

SUPPORTING INFORMATION SUBMITTED TO THE NATIONAL MARINE FISHERIES SERVICE COVERING SPAWNING COMPOSITION AND RECALCULATION PERTINENT TO THE METHOW HATCHERY SPRING CHINOOK HGMP

November 9, 2012

1.0 BACKGROUND

The National Marine Fisheries Service (NMFS) has requested that Douglas PUD provide additional information and analyses in support of the Methow Hatchery Spring Chinook Hatchery and Genetic Management Plan (HGMP) submitted to the NMFS on March 9, 2010. In particular, NMFS has requested that Douglas PUD quantify the probability of achieving various program- and population-specific goals including the probability of achieving pHOS of less than 0.25 in the Methow Basin. NMFS also requested a description of the methodology used for the analyses, a presentation of adaptive management options, and presentation of updates to the programs.

2.0 INTRODUCTION

This document provides additional information and analyses in support of the Methow Hatchery Spring Chinook HGMP submitted to the NMFS on March 9, 2010. The overall program size has decreased from what was originally proposed in the HGMP (550,000 smolts) because Douglas PUD hatchery compensation was adjusted for population dynamics (Wells HCP, Section 8.4.5) by the Wells HCP Hatchery Committee in December 2011, over a year after submittal of the HGMP to NMFS (Section 1.8.2). Similarly, Grant PUD hatchery compensation was adjusted in January 2012 by the Priest Rapids Coordinating Committee. Finally, in July 2012, Chelan PUD notified Douglas PUD that it was terminating the long-term hatchery sharing agreement whereby Douglas raised and evaluated fish for Chelan at the Methow Hatchery. The production numbers presented herein reflect the programs to be reared at the Methow Fish Hatchery for Douglas PUD (29,123) and Grant PUD (134,126) to meet their respective mitigation obligations. Douglas PUD and Grant PUD will also implement a monitoring and evaluation program for the Methow Hatchery spring Chinook programs. The Methow Fish Hatchery is owned by Douglas PUD and currently operated by WDFW.

Twisp River: The proposed production level of 30,000 yearling spring Chinook will be initiated starting with brood year 2013 (release year 2015). The spring Chinook production for the Twisp River conservation program will be managed to address demographic goals in the Twisp and to meet a pHOS target of 0.25 or less, to the extent possible, for the Twisp population based on abundance of natural origin fish, adult management opportunities, and broodstock collection needs, as described below. Projections presented below represent estimated long term averages with associated confidence intervals.

Methow River: The proposed production level of 135,000 yearling spring Chinook will be initiated starting with brood year 2013 (release year 2015). The spring Chinook production for the Methow River conservation program will be managed to address demographic goals in the Methow River and to meet a pHOS target of 0.25 or less in this river, to the extent possible, based on abundance of natural origin fish, adult management opportunities, and broodstock collection needs, as described below. Projections presented below represent estimated long term averages with associated confidence intervals.

Winthrop National Fish Hatchery: The USFWS proposes to release up to 400,000 spring Chinook smolts from Winthrop National Fish Hatchery (WNFH) in the Methow Basin. See the USFWS WNFH Spring Chinook HGMP for details on this program. The estimated combined pHOS including WNFH is presented for context. However, the management actions in the WNFH Spring Chinook HGMP are separate actions from those presented in this supplemental information document and in the Methow Hatchery Spring Chinook HGMP.

Adult Management: See Sections 1.8.1.2 and 1.8.2.4 of the Methow Hatchery Spring Chinook HGMP.

3.0 ANALYSIS

The management strategies described below were developed based on analyses that modeled likely outcomes of various management strategies and assumptions for Methow Hatchery spring Chinook programs.

The adult return, smolt release, and broodstock data used for the modeling were derived from the Monitoring and Evaluation of Wells and Methow Hatchery Programs in 2010 (Snow et al., 2011). The program sizes were from the Wells HCP Hatchery Committee Final Statement of Agreement (SOA) Regarding the 2013 No Net Impact (NNI) Recalculation and Implementation Plan, Approved on 14 December 2011. Additional data and information was provided by C. Snow, WDFW (October 2012) and M. Cooper, USFWS (October 2012).

The analyses used historic adult spring Chinook return estimates (Snow et al., 2011) spanning spring Chinook brood years 2004-2011. Data from earlier years was excluded because management regimes were substantially different than in more contemporary years.

