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UNITED STATES DISTRICT COURT
DISTRICT OF OREGON
PORTLAND DIVISION

NATIONAL WILDLIFE FEDERATION, et al.,

Plaintiffs,

v.

NATIONAL MARINE FISHERIES SERVICE, et al.,

Defendants.

Case No.: 3:01-CV-00640-SI

FEDERAL DEFENDANTS' RESPONSE TO JUNE 23, 2015 SUMMARY JUDGMENT HEARING QUESTIONS

INTRODUCTION

Federal Defendants provide the following response to the questions raised at the June 23, 2015 hearing regarding Tables 2.1-5 and 2.1-9 in the National Marine Fisheries Service's (NMFS) 2014 Supplemental Biological Opinion (2014 BiOp). *See* 2014 BiOp at 80, 90 (attached as Exhibit 1-2). These questions related to the relationship between geometric mean (geomean) estimates in Table 2.1-5, as well as whether geomean abundance estimates can be multiplied by mean recruit-to-spawner (R/S) estimates to characterize or predict future extinction.

As discussed below, the estimates in Table 2.1-5 are not directly comparable, and the approach of predicting future extinction by separating out the natural-origin component of the run and multiplying that value by the mean R/S estimates in Table 2.1-9 does not provide technically reliable results or constitute an informative extinction risk analysis. Among other things, that approach does not consider the complex life-history of salmon and steelhead populations or the effects of safety-net hatchery programs that greatly reduce short-term extinction risks. NMFS's extinction risk analysis, by contrast, considered these and other relevant factors in evaluating the extinction risks for the Upper Grande Ronde and other salmonid populations, as well as in evaluating the likely future status of the Snake River spring/summer Chinook, and other, Evolutionary Significant Units (ESUs).[1]

BACKGROUND

Before addressing the Court's questions, it is important to note that the methods and calculations used to evaluate the empirical data and life-cycle metrics are complex, taking into account many factors and different variables. Tables 2.1-5 and 2.1-9 summarize empirical data and life-cycle metrics[2] for the base and extended base period status of Snake River

[1] An Evolutionary Significant Unit corresponds to the Endangered Species Act's definition of "species," which includes "distinct population segments" (DPS). *See* 16 U.S.C. § 1532(16). Under Section 7(a)(2), the jeopardy and adverse modification inquiry is performed at the species (*i.e.*, ESU) level. 16 U.S.C. § 1536(a)(2); *id*. §1536(b)(3)(A) (after consultation, NMFS shall provide an "opinion, and a summary of the information on which the opinion is based, detailing how the agency action affects the species").

[2] NMFS used various metrics (*e.g.*, 10-year geomean abundance) in its analyses, and it further identified some metrics, such as the extinction risk and four productivity metrics, as indicator

spring/summer Chinook populations. 2014 BiOp at 80, 90; *see also id.* at 47-66; 2008 BiOp at 7-6–7-32. To calculate the metrics, NMFS applied methods that are consistently used in the region; for instance, by the Interior Columbia Technical Recovery Team (ICTRT)[3] in performing recovery planning evaluations and assessments. *See, e.g.*, 2014 NOAA B282:27646, 27662; 2014 BiOp at 55 n.9. These collaboratively developed methods and calculations are used to evaluate hypotheses and inform various lines of inquiry into the status and expected performance of the salmon and steelhead populations. NMFS also made available to the Action Agencies, regional sovereigns, and other experts the data and calculations used to generate the metrics. *See, e.g.*, 2014 NOAA C30417:256522.[4]

In addition to the complexity of the underlying data and calculations, three points are helpful to understanding and interpreting the various tables, metrics, and calculations contained in the 2014 BiOp and the administrative record.

First, NMFS uses geomeans as a way of summarizing variable data, such as the annual abundance estimates in Table 2.1-5. A geomean "is a type of mean or average that indicates the central tendency or typical value of a set of numbers by using the product of their values (as opposed to the arithmetic mean which uses their sum)." 2014 BiOp at 55 n.9. Thus, a geomean behaves differently than an arithmetic mean: "it discounts the influence of infrequent high numbers and is in this sense more conservative." *Id*.[5]

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metrics for its quantitative analyses of the Interior Columbia salmon. 2014 BiOp at 47-50. These metrics apply to salmonid populations and not to higher organizational levels, such as the listed "species" that are the subject of NMFS's ESA Section 7(a)(2) inquiry. 16 U.S.C. § 1536(a)(2).

[3] The ICTRT was a multi-disciplinary, inter-governmental science team that performed recovery planning assessments and evaluations for Interior Columbia salmon and steelhead. *See generally* www.nwfsc.noaa.gov/trt/domains.cfm (last visited June 30, 2015); *see also* 2014 NOAA B175, B176. ICTRT assessments are used primarily in recovery plans issued under Section 4 of the ESA, 16 U.S.C. § 1533(f), but they also inform Section 7(a)(2) consultations and are used in other ways within the region. 2014 NOAA B176:14159 n.1; ECF 1989 at 25 n.20.

[4] NMFS's technical and scientific analyses are directed largely at agency experts within the three FCRPS Action Agencies—the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, and Bonneville Power Administration. *See* 16 U.S.C. § 1536(b)(3)(A) (NMFS "shall provide to the Federal agency … a written statement setting forth the [agency's] opinion").

[5] *See also* 2014 NOAA B282:27662 ("The geometric mean is consistent with the general patterns in variability of annual return rates of anadromous salmon. Use of this metric reduces the

Second, the 2014 BiOp summarizes data and calculations that are contained in other parts of the administrative record. For example, abundance data for the listed salmonid populations—the starting point for calculating the metrics, *see* Declaration of Dr. Toole at 6 n.4 (ECF 2002)—is derived from the Northwest Fisheries Science Center's Salmon Population Summary (SPS) database, 2014 BiOp at 73 (explaining that the SPS database contains population-level information from state agencies, tribes, and other sources).[6] The detailed calculations used to produce the 2014 BiOp's Table 2.1-5 and other summary estimates, in turn, are contained in Excel spreadsheets located in the administrative record. *See, e.g.*, 2014 NOAA C34270 (Chinook spreadsheet); 2014 NOAA C32720 (steelhead spreadsheet).

Third, different types of fish can be present on spawning grounds. Natural-origin fish on the spawning grounds are fish originating from naturally-spawning natural-origin (wild) or hatchery-origin parents. 2014 NOAA B282:28512. Hatchery-origin fish on the spawning grounds are the progeny of fish that were selected for broodstock and were spawned artificially. *Id.*:28510. NMFS also tracks and evaluates sub-categories of fish within these two broad categories, such as: (1) age-3 fish (jacks), which are males that spend only one year in the ocean and return to freshwater at a small size;[7] and (2) age-4, age-5, and age-6 fish, which are salmonids that spend more than one year in the ocean and are classified as "adults" for recovery planning, harvest, and other purposes. Finally, within the natural-origin fish category, returning spawners can be collected and used as "broodstock"[8] for safety-net or other hatchery programs.

