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THE HONORABLE MICHAEL H. SIMON

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

PORTLAND DIVISION

NATIONAL WILDLIFE FEDERATION, *et al.*, Plaintiffs, and STATE OF OREGON, Intervenor-Plaintiff, v. NATIONAL MARINE FISHERIES SERVICE, *et al.* Defendants, and NORTHWEST RIVERPARTNERS, *et al.*, Intervenor-Defendants.	Case No. 3:01-CV-00640-SI STATE OF OREGON'S RESPONSE TO JUNE 23, 2015 SUMMARY JUDGMENT HEARING QUESTIONS AND FEDERAL DEFENDANTS' RESPONSE THERETO

INTRODUCTION

Oregon provides the following response to the Court's questions regarding two tables in the 2014 BiOp and Federal Defendants' Response to these questions.[1] (ECF No. 2040, hereafter, "Fed. Resp."). Oregon agrees with Federal Defendants that the Court's conceptual understanding of the relationship between abundance and recruits-per-spawner (R/S) is correct; namely that low abundance combined with low R/S indicates that a population is at high risk of extinction. *See* Fed. Resp. at 13. Many of the populations at issue in this action, including the Upper Grande Ronde, have a very low abundance, an R/S less than 1.0, and a high risk of imminent extinction.

In this response, Oregon highlights irregularities in Table 2.1-5 and Table 2.1-9 of the 2014 BiOp and responds to points raised by Federal Defendants regarding the Upper Grande Ronde population's extinction risk.[2]

I. Errors in Table 2.1-5 & Table 2.1-9 of the 2014 BiOp

After reviewing Tables 2.1-5 and 2.1-9 and Federal Defendants explanation, Oregon has identified computational errors, apparent reporting errors, unexplained inconsistencies in methods and, in some cases, potential biases.[3] *See* Suppl. Kostow Decl. ¶ 2.

[1] In its filing on June 30, 2015, Oregon explained that its experts were unable to provide a meaningful analysis of Tables 2.1-5 and 2.1-9 or otherwise answer the Court's questions without additional information from NMFS explaining its data and methodology. *See* ECF No. 2043. Oregon therefore requested until July 7, 2015, to review Federal Defendants response and respond to the Court's questions in light of it.

[2] In responding to Federal Defendants' filing, Oregon does not restate arguments already briefed by the parties in prior memoranda and hereby incorporates pertinent arguments by reference.

[3] Results from Tables 2.1-5 and 2.1-9 were reported in Oregon's Nigro Declaration. *See* Nigro Decl. Table 1 at p. 16 & Fig. 7 at p. 17 (ECF No. 1986). The tables were reported for the purpose of illustrating the general proposition that multiple populations are currently doing poorly. Oregon maintains that the general proposition made by the Nigro Declaration is valid and does not require revision. Oregon notes, however, that based on the irregularities discussed in this Response, the abundance and productivity data reported in the Nigro Declaration Table 1

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A. Table 2.1-5

To calculate the "Most Recent 10-year Geomean Abundance" column, Federal Defendants report that they included (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 been removed for safety-net hatchery broodstock. *See* Fed. Resp. at 5-6. Federal Defendants note that the 90% value is based on the ICTRT's estimate of survival from the point of removal from the stream for broodstock to the spawning grounds. *Id.* at 6 n. 10. The broodstock, however, is *removed* from spawning in the stream, not added to it. The value of "90% of the broodstock" represents an estimate of how many of the wild fish that were removed would have survived to the spawning grounds, and can be used to estimate the risk of removing fish from a wild population to produce the broodstock. *See* Suppl. Kostow Decl. ¶ 3. Federal Defendants provide no explanation of why fish that were removed from the wild population should be included in the estimate of wild fish abundance in the stream. The implication of this protocol is to bias the abundance estimate high, as shown in Table 1 to the Supplemental Kostow Declaration. *Id*. For example, when abundance is calculated for the Upper Grande Ronde population without the broodstock, the number drops from 65 to 37 fish. *Id.*

Even putting aside the issue of adding 90% of the broodstock into the geomean abundance, Table 2.1-5 contains errors. For populations that have no hatchery fish, the "Most Recent 10-year Geomean Abundance" should equal the "Most Recent 10-year Geomean Total Adult Spawners (Including Hatchery-Origin)." This is evident by reviewing the first two rows of Table 1 of the Federal Defendants' Response. *See* Fed. Resp. at 8. For populations with no hatchery fish, the Most Recent 10-year Geomean Abundance and the Most Recent 10-year Geomean Total Adult Spawners (Including Hatchery-Origin)" are both comprised solely of native-origin fish that reach the spawning ground. Adjustments to remove jacks would affect

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and Figure 7 may be inaccurate as described herein and in the Supplemental Declaration of Kathryn Kostow since they simply restate the tables in the 2014 BiOp.