Estimation of the annual run sizes and demographics, and effects of management actions was performed using the following approach: The annual number of natural-origin and hatchery-origin returns to Wells Dam (C. Snow, WDFW, October 2012) was further divided into their river of origin (natural-origin fish) or hatchery and river of origin (hatchery-origin fish). Return years 2004-2010 were used in the analysis. Origin groups consisted of the following (Table 1):

Table 1. Origin groups of spring Chinook in the Methow Basin

Origin	Hatchery	River of Origin	Stock	Program Type
Natural	NA	Twisp	Twisp	NA
Natural	NA	Methow	MetChew	NA
Natural	NA	Chewuch	MetChew	NA
Hatchery	Methow	Twisp	Twisp	Conservation
Hatchery	Methow	Methow	MetChew	Conservation
Hatchery	Methow	Chewuch	MetChew	Conservation
Hatchery	WNFH	Methow	MetChew	Safety-Net

The proportions of each origin group were derived from spawner survey population estimates for each year (Snow et al. 2012). The number of spawners was estimated by expanding redd counts in the Methow Basin using a redd-to-spawner multiplication factor. The origin of the spawners was estimated through carcass recovery, where fish were initially grouped into hatchery and natural origin. The hatchery origin fish were further grouped by hatchery of origin using CWT recoveries (Snow et al. 2012). Taken together, these data provided estimates of the number of spawners subdivided into origin groups (Snow et al. 2012). The estimates of spawners were then adjusted to account for pre-spawn mortality (C. Snow, WDFW, October 2012), which provided estimates of escapement after broodstock collection or fish removal for surplus. The numbers of fish removed for broodstock or surplus were added to these estimates, providing estimates of the escapement upstream of Wells Dam to the Methow River. However, these estimates were used only to obtain an estimate of the relative proportions of each origin group upstream of Wells Dam. These proportions were then applied to the counts of fish at Wells Dam for each year (counts were also adjusted for fish migrating to the Okanogan River). The count of fish at Wells Dam is a more reliable estimate of the number of fish escaping to the Methow Basin, but does not provide a breakdown of the groups of fish by origin. Therefore, we used the most reliable fish counts as a basis for overall numbers, and parsed these fish into categories of origin using the more detailed spawning ground and broodstock collection data. This provided an annual estimate of the number of fish returning to Wells Dam each year subdivided by origin.

Modeling of future management actions was accomplished by adjusting the numbers of hatchery-origin returns to reflect what would have returned in those years if smolt releases were of the numbers presented in this document. Natural-origin returns to the Methow Basin were maintained at the historic levels. Spatial distribution of hatchery returns was inferred through release location, where the preponderance of fish was assumed to return to the sub-basin where they were released. Broodstock and/or adult management opportunities that were assessed include Wells Dam, Twisp Weir, Winthrop National Fish Hatchery (WNFH) volunteer trap, and Methow Hatchery volunteer trap. Broodstock collection followed numbers presented in the Methow Hatchery Spring Chinook HGMP, but was adjusted for the new release numbers

Modeling was performed by estimating the overall removal of Methow Hatchery-released fish required to meet $\text{pHOS} \leq 0.25$. Removal was partitioned among hatchery facilities and programs, and removal rates pertaining to each program are presented in each section. Conservation fisheries were included in the analyses. However, these fisheries would only target WNFH returns. Returning Methow Hatchery conservation fish would be incidentally taken only as by-catch in the selective fisheries. The analysis assumes that a Columbia mainstem fishery

would remove 5% of target fish and 1% of non-target conservation hatchery and natural origin fish. Similarly, a conservation fishery in the Methow basin was assumed to remove 20% of target fish and 1% of non-target conservation hatchery and natural origin fish (J. Korth, WDFW, personal communication). For WNFH returns, a 15% removal by a fishery downstream of Wells Dam was also used (B. Gale, USFWS, personal communication, Nov. 2012). For the Twisp release, modeling was performed using historic return rates and modulating smolt release numbers to achieve an average pHOS ≤ 0.25 to minimize the need to perform adult management adjacent to the spawning grounds and reduce mining of natural-origin adults for broodstock. The number of natural spawners of each origin type was estimated in each sub-basin, as were the number of fish removed through adult management and broodstock collection activities. Key management parameters such as pHOS, pNOB, and PNI were also estimated. Each simulation was run 10,000 times by resampling the data with replacement, and uncertainty in the estimates, as expressed by 95% confidence intervals (PopTools; Hood, 2011), was primarily derived from inter-annual variation in return sizes. This modeling represents our best estimates of what is most likely to occur, and was used to guide the choice of preferred management strategies.