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influence of the relatively infrequent extreme high survival years during the period of interest."); *see also* http://deq.mt.gov/wqinfo/WPBForms/pdf/Geometric-Mean.pdf (description of geomeans and their utility in evaluating a series or variable data sets) (last visited June 30, 2015).

[6] *See* Graves Declaration at 17 n.3 (ECF 2005) (discussing the functions and role of the Northwest Fisheries Science Center).

[7] Because of their small size, jacks generally have lower reproductive success than age-4 to age-6 adults and do not contribute to fisheries. Further, recovery planning assessments generally refer to abundance and productivity of "adults," which excludes jacks. *See, e.g.*, 2014 NOAA B282:27683 n.6; id.:28384 n.3. Accordingly, the ICTRT and NMFS typically exclude jacks from annual abundance estimates in evaluating data and metrics. *Id.*

[8] Broodstock are natural-origin, age-4 to age-6 fish from a population or spawning aggregate that are taken to a hatchery for artificial spawning (instead of being left to spawn naturally). *See* 2014 NOAA B282:28558.

Depending on the metric or evaluation being performed, all or only a subset of these fish may be included in annual "abundance" or "spawner" estimates used to calculate a metric.[9]

Each of these points informs the metrics or estimates reported in Tables 2.1-5 and 2.1-9, as well as whether various metrics are directly comparable to each other. For example, some estimates may not be directly comparable because the "units" used to derive the estimates are not the same (*e.g.*, some estimates may include "jacks," while others may exclude jacks).

DISCUSSION

I. TABLE 2.1-5: TEN-YEAR GEOMETRIC MEAN ABUNDANCE

Table 2.1-5 reports the 10-year geometric mean abundance for Chinook salmon. 2014 BiOp at 80. The Court's questions primarily related to the interpretation and application of estimates in the "Most Recent 10-year Geomean Abundance," "Most Recent 10-Year Geomean Total Adult Spawners (Including Hatchery-Origin)," and "Most Recent 10-Year Geomean Percent Natural Origin Spawners" columns. *See* Exhibit 1. We summarize each column and estimate, and then address the Court's questions regarding the estimates.

A. Most Recent 10-year Geomean Abundance

The "Most Recent 10-year Geomean Abundance" column represents natural-origin adult spawners. *See* 2014 BiOp at 55 ("The 2008 BiOp included calculations of the most recent 10-year geometric mean *of natural origin spawners* …" (emphasis added)). The purpose of this estimate is to identify the 10-year geomean of the total natural-origin "run." Thus, the annual abundance estimates used to calculate this metric (contained in 2014 NOAA C34270) represent: (1) all natural-origin age-4 to age-6 adult spawners that reached the spawning grounds; and (2) 90% of the natural-origin adults that would have reached the spawning grounds had they not

[9] The terms "abundance" and "spawners" are often used interchangeably. However, in the headings to Table 2.1-5, there is a difference between "abundance" and "spawners." As discussed below (*see* Table 1), "abundance" refers to the "run" and therefore includes adult fish removed for broodstock prior to spawning, whereas "spawners" refers to fish estimated to be present on the spawning grounds to reproduce.

been removed for safety-net hatchery broodstock.[10]

To illustrate, the "Most Recent 10-year Geomean Abundance" for the Upper Grande Ronde population of Snake River spring/summer Chinook was reported as 65 fish in Table 2.1-5. The data and calculations used to produce this number are contained in 2014 NOAA C34270, "Up Gr Ronde_11" tab, Cell AC:86.[11] Cell AC:86 includes the geomean calculation of Column Q ("Natural Adult Annual Run 4-6") for the years 2002 to 2011. Column Q, in turn, includes only adults (age-4 to age-6 spawners, using the percent of those ages in Columns J, K, and L) and therefore excludes jacks present on the spawning grounds. Column Q also includes only natural-origin fish (by basing its calculations on Column P) and therefore excludes hatchery-origin fish (both adults and jacks) present on the spawning grounds. Finally, adult returning fish from the Upper Grande Ronde population are collected prior to reaching the spawning grounds and used as broodstock for a safety-net hatchery program (Column T). Following the precedent of the ICTRT, and to represent the total natural-origin "run" to the spawning grounds, 90% of the natural-origin adults removed for the safety-net hatchery program are added to the number of natural-origin adults on the spawning ground (evidenced by the equations within Column Q).

B. Most Recent 10-Year Geomean Total Adult Spawners (Including Hatchery-Origin)

The "Most Recent 10-Year Geomean Total Adult Spawners (Including Hatchery-Origin)" column in Table 2.1-5 represents the combination of: (1) adult (age-4 to age-6, jacks excluded) natural-origin spawners on the spawning grounds; and (2) adult (age-4 to age-6, jacks excluded) hatchery-origin spawners on the spawning grounds. 2014 BiOp at 80; 2014 NOAA C34270. The purpose of this estimate is to identify the 10-year geomean of all adults reproducing naturally on the spawning grounds. The estimate therefore does *not* include 90% of the natural-

[10] The 90% value represents the ICTRT's estimate of survival from the point of broodstock collection to the spawning grounds (*i.e.*, 10% "pre-spawning" mortality). *See*, *e.g.*, 2004 NOAA B119:2-3 (Tables 1-2, defining survival of unharvested adults before spawning (S_{sb}) as 0.9).

[11] Exhibit 3 contains a depiction and general overview of the Upper Grande Ronde spreadsheet.

origin adults removed for broodstock for the safety-net hatchery program.[12]

To illustrate, the "Most Recent 10-Year Geomean Total Adult Spawners (including Hatchery-Origin)" for the Upper Grande Ronde population of Snake River spring/summer Chinook was reported as 171 fish in Table 2.1-5. The data and calculations used to produce this number are contained in 2014 NOAA C34270, "Up Gr Ronde_11" tab, Cell AC:89. Cell AC:89 includes the geomean of Column O ("Total Adult Spawners 4-6") for the years 2002 to 2011. Column O includes total spawners (age-4 to age-6 spawners) and therefore excludes only jacks present on the spawning grounds and does not include broodstock removed prior to spawning.[13]

C. "Most Recent 10-Year Geomean Percent Natural Origin Spawners"

The "Most Recent 10-Year Geomean Percent Natural Origin Spawners" column represents the percentage of all fish of all ages (including jacks) present on the spawning grounds that are natural-origin spawners. 2014 BiOp at 80; 2014 NOAA C34270. The estimate does not include 90% of the natural-origin adults removed as broodstock for the safety-net hatchery.

