmon smolts passing dams. The conditions under which the subyearling Chinook salmon smolts migrate are characterized by warmer temperatures and lower flows than earlier in the spring. These conditions are expected to result in higher rates of predation for subyearling Chinook salmon smolts relative to yearling Chinook salmon smolts because of increased metabolism, increased foraging effectiveness, etc. NOAA believes that the 93% Juvenile Dam Passage Performance Standard is sufficient and represents a substantial overall improvement in fall Chinook salmon survival rates which is contributing to increased reach survival estimates, and to the recent increasing abundance of both ESA-listed Snake River fall Chinook and unlisted Upper Columbia River summer-fall Chinook salmon.

Comment E-12 One commenter suggested that PIT-tagged adult salmon and steelhead should not be used to assess adult conversion rates (minimum survival rates) through the hydrosystem – suggesting additional, potential sources or error or bias; another commenter suggested that pre-2002 data from McNary Dam could be used to further assess whether or not survival rates may have been reduced as compared to the Base Period in the 2008 FCRPS BiOp.

Response E-12 NOAA Fisheries personnel from the Interior Columbia Basin Office and Sustainable Fisheries Division are currently working – and will continue to work- together, with members of the Columbia Compact Technical Advisory Committee, to examine the issues identified in the draft BiOp and in these comments. At present, the validity of the PIT tag method of estimating adult upstream survival has been generally confirmed, with further analyses to identify potential sources of bias underway. The methodology of harvest estimation is also under review. The objective of these reviews and analyses is to refine methods of measuring adult survival and mortality (harvest, straying, hydro effects)to produce a methodology for estimating adult upstream mortality that is statistically valid as well as generally agreed upon.

Comment E-13 One commenter suggested that NOAA Fisheries should include itself in the 2014 FCRPS Biological Opinion as an Action Agency since NOAA Fisheries has some jurisdiction over fisheries.

Response E-13 It would be inappropriate to include NOAA Fisheries as an Action Agency in the FCRPS BiOp as NOAA Fisheries does not own, operate, or maintain the hydrosystem. However, with respect to harvest management activities, NOAA Fisheries, to the extent it exercises regulatory authority, does undergo a separate ESA Section 7(a)(2) consultation with itself as the Action Agency where it exercises such authority.

Comment E-14 Several commenters suggested that improved or greatly expanded research and monitoring programs are necessary to adaptively manage the hydrosystem.

Response E-14 NOAA Fisheries appreciates suggestions aimed at improving research, monitoring, and evaluation programs. However, while NOAA Fisheries has evaluated the current effects of RME on the listed species (see Section 3.8) and determined that the negative effects of these programs (e.g., substantial handling and tagging and incidental mortalities) can be tolerated by the ESUs each year, we remain concerned about the potential overall impacts of expanding intensive monitoring to include the majority of populations. We will continue to consider means of improving the data available for managing ESA-listed species while considering the associated risks of these activities.

Comment E-15 Many commenters indicated their support for implementing spill at the mainstem dams up to 125% total dissolved gas levels as a "test" of a hypothesis developed in the Comparative Survival Study (CSS). Supporters indicate that there is substantial reason to think that this action would, if taken, substantially increase SARs and the overall productivity of the ESUs. Many other commenters indicated their opposition to such a test at this time. These commenters highlight flaws in the CSS approach and point out that at the present time, implementing this operation would violate the total dissolved gas waivers issued by the states of Oregon and Washington that allows juvenile spill operations to exceed the national standard of 110% total dissolved gas.

Response E-15 NOAA Fisheries responded to this issue in the 2014 Supplemental FCRPS BiOp (Section 3.3.3.5).

NOAA Fisheries is interested in proposals that have the potential to further the attainment of recovery objectives by either addressing limiting factors or by improving the survival (either directly or indirectly) of salmon and steelhead throughout their life cycle. It is clear to NOAA Fisheries that the surface passage routes, fully implemented at the mainstem dams since 2009, are generally increasing survival, decreasing travel times, and potentially improving adult returns— all of which are consistent with the benefits being ascribed to a successful spill test.