4.0 OVERVIEW OF THE PROGRAM

The spawning escapement goal for the Methow Basin is 1,140 spawners, with 470 in the Methow and Chewuch rivers, each, and 200 spawners in the Twisp River (HGMP Section 1.8.2.3). The Douglas PUD and Grant PUD hatchery programs have a combined release of 163,249 yearling spring Chinook and were designed to return appropriate numbers of spawners to the Methow and Twisp sub-basins. However, a limitation in the number of natural origin spawners is likely to prevent achievement of the escapement goals in some years (HGMP Section 1.8.2.3). The Chewuch River is not supplemented by the Methow Hatchery programs due to the reduction in numbers of fish available at the facility through adjustment of hatchery compensation by the Douglas and Grant PUDs, and the departure of Chelan PUD's spring Chinook mitigation obligation production from the facility. A detailed description of the programs can be found in the following sections.

5.0 TWISP RIVER INTEGRATED RECOVERY PROGRAM

5.1 Management Goal

Enhance the wild Twisp River spring Chinook population. Achieve pHOS less than or equal to 0.25. The minimum spawning escapement (quasi-extinction threshold) is 50 spawners, with a management target of 200 spawners (HGMP Section 1.8.2.4). Analysis of management actions that would likely be required to meet pHOS less than or equal 0.25 are presented.

5.2 Program Size

30,000 yearling smolt release. (HGMP Section 1.8.2)

5.3 Broodstock

Broodstock (N = 18) will be wild x wild (WxW) parentage or hatchery x wild (HxW) parentage of Twisp stock adults collected at the Twisp Weir and Wells Dam. Up to 33% of the Twisp River natural-origin spawners may be collected and used as broodstock for the Twisp program. Hatchery-origin broodstock will be used to augment wild-origin broodstock to the extent necessary to meet the program production target. The expected pNOB is 0.88 (95% CI 0.79 – 0.97). Broodstock will be held and spawned at the Methow Hatchery, or the Wells Hatchery. (HGMP Section 1.8.2)

5.4 Rearing

Twisp River spring Chinook will be spawned and reared at the Methow Hatchery. Twisp River fish may be spawned and reared at the Wells Hatchery. Experimental early imprinting designed to enhance homing may be performed at the eyed-egg through emergent fry life stages. This would entail exposing fish to Twisp River water either on-site at the Twisp River in a remote incubation facility or at the Methow or Wells hatcheries.

5.5 Release/Acclimation

Yearling smolts will be acclimated on Twisp River surface water in the Twisp Pond (co-acclimated with 48,000 Twisp summer steelhead), introduced in March and released in April/May depending on conditions. (HGMP Section 1.8.2.2)

5.6 Adult Management

Adult management will be performed at Wells Hatchery, Wells Dam, Methow Hatchery volunteer channel, WNFH volunteer channel, and the Twisp Weir as necessary. Estimated adult management removal magnitude and proportion of the hatchery returns is provided in Table 2. Fish removed for adult management may be used for broodstock at WNFH or Chief Joseph Hatchery (CJH). (HGMP Section 1.8.2.4)

Table 2. Expected adult management disposition, number and proportion of Twisp River hatchery-origin adult spring Chinook (Wells Dam 25%, Twisp Weir 65%, pHOS goal \leq 0.25).

Disposition	Mean	95% CI of Mean	% of Hatchery Return	95% CI of % of Hatchery Return
Broodstock	2	1 - 4	2 %	1 - 4 %
Adult Managed	82	55 - 110	75 %	74 - 75 %
Combined (Total)	82	55 - 111	75 %	74 - 75 %

The expected pHOS is 0.23 (95% CI 0.14 - 0.34) and the expected PNI is 0.79 (95% CI 0.70 - 0.87). On average, approximately 80 (95% CI 54 - 109) hatchery origin adults will be available as broodstock for other programs. The combined annual wild and hatchery spawning escapement is estimated to be 90 fish (95% CI 49 - 147) (Table 3).

Table 3. Expected spawning escapement of wild- and hatchery-origin spring Chinook in the Twisp River.