To illustrate, the "Most Recent 10-Year Geomean Percent Natural Origin Spawners" for the Upper Grande Ronde population of Snake River spring/summer Chinook was reported as 0.19 in Table 2.1-5. The data and calculations used to produce this number are contained in 2014 NOAA C34270, "Up Gr Ronde_11" tab, Cell AL:87. Cell AL:87 includes the geomean calculation of Column E ("FracWild") for the years 2002 to 2011. Column E reports the annual percent of total spawners (including jacks) on the spawning grounds that are natural-origin fish.

D. Comparison of the Three Estimates/Metrics

At the June 23, 2015 hearing, the Court inquired about the difference between the three estimates or metrics and whether (or how) they relate to each other; for instance, whether the

[12] Natural-origin adults removed for broodstock are not included in the total adult spawners (age-4 to age-6) because these annual estimates are also used to calculate the recruit-per-spawner metric, *i.e.*, the "S" is "R/S." Thus, only the adults estimated to actually reach the spawning grounds to reproduce are included.

[13] An added complexity in the calculations exists because the age structure differs for natural-origin and hatchery-origin jacks. For example, in 2011, 8.3% of natural-origin spawners were age-3 jacks (Cell I:65), while 37% of the hatchery-origin spawners were jacks (Cell R:65).

most recent 10-year geomean percent natural-origin spawners for the Upper Grande Ronde population (0.19) can be applied to the most recent 10-year geomean total adult spawners (171) to derive the percent of wild fish present on the spawning grounds and, if so, how that value (32.5) relates to the most-recent 10-year geomean abundance (65).

The Table 2.1-5 estimates cannot be multiplied together in this manner. Principally, each estimate is not in identical units. The percent natural-origin spawners on the spawning grounds estimate (0.19) includes jacks, while the other metrics do not. Additionally, the percentage of jacks for natural-origin and hatchery-origin fish differs, so the relationship between natural-origin adults and total adults is not constant. Finally, the natural-origin adults also includes adults that were removed for hatchery broodstock, which further complicates the comparison between natural-origin and total adults. Table 1 highlights the key differences between the metrics and illustrates why they are not directly comparable.

	Encompasses	**Ages**	**Origin**
Most Recent 10-Year Geomean Abundance	Fish reaching spawning grounds, plus 90% of broodstock collected below spawning grounds	Adults (no jacks; different jack percentage for natural-origin and hatchery-origin fish)	Natural-Origin fish only
Most Recent 10-Year Geomean Total Adult Spawners (Including Hatchery-Origin)	Fish reaching spawning grounds	Adults (no jacks; different jack percentage for natural-origin and hatchery-origin fish)	Natural-Origin and Hatchery-Origin fish
Most Recent 10-Year Geomean Percent Natural-Origin Spawners	Fish reaching spawning grounds	All ages (including jacks)	Ratio of natural-origin and hatchery-origin fish

Table 1. Key differences between the metrics in Table 2.1-5.

In short, multiplying the 10-year geomean abundance (or 10-year geomean total adult spawners) by the 10-year geomean percent natural-origin spawners does not produce the average or mean number of natural-origin fish on the spawning grounds, and the Table 2.1-5 estimates were not intended to be used in this matter. Rather, NMFS provided the estimates to characterize and summarize annual estimates within each metric. Moreover, as discussed below, isolating and analyzing only the natural-origin component of the run does not characterize the short-term extinction risks for the Upper Grande Ronde population because, among other reasons, the existence of a safety-net hatchery program for this population.

II. TABLE 2.1-9: USING BASE AND EXTENDED BASE PERIOD GEOMETRIC MEAN R/S ESTIMATES TO PREDICT EXTINCTION RISK.

Table 2.1-9 reports estimates of the base and extended base period returns-per-spawner (also referred to as recruit-per-spawner) (R/S) productivity metric. 2014 BiOp at 90. R/S is a per-generation (3 to 5 years) measure of the rate of productivity. 2014 BiOp at 61-64. Data for the R/S metric begins with a brood year, which is the year that spawning occurs (the "S" in "R/S"). Both natural-origin and hatchery-origin adults are included in (S) because the metric represents the total number of adults reproducing naturally on the spawning grounds. Data for the R/S metric is complete when all adult progeny from the brood year return to spawn (the "R" in "R/S"). Only natural-origin fish are included in (R) because "all of the progeny of the original spawners are by definition of natural-origin." *Id*. For the Upper Grande Ronde population, adult progeny from a brood year return primarily in two age classes (age-4 and age-5 fish), so a brood cycle generally is complete in 5 years. In the 2014 BiOp, NMFS calculated R/S for this population through the 2006 brood year, because data were not available or progeny had not returned for the 2007 through 2014 brood years. *See* 2014 NOAA C34270 ("Up Gr Ronde_11" tab, Column D).

Concerning Table 2.1-9, the Court asked whether the extended base period R/S estimate for the Upper Grande Ronde population (0.36), combined with the 10-year geomean of natural-origin spawners (*e.g.*, 65), can be used to predict likely extinction of the natural-origin component of the population in 3 or 7 generations (or 9 to 35 years, based on a 3- to 5-year life-cycle). This method provides a very rough approximation of the expected per-generation abundance changes in the population, *assuming* that all hatchery supplementation ceases (*i.e.*, there are no hatchery-origin fish on the spawning grounds and reproducing), no base-to-current survival changes occurred, and no survival changes occur from implementing the Reasonable and Prudent Alternative (RPA). The method does not, however, reflect annual variability in or the complexity of salmonid populations, nor does the method realistically capture the extinction risks of a salmonid population, for five main reasons.

First, the extended base period R/S metric (Table 2.1-9) and the 10-year geomean abundance (Table 2.1-5) summarize different data sets that encompass different time periods. The extended base period R/S estimate encompasses the completed brood cycles for the 1981 to 2006 brood years. No R/S estimates were available for the incomplete brood cycles between 2007 and 2011. *Id*. The 10-year geomean abundance estimates, by contrast, encompass only adults in 2002 through 2011. The different time periods and data sets confound any calculations based solely on the mean estimates presented in Tables 2.1-5 and 2.1-9. *Cf*. Reply Declaration of Dr. Toole ¶ 21 (ECF 2028) (explaining problems with comparing non-comparable data sets).

Second, ignoring age structure and variable maturation rates (*e.g*., by assuming that returns from a single brood year represent the starting number of spawners for the next generation) can compound extinction risks in subsequent generations.[14] The variable maturation rate (age of returns), complex life-history, and population dynamics of salmonid populations, however, tend to spread the risk stemming from a single (or poorly surviving) brood year. This is because the progeny of a brood year return over successive generations (*e.g*., as age-4 and age-5 fish), which means that subsequent brood years include natural-origin and hatchery-origin fish produced over multiple brood years.[15]

Third, only applying mean values ignores density dependence, the process by which

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[14] Specifically, the method assumes that returns from spawners in a single year (*e.g*., 64*0.36 = 23) represent the next set of spawners, and returns from these fish (23*0.36 = 8) are then assumed to represent the next set of spawners, and so forth.