It seems equally clear to NOAA Fisheries that, aside from substantial technical issues that have been raised with this approach (see Section 3.3.3.5 for details), many additional considerations and assessments would need to be completed before any large-scale test could be implemented: potential effects on spilling basin structures, generation and system reliability, adult passage, gas bubble disease. Additionally, many permitting processes (Clean Water Act and NEPA) would need to be completed before a study of this nature could be implemented consistent with state and federal law and these processes, even if begun immediately, would reasonably be expected to take several years to complete.

NOAA Fisheries is aware that this issue is also being raised with the Northwest Power

and Conservation Council, which is enlisting the Independent Scientific Advisory Board to contemplate and respond to several initial questions relating to this proposal.

Taken together, NOAA Fisheries believes that the most prudent course of action is to (1) continue to monitor population abundance and productivity while annually gathering system survival and SAR information s to assess the efficacy of the hydrosystem as it has currently been configured; and (2) explore the issues relating to the proposed spill test prior to the end of 2018, the expected duration of the 2014 Supplemental Opinion.

NOAA Fisheries will participate in regional discussions (at the NPCC or elsewhere) of the proposed spill test and in any related biological, logistical, or regulatory discussions. Further, NOAA Fisheries has recommended (see Section 9) that the Action Agencies also participate in discussions (such as these) which could potentially further All-H recovery goals and which are related to activities for which they have legal responsibilities

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Comment E-16 One commenter indicated that the 2008 BiOp's prediction of a 6% survival improvement from kelt reconditioning has proven to be inaccurate; there is insufficient description to support a conclusion that this goal can be attained by 2018; and the quantitative analysis in the 2008 BiOp should be revised or the 6% goal for B-run Snake River steelhead kelts changed to something closer to zero.

Response E-16 See discussion in the 2014 Supplemental Opinion (Section 3.3.4).

Over the past 5 years, the kelt reconditioning program, paid for by BPA and administered primarily by the Nez Perce Tribe, has been in an experimental/developmental phase. It has made steady, though slow progress and is now ready to move into the production phase. The construction of a dedicated kelt reconditioning facility will provide the capacity to rehabilitate enough kelts to reach the target. New initiatives to collect kelts for reconditioning such as capturing them in the tributaries, and recent improvements to passage systems appear likely to increase both the quantity and quality of kelts available for rehabilitation.

In addition, while constructed and operated primarily to increase the survival of juvenile smolts, surface passage routes appear to be beneficial for kelts, and while the benefits of these existing structures is still being quantified, it appears to be significant.

NOAA Fisheries finds that there is sufficient basis to conclude that there will be a combination of kelt rehabilitation actions and downstream passage improvements likely to achieve the 6% goal for B-run steelhead called for in RPA 33 of the 2008 FCPRS BiOp.

Comment E-17 One commenter asserts that NOAA Fisheries should not consider structural or operational improvements that increase survival rates of migrating steelhead (upstream) or kelts (downstream) through the mainstem FCRPS dams as part of achieving the 6% survival improvement ascribed to the B-run kelt reconditioning

program.

Response E-17 NOAA Fisheries strongly disagrees with this assertion. Actions that improve the survival of steelhead or kelts should be considered as part of the suite of actions used to achieve the 6% goal for B-run steelhead. All of the co-managing fishery agencies generally support these operations and, though the benefits have not been fully quantified, they are expected to improve the survival of all migrating steelhead and kelts, not just B-run steelhead. There is no biological reason to eliminate from consideration structural or operational improvements at the dams, as long as they are economically and technically feasible.

Comment E-18 One commenter asked for an explanation why the BiOp does not require the Action Agencies to investigate the need to protect habitat upstream of Grand Coulee Dam as a means of providing some of the listed species refuge from the warming lower Columbia River water temperatures.

Response E-18 As currently defined, the Upper Columbia River steelhead and spring Chinook salmon ESU/DPS boundaries end at the Chief Joseph dam and there is no indication that such an action is necessary within the 2018 time frame of the 2014 Supplemental Opinion. Additionally, at present there is no known method of either collecting or passing juvenile migrating smolts through Grand Coulee dam and reservoir with sufficient survival or consistency to support populations upstream of this project. However, passage is being evaluated at the Corps' high head dams in the Willamette Valley Basin. Information gained through these investigations may help with some aspects of the technical challenges related to fish passage at very high head dams.