Origin	Mean	95 % CI
Wild	74	34 - 126
Hatchery	16	10 - 23
Combined (Total)	90	49 - 147

5.7 Adaptive Management

Adaptive management for the Twisp River is described in HGMP Section 1.8.2.4. The adaptive management plan described in Section 1.8.2.4 will be implemented with the following changes (underlined) aimed at achieving ≤ 0.25 :

- Escapement of NORs will not be restricted.
- The NOR extraction rate for broodstock will not exceed 0.33 of the resultant natural-origin-spawners (NOSs). This rule will maximize NOSs, facilitating the management of pHOS, especially when run sizes are too low to allow adult management. Application of this rule to historic data sets yielded a NOR extraction rate of approximately 0.20 for most run sizes capable of supporting hatchery production.
- pNOB will always be ≥ 0.50 , in accordance with the HSRG principles of maintaining the dominance of natural influence. Consequently, production from the Twisp component of the program will be limited by NOB such that the total broodstock number will never exceed twice the number of the NOB. Increased Methow/Chewuch production will compensate for shortfalls in Twisp production.
- The pHOS target will be a moving-average ≤ 0.25 .
- Adult management will be used to constrain pHOS when run sizes allow the achievement of a spawner escapement of at least 50 adults.
- NOR extraction rates would be reduced as necessary for run sizes where utilizing the full extraction rate of 0.33 of the NOSs, would cause the total spawner escapement to fall below the minimum of 50 adults. For run sizes where a reduction in the NOR extraction rate would no longer prevent the total spawner escapement from falling below 50 adults, broodstock collection should be terminated to maximize natural production.

6.0 METHOW INTEGRATED RECOVERY PROGRAM

6.1 Management Goal

Enhance the wild Methow River spring Chinook population. Achieve pHOS less than or equal to 0.25. The minimum spawning escapement target is 500 spawners for the Methow and Chewuch rivers, combined, while the spawning escapement target for the Methow River is 470 spawners (HGMP Sections 1.8.2.3 and 1.8.2.4). Analysis of management actions that would likely be required to meet pHOS less than or equal 0.25 is presented.

6.2 Program Size

135,000 yearling smolt release. (HGMP Section 1.8.2)

6.3 Broodstock

Broodstock (Methow stock N=85 for the Methow River program) will be of wild x wild (WxW) parentage or hatchery x wild (HxW) parentage. HxH crosses may be used only in years of very low abundance. Wild-origin broodstock collection will not exceed 33% of the wild run. Hatchery-origin broodstock will be used to augment wild-origin broodstock to the extent necessary to meet the program production target. Broodstock will be collected at Wells Dam and the volunteer trap at the Methow Hatchery. Broodstock will be held and spawned at the Methow Hatchery, or the Wells Hatchery. The estimated pNOB for the program is 0.49 (95% CI 0.46 – 0.51). (HGMP Section 1.8.2)

6.4 Rearing

Spawning and rearing will occur at Methow Hatchery or Wells Hatchery.

6.5 Release/Acclimation

Yearling smolts will be released from the Methow Acclimation Pond (acclimated on Methow River surface water) in April/May depending on conditions. (HGMP Section 1.8.2.2)

6.6 Adult Management

Wells Dam, and the Wells Hatchery, Methow Hatchery, and WNFH outfalls may all be used to control excess hatchery-origin returns from the Methow Integrated Recovery Program. Hatchery origin returns may be managed at the ladder traps at Wells Dam in years when pHOS is expected to exceed 0.25 and minimum spawning escapement goals have been achieved. Estimated adult management removal magnitude and proportion of the hatchery returns is provided in Table 4. On average, 87% of the returning Methow Hatchery adults (mean 592, 95% CI 367 – 807) will likely need to be removed for broodstock or other purposes, in order to meet pHOS equal to or less than 0.25 in the Methow River. Excess hatchery origin adults from the Methow conservation program (mean 539, 95% CI 319 - 749) may be used as broodstock for the WNFH spring Chinook program and the CJH spring Chinook program when managing for pHOS less than or equal to 0.25 (Augments HGMP Section 1.8.2.4). The number of broodstock available for other facilities will decrease commensurately with increasing escapement of hatchery returns to the natural spawning grounds in order to meet spawning escapement goals.

Table 4. Expected adult management disposition, number, and proportion of Methow Hatchery-origin adult spring Chinook (pHOS goal: ≤ 0.25 ; assumptions: 25% removal at Wells Dam for broodstock, 20% removal at WNFH, and 78% removal at Methow Hatchery).