[15] To illustrate, in 2004, there were a total of 531 natural-origin and hatchery-origin adults on the spawning grounds in the Upper Grande Ronde population. *See* 2014 NOAA C34270 ("Up Gr Ronde_11" tab, Cell O:58). The adult progeny of the 2004 brood year returned as age-4 spawners in 2008 and age-5 spawners in 2009. The combination of those age-4 and age-5 returning spawners, plus 90% of the age-4 and age-5 natural-origin adults removed for broodstock in those years, equaled 57 adults (Cell U:58). The next brood year, however, did not start with 57 spawners. Instead, the 2004 brood year returns were spread over two new brood years (2008 and 2009). Further, these returns combined with natural-origin and hatchery-origin fish from other brood years (2003, 2005) to constitute the total spawners in 2008 (82 fish, Cell O:62) and 2009 (148 fish, Cell O:63).

progeny tend to return at lower rates when there are a large number of spawners, and at higher rates when there are fewer spawners. *See* 2014 BiOp at 67-68, 109-119; *id*. at 116-18 (Figures 2.1-26, 2.1-27, 2.1-28). Additionally, occasional very productive years can have a large influence on population dynamics.[16] *See* Reply Declaration of Dr. Zabel ¶ 11 (ECF 2029) (addressing Oregon's analysis that also missed "important components of population dynamics that drive population trajectories," such as the "high recruitment events [that] can sustain the population for a number of years"). These population dynamics have a significant influence on the future trends and trajectories of a salmonid population.

Fourth, isolating and analyzing only the natural-origin component of the adults on the spawning grounds fails to consider the important effects that hatchery-origin fish have on a population's survival, productivity, and extinction risk. Safety-net hatchery programs, like the one in place in the Upper Grande Ronde, are "designed and operated to protect and promote Pacific salmon viability." 2014 NOAA B282:28509 ("Conservation Hatchery Program"). Under these programs, local broodstock are collected and the progeny of those fish are "intended to spawn naturally." *Id*.:28512 ("Supplementation Hatchery Program"). These and other hatchery practices "can preserve genetic resources and … increase the number and distribution of natural spawners." *Id*.:28512-13. As NMFS explained:

> Genetic resources that represent the ecological and genetic diversity of a species can reside in fish spawned in a hatchery as well as in fish spawned in the wild. … Hatchery programs can be designed to preserve the raw materials (i.e., genetic resources) that ESU and steelhead DPS conservation depends on and buy time until the factors limiting salmon and steelhead viability are addressed. In this role, hatchery programs reduce risk by mitigating the immediacy of an ESU's extinction risk.

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[16] For the Upper Grande Ronde population, the 2006 brood year—the last complete brood cycle analyzed in the 2014 BiOp—had only 52 spawners (Cell O:60). However, this was a productive brood year with 155 returning progeny (Cell U:60), and the R/S productivity for the population was 2.98 (155/52) (Cell W:60, expressed as a natural logarithm, 1.085606). A more dramatic example of this effect is illustrated by the Tucannon population. The 2006 brood year for this population had only 153 spawners. 2014 NOAA C34270 ("Tucannon_11" tab, Cell O:60). However, there were 1633 returning progeny for this brood year (Cell U:60), for an R/S of 10.7 (Cell W:60, expressed as a natural logarithm of 2.37). *Id*.

2014 NOAA B286:30442 (2010 BiOp).[17] Because these safety-net, supplementation hatchery programs are designed to and can greatly reduce extinction risk, considering these programs and the effects of hatchery-origin fish on the spawning grounds is critical to any evaluation of short-term extinction risk. *See* 2008 BiOp at 7-35 (considering the degree to which safety-net and/or supplementation programs meet program objectives).[18]

Fifth, the base and extended base period mean R/S estimate represents the effects of aggregate conditions over an approximately 20 to 26 year period. Many actions have occurred during the latter portion of that period that, if continued into the future, alter the projected biological performance of the species. 2008 BiOp at 7-11. Thus, completed and ongoing actions that have altered the survival of a population are not fully reflected in the *mean* base or extended base period estimates. *Id.*; *see also* 2014 BiOp at 51 (describing the purpose and need for a "base-to-current" adjustment). Moreover, the RPA is expected to further improve survival and the productivity of the salmonid populations. *Id*. (explaining need for a "current-to-prospective" adjustment to evaluate future population risks). Thus, any projection of a population's future risks must account for the completed and ongoing actions that have already changed a population's survival, as well as those future (prospective) actions that affect survival.

These (and other) factors are not captured by applying a mean R/S estimate to a single estimate of natural-origin adults on the spawning grounds. NMFS's extinction risk analysis, by contrast, provides a more rigorous examination of the risks to salmonid populations in the Columbia basin. *See generally* 2014 BiOp at 64 ("Extinction risk is the most complex indicator

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[17] *See also Policy on the Consideration of Hatchery-Origin Fish in Endangered Species Act Listing Determinations for Pacific Salmon and Steelhead*, 70 Fed. Reg. 37204, 37215 (June 28, 2005) (2010 NOAA BB275) ("The presence of hatchery fish within the ESU can positively affect the overall status of the ESU, and thereby affect a listing determination, by contributing to increasing abundance and productivity of the natural populations in the ESU, by improving spatial distribution, by serving as a source population for repopulating unoccupied habitat, and by conserving genetic resources of depressed natural populations in the ESU.").

[18] *See also* B282:27660 (NMFS "also considered a variety of qualitative factors which are described in Section 7.1.2. Included among these factors are important considerations that are not captured in quantitative assessments, such as the relevance of safety net hatchery programs for reducing or eliminating short-term extinction risk for some populations.").

metric included in the 2008 BiOp"); *id*. at 64-66, 84-88 (explaining and applying NMFS's extinction risk analysis). This analysis considers many details and relevant factors, including: population age structure and overlapping generations; density dependence (the propensity for higher productivity at lower densities, and vice versa); stochastic production functions (incorporating "chance" and allowing NMFS to generate probability of extinction for the population); autocorrelation (the propensity for good or bad conditions to occur in consecutive years); and other factors. *See generally* 2014 NOAA B282:27659 (NMFS "used the best estimates of productivity, density dependence, current abundance, variance, and autocorrelation, and estimated the resulting extinction probability"); *see also* 2014 BiOp at 64-66; 2008 BiOp at 7-14–7-20, 7-34–7-35; 2008 NOAA C1155:11-12. The result is explicit probabilities of extinction that take all relevant factors into account. *See*, *e.g*., 2014 BiOp at 85 (Table 2.1-7); *see also* 2014 NOAA B282:28467-80 (2008 population viability analysis for salmon and steelhead); 2014 BiOp, Appendix B (2014 Corps 4:892) (NMFS's 2014 analysis).