Comment E-19 Several commenters suggest that Configuration and Operation Plans (COPs) may not be sufficient for long-term contingency actions and do not adequately consider adult return effects; several commenters also suggest that management actions should be based on the entire life-cycle and not be limited to the Juvenile Dam Passage Standard.

Response E-19 It is true that COPs to date have primarily focused on achieving the Juvenile Dam Passage Standard. However, NOAA Fisheries intended the COPs to be "living" documents, subject to revision over time. NOAA Fisheries agrees that COPs should be revised to also consider actions that might be necessary in possible, but unlikely, event that long-term contingency actions have been triggered pursuant to the 2009 AMIP procedures.

NOAA Fisheries has, and will continue to assess, the cumulative effect of all factors—

including hydrosystem configuration and operation and transportation—affecting the life cycle of ESA-listed species in its FCRPS BiOps. In addition to tracking population abundance and productivity metrics, NOAA Fisheries is annually reviewing transport and in-river SARs, and juvenile and adult reach survival estimates, as well as the results of Juvenile Dam Passage Survival performance tests.

F. Hatchery

Comment F-1 Issues with the Stier-Hinrichsen methodology, "method was not accepted by the scientific community and was not accepted by NOAA in evaluating HGMPs . . . the method and math behind the model remain incomprehensible."

Response F-1 The method and math behind the Stier-Hinrichsen (2008) methodology are quite simple. The Stier-Hinrichsen methodology is used to quantify changes in the combined productivity of a population (i.e., R/S for both hatchery and natural-origin spawners). If the hatchery-origin spawners are less reproductively successful than the natural-origin spawners are, and you reduce the proportion of hatchery-origin spawners in the population, the combined productivity of the population will increase.

Example 1: A population has 100 fish. The productivity of the natural-origin fish is 1.0. Half of the fish are hatchery-origin. The hatchery-origin fish are 80% as productive as the natural-origin fish.

Combined productivity (R/S):

$$\frac{[(50*0.8=40)Returns\ From\ HO\ Spawners]+[(50*1.0=50)Returns\ From\ NO\ Spawners]}{50\ HO\ Spawners\ +50\ NO\ Spawners} = \frac{90}{100} = 0.90$$

Example 2: A population has 100 fish. The productivity of the natural-origin fish is 1.0. A quarter of the fish are hatchery-origin. The hatchery-origin fish are 80% as productive as the natural-origin fish.

Combined productivity (R/S):

$$\frac{[(25*0.8=20)Returns\ From\ HO\ Spawners]+[(75*1.0=75)Returns\ From\ NO\ Spawners]}{25\ HO\ Spawners+75\ NO\ Spawners} = \frac{95}{100} = 0.95$$

The Stier-Hinrichsen methodology converts the combined productivity equation to its logarithmic form for ease of calculation. Although the logarithmic form appears more complicated, the underlying math remains unchanged.

NOAA Fisheries did not reject the Stier-Hinrichsen in its evaluations of HGMPs. NOAA Fisheries determines the best method(s) for evaluating effects of hatchery programs on a case-by-case basis.

Comment F-2 Need better link between RPA Actions and analysis in Table 3.4.1

Response F-2 Please see clarifying text in Section 3.4.5.

Comment F-3 2013 BiOp fails to provide an accurate description of some programs (Tucannon Spring Chinook and Upper Columbia spring Chinook)

Response F-3 Please see revised text in Table 3.4-1.

Comment F-4 The Action Agencies are far behind in implementing RPA 39, but BiOp does not discuss the impacts or propose alternative actions to address it.

Response F-4 The hatchery operators with the cooperation of the action agencies have made progress in completing and submitting HGMPs that are sufficient for consultation. To date, NMFS has completed consultations on 11 HGMPs.[1]

The original schedule for completing RPA action 39 consultations was overly ambitious given the enormous amount of coordination, analysis, writing, and review needed to complete a consultation. However, this careful approach to consultations, albeit more time consuming than expected, has resulted in HGMPs that adequately describe the hatchery programs, are supported by the co-managers, NOAA Fisheries, and the Action Agencies, and identify necessary hatchery reforms. Several hatchery reforms have already been implemented and are already providing biological benefits. NOAA Fisheries expects to complete consultation on all HGMPs included in RPA 39 by the end of 2018 as was contemplated in the 2008 RPA.

[1] This number is different from the number in the Action Agencies' CE because the CE only reported actions completed by the end of 2012.