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both measurements the same way. *See* Suppl. Kostow Decl. ¶ 4. However, this is not true of the data in Table 2.1-5 for most of the populations with "Most Recent 10-year Geomean Percent Natural-Origin Spawners" equal to 1.0 (i.e, no hatchery fish). For example, for the Yankee Fork spring Chinook population, Table 2.1-5 shows percent natural origin spawners of 1.00, but the total adult spawners equal 32 and a natural-origin spawners equal 16; instead total adult spawners should equal natural-origin adult spawners. *See Id.*

The reason for this discrepancy is that NMFS made an error in how they adjusted for jacks in the natural origin abundances in 70% of the populations in the Snake River spring/summer Chinook ESU. They removed jacks, but they also removed age 6 adults from the abundances in these populations while defining adults as those age 4, 5 and 6. This error is the primary reason why total abundance does not equal wild abundance in most of the populations in Table 2.1-5 where percentage natural-origin equals 1.00. *See Id.* at ¶ 5. Other computational errors were also made. *See Id.*

B. Table 2.1-9

NMFS's calculations of the R/S point estimates are flawed. NMFS excluded from the R/S calculation some brood years for some populations where adult abundance dropped to or near zero in one or more years. A geomean cannot include a data point with a value of zero. However, by dropping years of zero abundance from the R/S calculation altogether, NMFS overestimated geomean R/S for some populations. If instead a dummy value of 0.000001 were substituted for 0.00 for those years, lower R/S values would have been calculated for eight of the spring Chinook populations in the Snake River ESU, as shown in Table 2 of the Supplemental Kostow Declaration.[4] For example, the Sulphur Creek population's R/S point estimate drops from 1.05 to 0.15 when years with an R/S of zero are accounted for in the calculation. *See Id.* Table 2 at ¶ 7.

[4] Oregon recalculates these point estimates without regard to confidence intervals for the purpose of demonstrating how the value changes when brood years with an R/S of zero are included.

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II. Extinction Risk for Upper Grande Ronde Population

The concept pursued by the Court in its questions about these two tables is sound. A population, like the Upper Grande Ronde spring Chinook population, with an abundance less than 100 fish and an R/S less than 1.00 is in danger of imminent extinction. Federal Defendants agree with the validity of this concept, but assert that an extinction risk model provides a more thorough examination of the risks to salmonid species. Oregon agrees with NMFS that the appropriate way to mathematically explore this dynamic is through a viability (or "extinction") model. Fed. Resp. at 13, *see also* Suppl. Kostow Decl. ¶ 8. In such a model, the values of abundance, productivity, and some estimates of data covariance and variation are entered and the probability of becoming extinct over some period of time is measured. Suppl. Kostow Decl. ¶ 8.

A. NMFS' Extinction Analysis

NMFS did a version of an extinction model for the Upper Grande Ronde in the 2008 FCRPS BiOp and apparently updated it in the 2014 FCRPS BiOp. *See Id*. at ¶ 9. In both modeling efforts, NMFS confirmed the Court's concern that the Upper Grande Ronde is in danger of imminent extinction in about six generations. In 2008, NMFS calculated as a point estimate, that Upper Grande Ronde population had a 70% probability of becoming extinct in the next 24 years, but with a 95% confidence interval of a 7% risk of extinction up to a 97% risk of extinction. *See* 2008 FCRPS BiOp Table 8.3.2-3 at p. 8.3-49, under columns "Risk (QET=50)." In 2014, NMFS updated this projection and found the Upper Grande Ronde to have a 48% probability of becoming extinct in the next 24 years with a confidence interval of 7% to 94%. *See* 2014 FCRPS BiOp Table 2.1-7, page 85.

Federal Defendants claim that the point estimate change from 70% to 48% probability of extinction indicates that "[t]hrough the safety-net hatchery program and other measures, that [extinction] trajectory has changed, and the extinction risk for this population has been reduced." Fed. Resp. at 13. However, 70% and 48% are merely two values both within the 7% to 94/97% confidence interval, and represent no significant difference from each other. The error in the

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NMFS extinction models is too wide to estimate true extinction risk. *See* Suppl. Kostow Decl. ¶ 10; Amended Bowles Decl. ¶¶ 51-53. Regardless of these wide confidence intervals, however, it is clear that the Upper Grande Ronde is very likely at high risk of extinction given its critically small and unproductive population. Suppl. Kostow Decl. ¶ 10.