III. EXTINCTION RISK FOR THE UPPER GRANDE RONDE POPULATION OF SNAKE RIVER SPRING/SUMMER CHINOOK

Although using mean R/S estimates and 10-year geomean estimates of natural-origin abundance to predict the future trajectory of Upper Grande Ronde Chinook suffers from several problems addressed above, the underlying premise of the Court's questions was generally correct and consistent with NMFS's analysis in the 2014 BiOp. Given low historic natural-origin abundance and low mean R/S productivity over the base and extended base periods, the extinction risk for this population was high. *See* 2008 BiOp 8.3-49 (Table 8.3.2-3, base period extinction risk estimates); 2014 BiOp at 85 (Table 2.1-7) (base period and extended base period extinction risk estimates). Without intervention, the Upper Grande Ronde population was on a path toward extinction. Through the safety-net hatchery program and other measures, that trajectory has changed, and the extinction risk for this population has been reduced.

Applying its extinction risk analysis (2008 BiOp at 7-14–7-20), NMFS reported a 70% 24-year risk of quasi-extinction (population dropping below 50 natural-origin adults for four consecutive years) based on the population's performance during the 1981-2000 brood years. 2008 BiOp at 8.3-49 (Table 8.3.2-3). With the extended base period data, the extinction risk estimate has been reduced to 48%, but the estimate is still very high. 2014 BiOp at 85. These extinction risk estimates, however, do not capture all of the relevant factors. The quantitative estimates assume that the safety-net hatchery programs cease and that there are no additional survival improvements associated with current or RPA actions. *See* 2014 BiOp at 54, 66; 2008 BiOp at 8.3-43–8.3-44 (quantitative extinction risk estimates "do not consider base-to-current improvements and improvements expected from Prospective Actions [the RPA]").

Because of the uncertainties present and the assumptions used, NMFS considered qualitative factors that bear on the population's short-term risks of extinction. 2008 BiOp at 7-34–7-35. The safety-net hatchery program for the Upper Grande Ronde population is one of those important qualitative factors. This program began in the late 1990s and early 2000s as a rescue program intended to preserve and build genetic resources and promote the viability of natural-origin fish. 2014 NOAA B282:28606. It collects adult spawners for broodstock, spawns the fish and rears the progeny, and releases the fish so that they can return to spawn in the wild. 2014 NOAA B422:44446-47. These hatchery fish are part of the ESA-listed spring/summer Chinook species, *see Final Rule*, 70 Fed. Reg. 37160, 37176, 37178 (June 28, 2005) (2008 NOAA B330), and the hatchery program is conserving genetic resources, slowing the population's trend toward extinction, and improving the viability of the species. 2014 NOAA B282:28545, 28562; 2008 BiOp at 8.3-30 ("The Upper Grande Ronde hatchery program has transitioned into a supplementation program that will build genetic resources and diversity.").

This safety-net hatchery program works to greatly reduce the short-term risks of extinction of this population. In 2008, for example, NMFS estimated extinction risk probabilities assuming that hatchery supplementation continues into the future. This analysis showed that short-term risk of extinction was greatly reduced, in a number of cases to near zero. 2014 NOAA B282:28492 (Table 4). Moreover, hatchery reforms occurring during the base period eliminated use of non-local broodstock and reduced straying, "likely resulting in increased hatchery fish effectiveness or fitness in the wild and reduced impacts on genetic diversity." 2014 NOAA B282:27778. In 2014, NMFS's analysis revealed the beneficial effects of these completed reforms were greater than anticipated. 2014 BiOp at 206-07 (finding a 29% increase in base period productivity from completed hatchery actions). While the quantitative extinction risk analysis showed the population has a greater than 5% risk of short-term extinction, the hatchery supplementation program provides a significant buffer against near-term extinction, ensuring "that the affected populations will not go extinct in the short term." 2008 BiOp at 8.3-42–8.3-43; *see, e.g.*, Figure 1 (combined natural-origin and hatchery-origin spawners available to avoid short-term extinction).

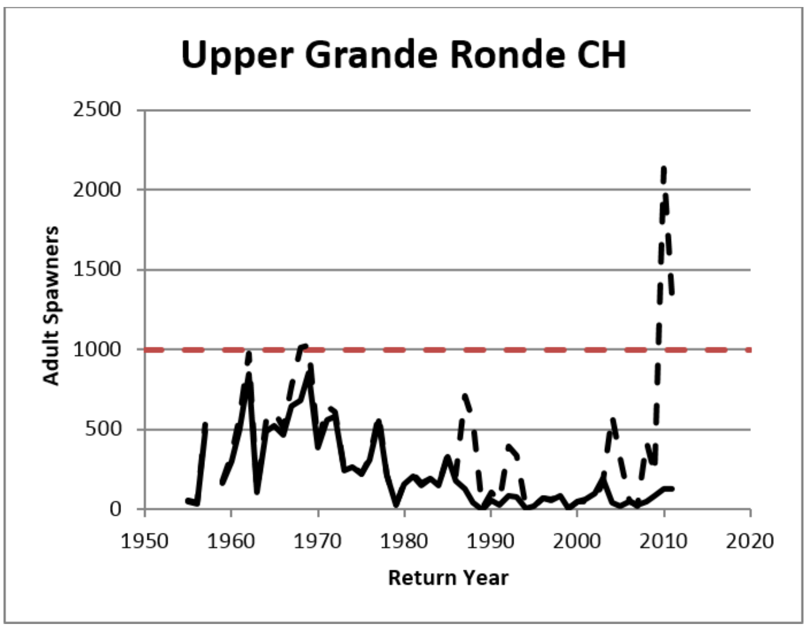

Figure 1: 2014 NOAA C34270 ("Up Gr Ronde_11" Tab) (figure incorrectly labeled as "Natural Adult Spawners" in 2014 NOAA C34270). Red dashed line represents the ICTRT's recovery abundance thresholds for this population. The solid black line represents natural-origin spawners, and the black dashed line represents total spawners (including jacks).