Comment F-5 NOAA cannot claim survival improvements from anticipated but as yet unproven, and in many cases even implemented, future reform actions that have not yet undergone ESA consultation.

Response F-5 As described in Section 3.4.6, in the 2013 BiOp, NOAA only considered the benefits of hatchery RPA actions that have completed ESA consultations.

Comment F-6 NOAA does not address the significant flaws in the 2008 BiOp analysis of potential survival improvements from hatchery reforms. The 2008 hatchery analysis relies on a model that removed the long-term productivity of wild, naturally spawning fish from consideration. It also assumed a percentage of natural spawners that has not been sustained to date.

Response F-6 In the 2008 BiOp, most benefits and risks from past and present hatchery practices were imbedded in the environmental baseline. However, because estimates of productivity and extinction risk in the 2008 BiOp were based on the performance of populations during a 20-year "base period" that ended in most cases with the 1999 brood year (with adults returning through 2003–2006, depending on the population), the Environmental Baseline had to be adjusted to account for the effects of hatchery reform actions, for which empirical data had not yet been gathered or did not yet exist. For example, the empirical data from the base period did not fully reflect the effects of hatchery reform actions taken in the latter portion of the base period or after the base period (e.g., elimination of an out-of-basin broodstock in the Upper Grande Ronde). The Stier and Hinrichsen (2008) methodology was used to make base-to-current (i.e., base-to-2008) adjustments in survival from completed hatchery reform actions. Survival adjustments were based on changes in the productivity of the entire naturally spawning population, which includes hatchery-origin fish when they spawn naturally. Therefore, hatchery management actions that improved the productivity of hatchery-origin fish spawning naturally affected the base-to-current adjustment. Appendix I of the 2008 Supplemental Comprehensive Analysis describes this methodology.

Because the Stier and Hinrichsen (2008) methodology does not account for genetic and ecological effects on natural productivity from naturally spawning hatchery-origin fish quantitatively (i.e., the model does not account for potential reductions in the productivity of natural-origin fish from interbreeding with hatchery-origin fish), NOAA Fisheries considered these prospective effects qualitatively in the 2008 BiOp's effects analysis.

The commenters are correct in that the percentage of natural-origin fish on the spawning ground has been lower in recent years than anticipated in 2008. As a result, NMFS used the most current data available to update the baseline (See Section 2.2.5.2).

Comment F-7 The draft Supplemental BiOp makes no mention of the completion of Chief Joseph Hatchery or its role in implementing RP A 42, Hatchery Strategy 2. The Supplemental Opinion should update the status of the hatchery and reference the steps that CCT is taking toward implementation of the RP A and the UCR Recovery Plan, namely by requesting NOAA Fisheries to designate a 10j experimental population. In light of the current status of the UCR spring Chinook ESU, this information is relevant to NOAA's consultation for the remaining five years of the BiOp.

Response F-7 Please see revised text in Table 3.4-1.

G. Predation

Pinniped Predation

Comment G-1 One commenter suggested that the Corps of Engineers should be required to fund the future removal of California sea lions under section 120 of the Marine Mammal Protection Act.

Response G-1 NOAA Fisheries funds the lethal removal of California sea lions below Bonneville dam and plans to do so for the foreseeable future. The AA's will continue to support harassment and removal efforts by providing effective monitoring that satisfies the requirements of the section 120 permitting process.

Comment G-2 In a comment from the Colville Confederated Tribes, they agree with modified RPA Actions 46 and 47. However, they add, "We recommend that NOAA Fisheries' modification to RPA 46 include a robust adaptive management component that would expressly allow for an adjustment in the nesting pair target if reduction of salmonid predation by cormorants to base levels is not achieved at the end of this BiOp's term."

Response G-2 Continuing to monitor cormorant colony smolt-consumption levels at the bioenergetics level used in 2014 Supplemental Opinion analysis is labor intensive, expensive, and annual estimates can be misleading. We have seen that per capita consumption levels rise and fall with other variables such as river flow and alternative prey abundance. The target nesting pair reduction goals are based on a 15-year data set (1998–2012) that we believe captures these variables well. Since this will be a long-term program, likely to extend into the next BiOp period, we would expect the target nesting pair reduction estimates to provide the anticipated level of smolt survival increase over that period.