B. Role of Degraded Tributary Habitat

Oregon agrees with NMFS that improvements to the Upper Grande Ronde's tributary habitat are needed for this population to replace itself and grow. *See* Nigro Decl. ¶ 41, ECF No. 1986; Kostow Decl. at ¶ 18 & Fig. C, ECF No. 2021. As Oregon has explained, however, habitat actions—including those for the Upper Grande Ronde population—are not being implemented as planned. *See* Nigro Decl. ¶ 47 & App. B. For example, only 4% of a 23% HQI performance standard has been achieved for the Upper Grande Ronde population. *See* 2014 BiOp at 291. An additional 1% is projected to be achieved between 2012 and 2018. *Id.* While the Action Agencies have worked to "identify a menu of supplemental actions" that would achieve the remaining 18%, there is little concrete explanation or identification of these additional actions. *Id.* at 291-93. The 2014 BiOp simply concludes that these actions have "the potential to contribute an additional 18%" although they have yet to be fully detailed or submitted for review to the expert panel. *Id.* at 291-92. Oregon has previously noted the high uncertainty and considerable inflation seen in HQI measures. *See* Nigro Decl. Appendix B at 63. As thoroughly addressed in the Nigro Declaration, these uncertainties are especially pronounced in the spring Chinook of the Snake River (which includes the Upper Grande Ronde population). *Id.*

Even assuming all of NMFS' predicted survival improvements from tributary habitat actions (23%) and hatchery actions (29%) are realized for the Upper Grande Ronde population, the smolt-to-adult return (SAR) is still too low for this population to replace itself, much less grow to a minimum viable population size. *See* Suppl. Kostow Decl. ¶ 12 & Fig. 1; OR Reply MSJ at 22-24, ECF No. 2020 (using the Pahsimeroi Spring Chinook example to show impact of tributary habitat improvement for populations with degraded habitat). Substantially improving

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this population's survival through the FCRPS is necessary to reduce the high risk of extinction it faces. *See Id.* at ¶ 13

Further, the Upper Grande Ronde population is not the only one at risk of imminent extinction. Two wilderness area populations in the Middle Fork Salmon are also under 100 fish and have a high extinction risk. According to the 2014 BiOp, the Sulphur Creek population has an abundance of 58 fish, *see* Table 2.1-5, and a 67% chance of extinction in the next 24 years, with a confidence interval of 21% to 100%, *see* Table 2.1-7. The Camas Creek population has an abundance of 47 fish, *see* Table 2.1-5, and a 92% chance of extinction in the next 24 years, with a confidence interval of 43% to 100%, *see* Table 2.1-7. Both of these populations are in wilderness areas and are without hatchery influence, thus the primary action available is to improve their survival through the FCRPS.

CONCLUSION

Tables 2.1-5 and 2.1-9 contain errors and include numerous technical irregularities that are not explained or justified in the 2014 BiOp or in Federal Defendants' Response. Many populations—including the Upper Grande Ronde population and wilderness populations with pristine habitat—have low abundances, negative R/S and high extinction risks. Tributary habitat restoration for the Upper Grande Ronde population is needed, but is not being implemented as planned. Even if all predicted benefits from tributary and hatchery actions are realized, the

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Upper Grande Ronde's survival through the FCRPS must also improve significantly in order for this population to replace itself, much less grow to a minimum viable population.

DATED this 7th day of July, 2015.

Respectfully submitted,

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

PORTLAND DIVISION

NATIONAL WILDLIFE FEDERATION, *et al.*,, Plaintiffs, and STATE OF OREGON, Intervenor-Plaintiff, v. NATIONAL MARINE FISHERIES SERVICE, *et al.*,, Defendants, and NORTHWEST RIVERPARTNERS, *et al.*, Intervenor-Defendants.	Case No. 3:01-CV-00640-SI SUPPLEMENTAL DECLARATION OF KATHRYN KOSTOW

I, Kathryn Kostow, state and declare as follows:

1. I am a conservation biologist with Oregon Department of Fish and Wildlife in Fish Division. I have worked for the State of Oregon since 1990 on projects related to various fish conservation and management issues, including fish population status assessment, hatchery risk assessment, hydropower risk assessment, fish biodiversity studies, harvest management and the Endangered Species Act. I submitted a previous declaration in this case (ECF No. 2021), which details my education, work history and expertise. This supplemental declaration addresses the questions raised by the Court during oral arguments on June 23, 2015 and responds to Federal Defendants' response to these same questions.