With the extinction risk reduced, the RPA identifies actions that can be implemented and are likely to further reduce limiting factors, reduce short-term extinction risk, and improve the survival of this population. *See* 2008 BiOp at 7-18 ("[T]he main purpose of the [extinction risk] metric is to inform our judgment regarding the ability of the species to survive while actions to promote recovery are implemented" under the RPA). One important action is the continuation of the safety-net hatchery program. These "[h]atchery programs will have a prominent role to play until degraded and blocked habitats are rehabilitated and restored," NOAA B282:28507, and RPA action 41 requires the continued funding and improvements to the hatchery program, 2014 NOAA B281:27457-58 (RPA 41 & Table 7). Accordingly, this program will continue "acting as a safety net for most of the affected populations [including the Upper Grande Ronde population] to reduce short-term extinction risk." 2008 BiOp at 8.3-32; *id*. at 8.3-22–8.3-23.[19]

The safety-net hatchery program, however, does not address the underlying factors limiting the survival and recovery of the population. Among other factors, the Upper Grande Ronde population is limited by extensively altered and degraded tributary spawning and rearing habitats. *See* 2014 NOAA C2020:62117-18 (draft Oregon Snake River Recovery Plan) ("Past and present land use activities have significantly altered habitat conditions for the Upper Grande Ronde spring Chinook population."). This habitat degradation and other land-use practices significantly contributed to the decline in abundance for this population, *id*.:62117, to the degree that experts "determined that past and current land use practices are the primary threat to the viability of the Upper Grande Ronde River spring Chinook population," *id*.:62118-62133.[20] Moreover, this population experiences high levels of mortality during its downstream migration before it reaches the first Federal Columbia River Power System dam (Lower Granite Dam). In 2012, for example, juvenile Chinook from the Upper Grande Ronde population had only a 41% survival rate from their tributary habitat to Lower Granite Dam. 2014 NOAA B114:9316 (Appendix Table B7, "U. Grande Ronde" row, "Release to LRG" column).[21]

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[19] Notably, these safety-net hatchery programs are adaptive; as they demonstrate success, they are phased out. *See* 2014 NOAA B47:3585 (explaining that the "Catherine Creek and Lostine River [populations] have met adult return goals of 150 spawning adults in nature, therefore these two safety net programs have now been phased out. Adult return goals have not been met for the upper Grande Ronde stock; this safety-net work continues to be funded under this project.").

[20] *See also* 2014 NOAA C1965:61684 ("Meeting long-term targets for the Upper Grande Ronde population will require protection and restoration actions affecting all life stages, but primarily the summer rearing life-stage."); 2008 BiOp at 8.3-11 (discussing degradation and limiting factors in the population's spawning and rearing habitats).

[21] *See also* 2010 NOAA BB251:1 ("Smolts of spring Chinook salmon … experience substantial mortality while migrating through free-flowing reaches of the Snake River basin before reaching

Thus, tributary spawning and rearing habitats in the Grande Ronde basin are limiting the survival and productivity of the Upper Grande Ronde population. These conditions are not caused by the operation and maintenance of the FCRPS and cannot be addressed by implementing actions only at the mainstem dams. Therefore, the RPA includes significant actions to address and improve these limiting factors. 2014 NOAA B281:27441-44 (RPA action 35 & Table 5); 2014 BiOp at 291-93 (summarizing habitat work for this population, including working with the Umatilla tribe to "identify opportunities to expand projects in areal extent, size, or configuration, or to incorporate new features that would yield higher benefits"); *see also* 2014 NOAA B47:3526-27, 4042-47 (discussing extensive habitat restoration work in the Grande Ronde basin); 2014 NOAA B41:2715-16 (discussing research in the Upper Grande Ronde River by the Columbia Intertribal Fish Commission that is confirming "the connection between fish and habitat"). And the RPA includes extensive actions outside of the tributary spawning and rearing habitat to address limiting factors and improve survival. *See* 2008 BiOp at 8.3 -54 (Table 8.3.5-1) (predicting a 115% increase in survival from all completed and RPA actions for the Upper Grande Ronde population); Declaration of Dr. Toole ¶ 43, Table 1 (ECF 2002).

Collectively, the completed and ongoing RPA actions address limiting factors throughout the freshwater life-history of the Upper Grande Ronde spring/summer Chinook population, and these actions are expected to reduce the population's short-term risk of extinction. 2008 BiOp at 8.3-40 ("[A]ctions included in the [RPA] represent significant improvements that reasonably can be implemented within the next 10 years."); *id*. at 8.3-43–8.3-44.

Finally, it is important to understand that the extinction risk to a population of an ESU, standing alone, is not determinative of whether the agency action is likely to jeopardize the continued existence of a listed species. The ESA's jeopardy analysis is performed at the ESU, not individual population, level. 16 U.S.C. § 1536(a)(2), (b)(3)(A); *see also* 2008 BiOp at 7-49

Lower Granite Dam, the first dam encountered in the Columbia–Snake river hydrosystem."); 2014 NOAA B286:30394 (summarizing survival rates within the Grande Ronde Basin for wild and hatchery fish).

("The ESA requires the jeopardy determination to be made at the [species] level.") (quoting 2008 NOAA B344:5). Thus, even a high extinction risk for one population is not dispositive to NMFS's Section 7(a)(2) inquiry.

Consistent with that understanding, NMFS "consider[s] metrics and other information relevant to the population and major population group (MPG) in making a jeopardy determination for an ESU." *Id.*[22] The Snake River spring/summer Chinook ESU includes 28 populations in 5 MPGs, and NMFS examined quantitative and qualitative factors to evaluate whether the MPGs and, in turn, the Snake River spring-summer Chinook species can be "expected to survive with an adequate potential for recovery … under the effects of the action, the effects of the environmental baseline, and any cumulative effects." 2008 BiOp at 1-10; *see* 2008 BiOp at 8.3-30–8.3-32 (combined quantitative and qualitative analysis of the Grande Ronde/Imnaha MPG); *id.* at 8.3-39–8.3-45 (aggregate analysis of all populations and MPGs for the Snake River spring/summer Chinook species). NMFS found that not all populations (such as the Upper Grande Ronde population) will meet the goals for the quantitative indicator metrics, but that all relevant factors showed that the Snake River spring/summer Chinook ESU is likely to have a low short-term risk of extinction. 2008 BiOp at 8.3-42–8.3-45. As NMFS summarized:

> Taken together, the combination of all the factors above indicates that the ESU as a whole is likely to have a low risk of short-term extinction when the environmental baseline and cumulative effects are considered along with implementation of the Prospective Actions. The status of the species has been improving in recent years, compared to the base condition, and abundance is expected to increase in the future as a result of additional improvements. These improvements result in lower short-term extinction risk than in recent years. NOAA Fisheries cannot demonstrate quantitatively that all populations or all

[22] This is the same approach used in recovery planning, where not every population must be viable in order to recover the species. As NMFS and the ICTRT have explained, "there is more than one combination of populations and MPGs at various risk levels and trends that constitutes an ESU/DPS on a trend toward recovery." 2008 BiOp at 7-50. For example, the ICTRT has recommended that four of the six extant populations in the Grande Ronde/Imnaha MPG of Snake River spring/summer Chinook—the MPG containing the Upper Grande Ronde population—be viable or highly viable to achieve recovery, and the ICTRT provided different scenarios to reach this result. 2008 BiOp at 8.3-30; 2014 NOAA B128:9935. Under one scenario, the MPG (and the species) can recover where the Upper Grande Ronde population is not viable or highly viable. *Id.* (explaining that one of the two "large" populations—Catherine Creek or Upper Grande Ronde—would need to be viable or highly viable for recovery).