Comment G-3 Nez Perce Tribe: "Avian Predation. The Tribe is concerned that NOAA's Draft 2013 FCRPS BiOp does not use the most recent data on avian populations, resulting in an underestimate of current avian populations; that NOAA now acknowledges that predation rates for cormorants on salmon and steelhead were under-estimated but does not include the more recent information that indicates these predation rates were even greater; and that many of the proposed avian actions appear unlikely to occur and/or to achieve the survival improvements that NOAA relied upon, and that NOAA has not attempted to fill these gaps through other actions."

Response G-3 The commenter may not understand the construct of the BiOp base-to-current analysis. The base and current periods are specific for a species and time. The base for steelhead (species most effected by avian predation) is 1983-2002. The current period

for steelhead is 2003-2009. The differential survival rate reported in the 2014 Supplemental Opinion is the difference in consumption rates between these two periods. The future goal is to get predation rates down to the level of the base period, regardless of how large the colony and associated smolt consumption is now (2013).

Comment G-4 The state of Idaho made the following comment: "Section 2.2.4.1 on page 184: This section includes the statement 'NOAA Fisheries did not assume any compensatory mortality for predation by Caspian terns in the estuary in the 2008 BiOp and has no clear indication that the case would be different, or substantial, for predation by double-crested cormorants.' That statement should be clarified. Assuming no compensatory mortality (eating proportionally more sick, injured, or weakened fish) by avian predators that swim to capture their prey is contrary to the ecological principal of minimizing energy expenditures to capture prey. Also, recent USACOE funded research has demonstrated compensatory smolt predation by avian predators in the Columbia Basin (Evans et al. 2012)."

Response G-4 The Hostetter et al. (not Evans), 2012 study was done among the dams in the mid-Columbia and Snake rivers, not in the estuary. Also, this study only established that fish in a degraded condition are more likely to be preyed upon. It did not determine a specific level of compensatory mortality. Section 3.5 in the 2014 Supplemental Opinion addresses the issue of compensatory predation in regards to cormorants. This is a comparative analysis between two periods, the Base and Current periods as defined by the 2008 BiOp's analysis (e.g., for steelhead the base period is 1983-2002 and the current period is 2003-2009.). We are simply making the assumption that compensatory predation is equal on both sides of this comparison.

Comment G-5 The Wildlife Center of the North Coast commented that, basically, human activities are the problem, not the cormorants. There are other ways to address salmon losses. Also, current Caspian tern management is off course. They added, "Could you please provide the public with access to the following literature referenced in the 2013 Draft Supplemental Bi-Op."

Response G-5 Regardless of the reason, double-crested cormorant numbers and their impact on listed salmon have increased dramatically in the last 20 years. This is a significant source of listed smolt mortality that can be addressed with prudent management actions. These actions are a part of a much greater effort that includes significant restrictions on hydropower production, salmon harvest, land management actions and hatchery programs.

While we understand the comments regarding Caspian terns and are actively pursuing implementation improvements with the Action Agencies, this comment is off the topic of the 2014 Supplemental Opinion since the Supplemental Opinion does not change the original RPA action on terns.

The final version of Fredricks 2013 will be included as an Appendix to the final 2014

Supplemental Opinion.

Comment G-6 NWF/SOS commented, "As noted in comments on the Draft CE and IP, and in prior briefs and declarations, avian predation – particularly from double-crested cormorants – has increased substantially and to a degree that NOAA ignored in the 2008 BiOp. NWF/SOS adopt and incorporate those comments by reference here. While the draft BiOp admits that NOAA did not consider this issue in 2008, NOAA does not update its analysis to account for this increased mortality, nor does it prescribe measures to compensate for five years of increased mortality or otherwise address the effects of this unassessed past mortality in the future. NWF/SOS hereby adopt and incorporate into these comments their prior comments on the draft 2010 BiOp as well as their comments on the draft AMIP. This incorporation specifically includes the declarations identified in our comments on the draft 2010 BiOp. In addition, we offer the following comments about the flaws in the draft BiOp:

It appears that little progress has been made in achieving the assumed survival improvements for the current-to-prospective adjustments by reducing tern predation (3.4% for steelhead, 2.0% for spring/summer Chinook, and 0.8% for fall Chinook). To achieve the tern predation reductions planned and assessed in the 2008 BiOp, terns need to be reduced by 2000-3000 pairs. When the amount of nesting habitat was reduced in an attempt to reduce the number of breeding pairs, the terns nested at higher densities. Research and monitoring in 2012 showed 6400 breeding pairs at East Sand Island. This number may have increased in 2013. As a result, smolt consumption levels by Caspian terns remain at pre-management levels."