2. I have reviewed the 2014 NOAA C34270 Chinook spread sheet and checked the calculations for all spring Chinook populations in the Snake River spring/summer Chinook ESU and the Upper Columbia spring Chinook ESU. I was able to reproduce most of the numbers in Tables 2.1-5 and 2.1-9, or identify where errors occurred. Using methods in the Federal Defendants' Response as a guide, and tracking the calculations in the spread sheet, I found technical irregularities. These irregularities include computational errors, apparent reporting errors, unexplained inconsistencies in methods, and in some cases potential biases.

Review of Table 2.1-5

3. NMFS's protocol of adding broodstock back into the natural-origin spawner abundance column in Table 2.1-5 has the effect of biasing the abundance estimate high, as shown in Table 1, below. Natural-origin spawner abundance should represent the abundance of the wild population spawning in the stream. The broodstock is removed from spawning in the stream, not added to it. The value "90% of the broodstock" represents an estimate of how many adult wild fish were removed from the wild population after accounting for natural mortality. (Fed. Resp. at 5-6 & n. 10). This number can be used to estimate the risk of removing fish from a wild population to produce the broodstock. It is not appropriate to retain them in the estimate of

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wild/natural fish abundance, although it may be appropriate to include them in a measure of recruits.

Table 1. The effect of counting those fish removed for broodstock in wild fish abundance for all spring Chinook populations in the Snake River and Upper Columbia ESUs where this protocol was applied.

ESU	Population	Abundance including broodstock	Abundance excluding broodstock
Snake River Spring/Summer Chinook	Tucannon	375	313
	Catherine Cr	137	105
	Upr Grande Ronde	65	37
	Lostine	370	320
	Imnaha	460	381
	East Fork S. Fork Salmon	282	203
Upper Columbia Spring Chinook	Wenatchee	568	486
	Methow	398	332

4. Federal Defendants' explanation of the different units used in each column of Table 2.1-5 does not explain all of the mathematical irregularities. This is most clearly shown for populations where there have been no hatchery-origin spawners for the relevant time period (i.e. "Geomean percent natural origin spawners" = 1.00). In those populations, the "Geomean total adult spawners" must equal the "Geomean natural origin abundance" since total adult spawners are simply multiplied by 1.00. Adjustments to remove jacks would affect both measurements the same way. However, this is not true of the data in Table 2.1-5 for most of the populations with "Geomean percent natural origin spawners" equal to 1.0. For example, for the Yankee Fork spring Chinook population, Table 2.1-5 has a percent natural origin spawners = 1.00, but a total adult spawners = 32 and a natural origin spawners = 16; instead total adult spawners should equal natural origin adult spawners.

5. Regarding calculations of abundance in Table 2.1-5, it is reasonable to subtract jacks (age 3 spring Chinook) from abundance and productivity calculations and to acknowledge

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that the jacking rate for hatchery fish differs (is usually higher) than for wild fish. However, NMFS made an error in how they adjusted for jacks in the natural origin abundances in 70% of the populations in the Snake River spring/summer Chinook ESU. They removed jacks, but they also removed age 6 adults from the abundances in these populations while defining adults as those age 4, 5 and 6. This error is the primary reason why total abundance does not equal wild abundance in most of the populations in Table 2.1-5 where % wild = 1.00. NMFS further made a cell reference error that compromised their calculation of total abundance in the Imnaha population and made unexplainable errors across all values reported for the Marsh Creek population (except for % wild), across all values for the Yankee Fork population (including % wild), and for the Methow wild abundance value.

Review of Table 2.1-9

6. Regarding calculations of R/S in Table 2.1-9, NMFS properly calculated R/S by accounting for fish by brood year (as opposed to run year) and including total spawners (including hatchery fish) as “S” and only naturally-produced fish as “R”. However, the Federal Defendants’ Response says (page 10) the extended base period R/S estimates in Table 2.1-9 encompassed brood years 1981 to 2006, while for many populations their estimates actually started in brood year 1980 or 1979. While this does not, in itself, introduce an error or bias, it is a departure from their described methods.