> MPGs will have a low short-term extinction risk as indicated by quantitative estimates and a quasi extinction threshold of 50 fish, which the ICTRT associated with long-term viability. These extinction risk estimates assume that all hatchery supplementation ceases. However most of the populations with high short-term extinction risk are protected from extinction by safety-net hatchery programs. Quantitative estimates, with an assumption of continuing supplementation, indicate that supplemented populations have low short-term extinction risk. *** In summary, enough populations are likely to have a low enough risk of extinction to conclude that the ESU as a whole will have a low risk of short-term extinction. 2008 BiOp at 8.3-45.

In short, the method explored by the Court during the hearing—projecting abundance of the Upper Grande Ronde population by using geomean estimates in Tables 2.1-5 and 2.1-9—is not a technically valid way to assess future risk to the population. This is not to say that there are no issues with this population. NMFS's more detailed extinction risk analysis projected a high likelihood of extinction when considering base and extended base period mean R/S productivity and assuming that survival does not improve in the future. This is why the RPA specifically requires continuation and improvement of the safety-net hatchery program (RPA 41), which greatly reduces the likelihood of extinction for this population over 24 years. This is also why the RPA requires additional actions to improve survival in the tributary habitats, which are limiting the survival of this population, as well as a suite of actions to improve survival in the mainstem migration and estuary life-history stages. NMFS's analysis provided a rigorous, comprehensive evaluation into the future risks and status of the Upper Grande Ronde population, the Grande Ronde/Imnaha MPG, and the Snake River spring/summer Chinook species.

CONCLUSION

Federal Defendants appreciate the Court's attention to the details of NMFS's analysis, and Federal Defendants are available to address or respond to any additional questions regarding NMFS's analysis or methods used in its jeopardy or adverse modification analyses.

Dated June 30, 2015

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CERTIFICATE OF SERVICE

I certify that on June 30, 2015, the foregoing was electronically filed through the Court's electronic filing system, which will generate automatic service upon on all Parties enrolled to receive such notice. I also certify that the following will be manually served via overnight mail:

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EXHIBIT 1

Table 2.1-5, 2014 Supplemental Biological Opinion at 80
[2014 NOAA A1]

Table 2.1-5 Comparison of Chinook Base Period 10-year geometric mean abundance reported in the 2008 BiOp, corrected estimates for the 2008 BiOp's Base Period, and extended Base Period estimates based on new information in the NWFSC SPS database that has become available since the 2008 BiOp. Extended Base Period mean abundance is higher than the 2008 BiOp mean for all Chinook populations. Recent total spawners (including hatchery-origin spawners) and percent of natural-origin spawners are also displayed.

ESU	MPG	Population	ICTRT Threshold Abundance Goal	2008 BiOp					Corrected 2008 BiOp Estimate	New Information					
				Most Recent 10-Year Geomean Abundance (2008 BiOp)	Lower End of ICTRT (2007b) Range[1]	Upper End of ICTRT (2007b) Range[1]	Return Years (2008 BiOp)			Most Recent 10-Year Geomean Abundance	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Return Years	Most Recent 10-Year Geomean Total Adult Spawners (Including Hatchery-Origin)	Most Recent 10-Year Geomean Percent Natural-Origin Spawners
Snake River Spring/ Summer Chinook Salmon	Lower Snake	Tucannon	750	82	5	667	1997-2006		119	375	246	570	2002-2011	600	0.53
		Asotin - Functionally Extirpated													
	Grande Ronde / Imnaha	Catherine Creek	1000	107	38	420	1996-2004		89	137	82	227	2002-2011	304	0.35
		Upper Grande Ronde	1000	38	4	140	1996-2005		47	65	42	100	2002-2011	171	0.19
		Minam River	750	337	142	638	1996-2006		336	489	416	576	2003-2012	525	0.92
		Wenaha River	750	376	48	750	1996-2007		380	436	364	522	2003-2012	465	0.92
		Lostine/Wallowa Rivers	1000	276	85	812	1996-2008		212	370	251	546	2002-2011	847	0.33
		Imnaha River	750	380	124	2217	1996-2009		486	460	304	696	2002-2011	1288	0.30
		Big Sheep Creek - Functionally Extirpated													
		Lookingglass- Functionally Extirpated													
	South Fork Salmon	South Fork Salmon Mainstem	1000	601	112	1873	1994-2003		504	813	634	1041	2003-2012	1269	0.65
		Secesh River	750	403	86	1228	1996-2005		483	605	408	897	2002-2011	635	0.96
		East Fork S. Fork Salmon (including Johnson)	1000	105	20	579	1994-2003		215	282	199	400	2003-2012	425	0.50
		Little Salmon River (including Rapid R.)													
	Middle Fork Salmon	Big Creek	1000	90	5	662	1995-2004		91	181	115	286	2003-2012	184	1.00
		Bear Valley/Elk Creek	750	182	15	1232	1994-2003		189	471	328	677	2003-2012	479	1.00
		Marsh Creek	500	42	0	599	1994-2004		53	221	130	377	2003-2012	225	1.00
		Sulphur Creek	500	21	0	178	1994-2005		19	58	37	91	2003-2012	59	1.00
		Camas Creek	500	28	0	261	1995-2004		29	47	28	77	2003-2012	47	1.00
		Loon Creek	500	51	0	611	1995-2005		46	77	49	119	2003-2012	78	1.00
		Chamberlain Creek	500	N/A	N/A	N/A	N/A		N/A	648	502	836	2003-2012	658	1.00
		Lower Middle Fork Salmon (below Ind. Cr.)													
		Upper Middle Fork Salmon (above Ind. Cr.)													
	Upper Salmon	Lemhi River	2000	79	10	582	1994-2003		79	81	58	112	2003-2012	81	1.00
		Valley Creek	500	34	0	292	1994-2003		34	101	75	135	2003-2012	102	1.00
		Yankee Fork	500	13	0	153	1994-2003		12	16	7	36	2002-2011	32	1.00
		Upper Salmon River (above Redfish L.)	1000	246	91	567	1996-2005		250	360	285	455	2003-2012	433	0.84
		North Fork Salmon River													
		Lower Salmon River (below Redfish L.)	2000	103	37	378	1996-2005		108	125	102	153	2003-2012	127	1.00
		East Fork Salmon River	1000	148	9	598	1996-2005		135	320	210	487	2003-2012	324	1.00
		Pahsimeroi River	1000	127	45	316	1996-2005		129	223	174	286	2003-2012	306	0.73
		Panther - Extirpated													
Upper Columbia Spring Chinook Salmon	Eastern Cascades	Wenatchee R.	2000	222	18	1779	1994-2003		215	568	443	727	2002-2011	1531	0.32
		Methow R.	2000	180	20	1694	1994-2003		170	398	264	601	2002-2011	1587	0.21
		Entiat R.	500	59	10	174	1994-2003		59	148	114	191	2002-2011	275	0.54
		Okanogan R. (extirpated)													
Snake River Fall Chinook Salmon	Main Stem and Lower Tributaries	Lower Mainstem Fall Chinook 1977-Most Recent BY	3000	1273	306	5083	1995-2004		1189	4576	3438	6090	1999-2008	15015	0.31
		Lower Mainstem Fall Chinook 1990-Most Recent BY	3000	1273	306	5083	1995-2004		1189	4576	3438	6090	1999-2008	15015	0.31