Response G-6 The goal of the Caspian tern reduction is to get to a range of approximately 3,000 to 4,000 pairs on East Sand Island. We recognize that the number of pairs is still nearly double this number on East Sand Island. Reducing the cormorant population to these levels will reduce the ongoing impact of the predators on the productivity of the affected fish populations back to Base Period levels. We continue to believe that the appropriate number of terns can be moved from the estuary; however, establishing appropriate alternative nesting locations continues to be a priority. The Action Agencies are working on this issue now and remain within the overall timeframe of the 2008 BiOp.

See also, Response G-2, G-4, and G-5, and Section 3.5.2 in the 2014 Supplemental Opinion.

Comment G-7 NWF/SOS commented that, attempts to establish alternative nesting habitat to disperse Caspian terns has had problems and further reductions in the amount of nesting habitat on East Sand Island may be limited by the availability of alternative nesting habitat. Since management was intensified recently to reduce nesting at East Sand Island, banded Caspian terns from East Sand Island have been detected upriver where tern predation rates on salmonids are generally higher than in the estuary. If this or other dispersal trends to other areas is substantial, it could offset benefits to salmonids by shifting impacts to other areas. This evidence and risk is not addressed in

the discussion of either upriver or estuary tern predation.

Response G-7 The Action Agencies continue to work on development of new alternative nesting sites. Individual Caspian tern movements do vary from year to year, but the colonies in the interior Columbia basin and East Sand Island have remained stable. The Columbia Plateau colonies have varied around 900 pairs over the last decade; however, these colonies actually decreased to fewer than 800 pairs in 2013. We have seen more birds actually shift to the alternative nesting habitat sites, particularly the island in Malheur National Wildlife Refuge.

Comment G-8 NWF/SOS commented that "NOAA has admitted that it erred in not accounting for double-crested cormorant predation in the 2008 BiOp. Current predation rates for cormorants are higher than assumed in the base period used in the 2008 BiOp. Draft BiOp at 375 (admitting that "productivity of interior Columbia basin steelhead populations is about 3.6% lower than assumed for the 'Current' period in the 2008 BiOp analysis, and that of interior Columbia basin stream-type spring- and summer-run Chinook salmon and ocean-type Snake River fall Chinook salmon is about 1.1% lower than assumed."). Despite the significant increase in cormorant predation over the past five years and its impacts on salmonid populations, NOAA has not adjusted its analysis in the draft BiOp to account for this increased mortality, nor does it provide any alternative or compensatory actions to offset this substantial increase in mortality."

Response G-8 Section 3.5.2 in the 2014 Supplemental Opinion addresses this significant increase in cormorant predation.

Comment G-9 NWF/SOS made the following comment: "Although a plan to address this increasing cormorant predation does not yet exist, NOAA confidently predicts that 'survival is expected to improve beyond 2008 BiOp expectations for all interior Columbia species and populations as a result of the modification to RPA Action 46 requiring a reduction in the number of cormorants on East Sand Island.' Draft BiOp at 428. Evidently, NOAA believes that a plan to develop a plan to back-fill a growing hole caused by a problem it ignored in the 2008 BiOp now counts as an 'improve[ment] beyond 2008 expectations.'"

Response G-9 NOAA Fisheries has reviewed the available material (2014 Supplemental Opinion, Section 3.5.2) and information provided by the Corps of Engineers' and (supported by US Fish and Wildlife Service) through this consultation, which further details the cormorant management alternatives being considered. This leads NOAA Fisheries to conclude that implementing this RPA is feasible within the remaining period of the 2008 FCRPS BiOp.

Comment G-10 NWF/SOS made the following comment: "NOAA fails to acknowledge that any plan to address cormorant numbers may suffer from the same problems that have manifested with Caspian Terns -- projected benefits from control actions do not always produce the expected results. Attempts to control the largest cormorant colony in western North America also may have unexpected problems and delays that have not been encountered in the other smaller relocation efforts in other parts of North America that NOAA cites as successful in the draft BiOp."