7. For some populations in Table 2.1-9, some brood years were left out of the calculations without an explanation, which introduced a bias. This appears to have occurred in populations where adult abundance dropped to or near zero in one or more years since 1980. For example, in Sulphur Creek, abundance in 1984, 1994, and 1999 fell to zero, in 1995 it was 2. The production from these brood years was therefore zero (R/S = 0.00). However, since a Geomean cannot include a data point with a value of zero, NMFS dropped these years from their calculation of R/S. However, by doing so, NMFS overestimated Geomean R/S for the period 1981-2006 brood years. If instead a dummy value of 0.000001 were substituted for 0.00 for

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those years lower R/S values would have been calculated for eight of the spring Chinook populations in the Snake River ESU, as shown in Table 2. For the purpose of illustrating the effect of excluding years where R/S equals zero, I reproduce below how the point estimates in Table 2.1-9 change when a dummy value of R/S equals 0.000001 is used instead of simply dropping the brood year from the calculations. Federal Defendants do not consider the effect of dropping the zero R/S values from the R/S point estimate calculation or explain why this methodology is appropriate in light of that effect.

Table 2. The effect of excluding years when adult abundances were at or near zero in the calculation of R/S. Since R/S = 0.00 in those years, and a Geomean calculation cannot include data with a value of zero, a dummy value of 0.000001 was used for those years.

ESU	Population	Point Estimate of R/S excluding years where R/S = 0	Point Estimate of R/S including years where R/S = 0
Snake River Spring/Summer Chinook	Sulphur	1.05	0.15
	Yankee Fork	0.50	0.03
	Upr Grande Ronde	0.36	0.13
	Valley Cr	1.10	0.40
	Loon Cr	0.91	0.12
	Camas	0.69	0.10
	Marsh	0.98/1.05*	0.35
	Big Cr	1.12	0.61
* The R/S value reported in Table 2.1-5 for Marsh Cr does not match the computation reported in 2014 NOAA C34270; both numbers are included here			

Review of Extinction Risk Analysis

8. I agree with the concept that was pursued by the Court in its questions: a population, like the Upper Grande Ronde spring Chinook population, that has an abundance less than 100 fish and an R/S less than 1.00 is in danger of imminent extinction. However, NMFS is correct that the appropriate way to mathematically explore this dynamic is through a viability (or "extinction") model. In such a model, the values of abundance, productivity, and some estimates

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of data covariance and variation are entered and the probability of becoming extinct over some period of time is measured.

9. NMFS did a version of an extinction model for the Upper Grande Ronde in the 2008 FCRPS BiOp and apparently updated it in the 2014 FCRPS BiOp. In both modeling efforts, NMFS confirmed the Court's concern that the Upper Grande Ronde population is in danger of extinction within about 6 generations. In 2008, NMFS found the Upper Grande Ronde to have a 70% probability of becoming extinct in the next 24 years, but with a confidence interval of 7% to 97% (2008 FCRPS BiOp Table 8.3.2-3 page 262). In 2014, NMFS updated this projection and found the Upper Grande Ronde to have a 48% probability of becoming extinct in the next 24 years with a confidence interval of 7% to 94% (2014 FCRPS BiOp Table 2.1-7, page 85).

10. Federal Defendants mistakenly interpret the point estimate change from 70% to 48% to represent a reduction in extinction risk and attribute the change to the hatchery program in the Upper Grande Ronde. These two values of 70% and 48% are merely two numbers, both within the 7% to 94/97% confidence interval, are as likely to be true as a 90% or a 10% extinction risk, and represent no significant difference from each other. The error in the NMFS extinction models is too wide to estimate "true" extinction risk. However, it is reasonable to recognize that the critically small, unproductive population in the Upper Grande Ronde is in imminent danger of extinction.

11. The Upper Grande Ronde population resides in degraded tributary habitat. NMFS anticipated a 23% survival improvement due to tributary habitat actions in the RPA (2008 FCRPS BiOp Table 8.3.5-1, p 267). The 2014 FCRPS BiOp indicates that the Upper Grande Ronde population is in need of unspecified "supplemental" habitat actions (see Table 3.1-1, p 272). Oregon's analysis indicates that habitat projects in the Upper Grande Ronde are behind schedule, similar to other basins (Nigro Declaration Appendix B Table 2). However, even with its current habitat quality, the basin is able to support the smolt production of about 600 spawners (S_{max} for the Upper Grande Ronde = 600, shown in Kostow Declaration Figure C (ECF

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No. 2021)). While this number is below the ICTRT minimum viable abundance size of 1000 spawners—in part because of tributary habitat degradation—it is well above the current abundance (averaging only 37 fish, not counting fish removed for broodstock). Oregon's analysis indicates that current abundance is being limited by low SARs. Recent median SAR for the Upper Grande Ronde is only 0.31%., while we estimate that a minimum SAR of 3.6% is needed for this population to stabilize at its current S_{max} of 600 spawners (Nigro Decl. App. A).