[1] Base Period mean abundance estimates in the 2008 BiOp were from ICTRT (2007b). That report did not include confidence intervals for the means, only ranges. NOAA Fisheries in the September 6, 2013, Sovereign Draft included approximate confidence intervals calculated from original data in an ICTRT spreadsheet but does not include those estimates in the final supplemental opinion because validity of the calculations could not be confirmed.

EXHIBIT 2

Table 2.1-9, 2014 Supplemental Biological Opinion at 90
[2014 NOAA A1]

Table 2.1-9. Comparison of Chinook Base Period geometric mean R/S reported in the 2008 BiOp, corrected estimates for the 2008 BiOp's Base Period, and extended Base Period estimates based on new information in the NWFSC SPS database that has become available since the 2008 BiOp. The 2008 BiOp's goal for prospective actions for this metric is R/S greater than 1.0. Extended Base Period mean R/S estimates are lower than the 2008 BiOp estimates for most Chinook populations; however, all new estimates are within the 2008 BiOp's 95% confidence limits.

ESU	MPG	Population	2008 BiOp			Corrected 2008 BiOp Mean Estimate	New Information		
			Mean Base Period R/S	Lower 95% Confidence Limit	Upper 95% Confidence Limit		Mean Extended Base Period R/S	Lower 95% Confidence Limit	Upper 95% Confidence Limit
Snake River Spring/ Summer Chinook Salmon	Lower Snake	Tucannon	0.72	0.48	1.10	0.68	0.72	0.47	1.10
		Asotin - Functionally Extirpated							
	Grande Ronde / Imnaha	Catherine Creek	0.44	0.22	0.84	0.38	0.38	0.22	0.64
		Upper Grande Ronde	0.32	0.18	0.57	0.35	0.36	0.22	0.59
		Minam River	0.80	0.47	1.37	0.80	0.85	0.57	1.27
		Wenaha River	0.66	0.41	1.08	0.65	0.67	0.47	0.96
		Lostine/Wallowa Rivers	0.72	0.41	1.26	0.73	0.69	0.45	1.06
		Imnaha River	0.59	0.40	0.86	0.75	0.56	0.39	0.80
		Big Sheep Creek - Functionally Extirpated							
		Lookingglass- Functionally Extirpated							
	South Fork Salmon	South Fork Salmon Mainstem	0.86	0.59	1.28	0.87	0.76	0.57	1.02
		Secesh River	1.19	0.81	1.76	1.19	1.05	0.74	1.50
		East Fork S. Fork Salmon (including Johnson)	0.97	0.67	1.41	0.97	0.92	0.66	1.27
		Little Salmon River (including Rapid R.)							
	Middle Fork Salmon	Big Creek	1.20	0.66	2.19	1.16	1.12	0.67	1.86
		Bear Valley/Elk Creek	1.35	0.82	2.22	1.34	1.21	0.82	1.78
		Marsh Creek	0.95	0.52	1.75	0.99	0.98	0.60	1.60
		Sulphur Creek	0.97	0.45	2.09	1.02	1.05	0.62	1.79
		Camas Creek	0.79	0.39	1.62	0.79	0.69	0.41	1.17
		Loon Creek	1.11	0.54	2.31	1.22	0.91	0.52	1.60
		Chamberlain Creek					1.06	0.55	2.07
		Lower Middle Fork Salmon (below Ind. Cr.)							
		Upper Middle Fork Salmon (above Ind. Cr.)							
	Upper Salmon	Lemhi River	1.08	0.63	1.84	1.10	0.95	0.62	1.47
		Valley Creek	1.07	0.61	1.87	1.08	1.09	0.72	1.66
		Yankee Fork	0.61	0.28	1.29	0.63	0.50	0.26	0.97
		Upper Salmon River (above Redfish L.)	1.51	0.84	2.72	1.56	1.23	0.76	1.99
		North Fork Salmon River							
		Lower Salmon River (below Redfish L.)	1.20	0.75	1.92	1.20	1.04	0.72	1.49
		East Fork Salmon River	1.06	0.54	2.08	1.22	1.18	0.70	2.00
		Pahsimeroi River	0.51	0.22	1.18	0.56	0.59	0.32	1.08
		Panther - Extirpated							
Upper Columbia Spring Chinook Salmon	Eastern Cascades	Wenatchee R.	0.75	0.46	1.22	0.68	0.59	0.41	0.86
		Methow R.	0.73	0.42	1.27	0.72	0.51	0.32	0.81
		Entiat R.	0.72	0.49	1.05	0.72	0.66	0.50	0.89
		Okanogan R. (extirpated)							
Snake River Fall Chinook Salmon	Main Stem and Lower Tributaries	Lower Mainstem Fall Chinook 1977-Most Recent BY	0.81	0.46	1.21	0.90	0.74	0.60	0.92
		Lower Mainstem Fall Chinook 1990-Most Recent BY	1.24	0.93	1.66	1.49	0.86	0.67	1.12

EXHIBIT 3

Upper Grande Ronde population spreadsheet, Snake River Spring/Summer Chinook ESU

[2014 NOAA C34270, “Up Gr Ronde_11” Tab]

Data and calculations for the Upper Grande Ronde population of Snake River spring/summer Chinook. 2014 NOAA C34270 (“Up Gr Ronde_11” tab). Green columns are direct inputs from the Salmon Population Summary (SPS) database. Yellow columns are calculated within the spreadsheet using formulas identical to those used by the Northwest Fisheries Science Center (Science Center). Blue columns represent calculations taken directly from a Science Center spreadsheet, but not used in calculations of the 2008 and 2014 BiOp indicator metrics. The unshaded columns at the right [marked “**A**”] are used to generate the figures at the bottom of the worksheet. The unshaded columns at the right above the figures [marked “**B**”], are the calculations for the summary statistics (means and confidence intervals) that were presented in the 2014 BiOp and prior biological opinions.

Exhibit 3. Upper Grande Ronde Chinook spreadsheet (Up Gr Ronde_11)