Response G-10 The cormorant management plan will be adaptive; however, the goal is to achieve the target population levels in the estuary, which NOAA finds to be technically feasible.

Comment G-11 NWF/SOS made the following comment: "When counting benefits from control actions, NOAA continues to incorrectly assume that avian predation is 100% additive and does not include any compensatory mortality. This assumes that every fish saved by controlling avian predation would not have perished because of other sources of mortality. In recent years, research indicates that smolt mortality from avian predation is neither completely additive nor completely compensatory. These findings indicate that 25-75 percent compensation represents a biologically more likely range of potential benefits (Lyons et al. 2011). NOAA's analysis should reflect a range of compensation rather than assuming that predation control measures are 100 percent additive."

Response G-11 The citation of Lyons et al. (2011) is for terns in the Columbia Plateau. Also, this was not a measurement, but rather a range put into the report to illustrate how the benefits of addressing avian predation might be affected if there was compensation at these levels. Regarding the context of double-crested cormorants in the estuary, we address compensatory predation in Section 3.5 of the2014 Supplemental Opinion. In this case, we are making a relative comparison between two periods (Base and Current) and assume that any compensation is the same on both sides of the analysis. Regarding terns, there are no new data that would offer a specific compensation level for predation by the estuary tern population. That analysis remains unchanged from the 2008 BiOp.

H. Harvest

Comment H-1 The states of Oregon and Washington commented that the BiOp should direct the Action Agencies to continue funding coded-wire tagging (CWT) and tag recovery operations.

Response H-1 The Action Agencies have supported a variety of CWT and tag recovery programs for many years. During the term of the current FCRPS BiOp, these programs and others have been used to support RPA Action 62 in general, and subaction 62.4 in particular. We are aware of the Action Agencies' efforts to restructure contracts in such a way that this work will continue through alternative sources of funding. NOAA does not object to alternative funding mechanisms and assumes that work to support RPA Subaction 62.4 will continue to occur.

Comment H-2 The states of Oregon and Washington also suggested that the BiOp should direct the Action Agencies to expand efforts under RPA Action 62 to evaluate methods for increasing harvest on hatchery-origin fish while reducing the incidental take of natural-origin fish.

Response H-2 The FCRPS Action Agencies have implemented several projects under RPA Action 62 as described in the draft Comprehensive Evaluation (BPA et al. 2013): evaluate live-capture fishing gear for salmon; selective gear deployment; and Select Area Fisheries enhancement. The Action Agencies will continue to implement two of these projects (evaluate live capture gear and Select Area Fisheries Enhancement) during the remainder of the BiOp term. The FCRPS Action Agencies are not required to pursue additional methods of reducing harvest on natural-origin fish from listed ESUs/DPSs to avoid the likelihood of jeopardizing these listed species.

I. Critical Habitat

Comment I-1 The NWF/SOS stated that NOAA summarily assumes that critical habitat has either remained the same or improved under the RPA although it acknowledges that climate change as well as pesticide use (the latter of which has been evaluated in several biological opinions since the 2008) are causing additional damage to these areas.

Response I-1 The focus of our critical habitat analysis is whether, after implementation of the RPA, critical habitat will remain functional (or retain the current ability for the PCEs to be functionally established) to serve the intended conservation role for the species (NMFS 2005). The commenter seems to be saying that the PCEs of adequate water quantity and quality in designated areas are not retaining at least their current ability to become functionally established due to ongoing changes in habitat under the environmental baseline such as those associated with climate change and pesticide use. In the case of climate change, the RPA serves to improve the functioning of PCEs from their current condition, often in ways that will offset some of the negative effects of climate change on water quantity and quality (e.g., restoring instream and hydrologic connectivity, protecting and restoring wetlands and floodplains, using water from cool/cold water reservoirs to reduce mainstem temperatures; ISAB 2007b). Section 2.2.6.1 in the 2010 Supplemental BiOp describes the effect of pesticides and other toxic chemicals on water quality as well as fish condition and survival. The conditions that we described as limiting the functioning of designated critical habitat under the environmental baseline, as described in the 2008 and 2010 BiOps have not changed significantly for the purposes of this Supplemental Opinion.

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