12. In Figure 1, I explore the effect on SAR of increasing tributary productivity in the Upper Grande Ronde, in a similar analysis as was done on the Pahsimeroi population in the Nigro Declaration, Figure 13 p. 30. In Figure 1, I increased productivity measured as both α and β in the Upper Grande Ronde Ricker curve by 50% (for a total increase in smolt production of 100%). This approach assumes that the expected survival benefits of actions in both the hatchery (29%) and habitat (23%) occur. This increase in productivity would lower the minimum SAR required to reach the ICTRT minimum viable abundance threshold (1,000 spawners) to 1.6%. Thus we expect that tributary improvements, if actual increases in smolt production result from them, would benefit the Upper Grande Ronde population. However, this lower 1.6% SAR needed to meet the ICTRT minimum viable threshold of 1,000 is still well above the current observed SAR of 0.31%.

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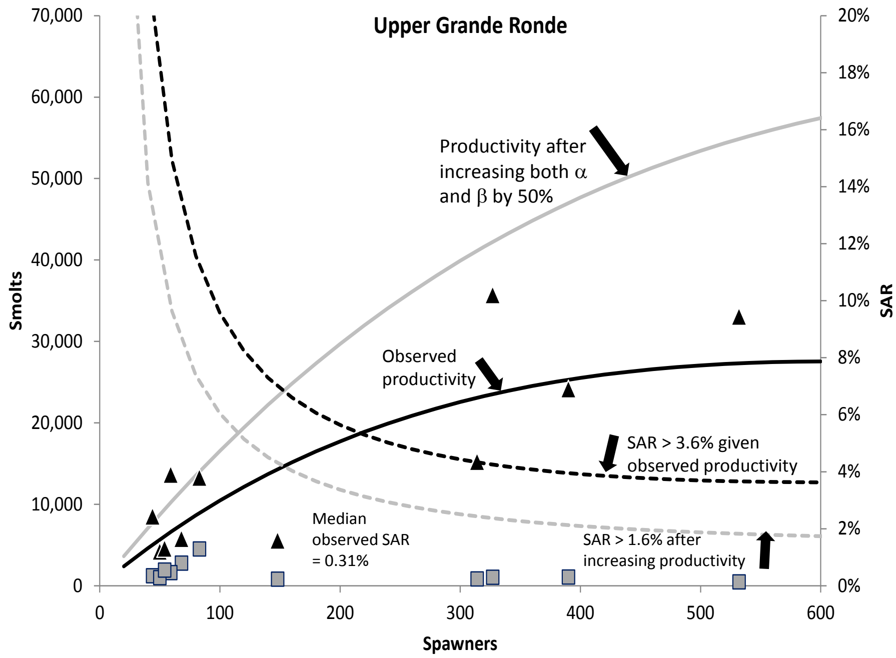

Figure 1. Changes in the SAR of the Upper Grande Ronde spring Chinook population required to stabilize the population at the ICTRT minimum viable abundance of 1,000 spawners if freshwater productivity is improved by increasing both the α and β parameter in the Ricker productivity model for the population by 50%. Black triangles represent empirical smolt per spawner data; grey squares represent observed SARs.

13. Similar to the Pahsimeroi, improvements in freshwater production of smolts alone will not allow the Upper Grande Ronde to overcome FCRPS-related mortality. A substantial improvement in survival after the smolts leave the tributaries is also required. Given that the S_{max} of this population, measured by smolt production, is already at 600 spawners, well above current abundance (Kostow Declaration Figure C), and that the addition of hatchery spawners to the population has already been shown to not increase the abundance of naturally produced fish

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(Scheuerell et al. 2015)[1] even with available carrying capacity, the immediate problem in the Upper Grande Ronde is poor survival through the FCRPS.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on July 7, 2015.

Kathryn Kostow

KATHRYN KOSTOW

[1] Scheuerell, MD, and five co-authors. 2015. Analyzing large-scale conservation interventions with Bayesian hierarchical models: a case study of supplementing threatened Pacific salmon. Ecology and Evolution 5:2115-2125.

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