Disposition	Mean	95% CI of Mean	% of Hatchery Return	95% CI of % of Hatchery Return
Broodstock - MFH	43	42 - 46	9 %	5 - 13 %
Adult Managed	549	332 - 762	78 %	74 - 82 %
Combined (Total)	592	367 - 807	87 %	87 - 87 %

The expected pHOS is 0.26 and the expected PNI is 0.67 (95% CI 0.59 - 0.73). On average, approximately 539 hatchery origin adults will be available as broodstock for other programs. To meet pHOS equal to or less than 0.25 the combined annual wild and hatchery spawning escapement is estimated to be 188 (95% CI 136 - 243) (Table 5). However, to meet the combined Methow and Chewuch minimum spawning escapement target of 500 will likely necessitate exceeding pHOS = 0.25 in the early years of the program until NORs increase (see HGMP Section 1.8.2.3).

Table 5. Expected spawning escapement of wild- and hatchery-origin spring Chinook in the Methow River.

Origin	Mean	95 % CI
Wild	139	104 - 175
Hatchery	49	32 - 68
Combined (Total)	188	136 - 243

6.7 Additional Adult Management Opportunities

See Section HGMP 1.8.2.4 for more complete discussion. The information below augments Section 1.8.2.4.

Wells Dam: Broodstock collection and stock assessment activities already occur at Wells Dam for Methow Basin spring Chinook. Managers may take advantage of this opportunity to collect Methow Basin hatchery-origin fish for broodstock prior to capture opportunities in the Methow Basin. Such action would ensure adequate broodstock collection in case environmental conditions restrict the ability to collect broodstock in the Methow Basin. Such collections may double as adult management collections (adult management includes the transfer of broodstock from MFH programs to the WNFH and CJH) if additional broodstock are collected in the Methow Basin subsequent to the Wells Dam collections.

Wells Hatchery: The Wells Hatchery volunteer channel will already be in operation for the adult management of surplus hatchery steelhead. We expect a sizable proportion of hatchery origin spring Chinook will be handled at this site during adult steelhead management actions.

Foghorn Dam: Foghorn Dam, located on the Methow River a short distance upstream of Methow Hatchery, is equipped with a fish trap. The dam itself is not a barrier to fish passage, and the trap is currently unused. However, the trap may be effective in capturing hatchery fish because 1) adult salmon tend to hold below Foghorn Dam near the entrance to the fish trap (Dave Dinsmore, WDFW, personal communication), and 2) some adults may prefer to try to ascend the dam through the trap rather than over the dam, particularly at high flows.

Conservation Fishery Management: Currently, no fishery on Methow Basin spring Chinook exists. Conducting a conservation fishery will help reduce the number of hatchery-origin adults; however, a fishery would be directed at WNFH returning adults, and not at the Methow Hatchery conservation fish. Therefore, a fishery may help overall adult management in the basin, but should not have a substantial effect on adult management of Methow Hatchery spring Chinook.

7.0 METHOW BASIN OVERALL

This supplemental information to the Methow Hatchery spring Chinook HGMP describes the effect that reduced program sizes at Methow Hatchery (Twisp and Methow programs) is likely to have on spring Chinook management. In particular, pHOS is expected to be less than or equal to 0.25 in the Twisp and 0.26 in the Methow. However, the WNFH also will release spring Chinook in the Methow River. Therefore, to supply a holistic perspective of the effects of all the hatchery programs in the Methow Basin, the net pHOS of the Methow River programs released from both Methow Hatchery and WNFH is estimated to be 0.28 (95% confidence interval 0.24 - 0.32) in the Methow and Chewuch rivers combined. The Methow and Twisp rivers hatchery programs are expected to have sufficient natural-origin representation in the broodstock to achieve a basin PNI exceeding 0.78. The expected spawning escapement of hatchery- and natural-origin fish is presented in Table 6. Given the low number of wild fish and a pHOS goal of ≤ 0.25 , the number of hatchery spawners required is also low.

Table 6. Expected spawning escapement of wild- and hatchery-origin spring Chinook in the Methow Basin.

Origin	Mean	95 % CI
Wild	358	250 - 489
Methow Hatchery	65	41 - 91
WNFH	64	42 - 89
Combined (Total)	487	333 - 669

8.0 MONITORING AND EVALUATION

Currently, a robust Monitoring and Evaluation (M&E) program is in place to assess the Methow Hatchery spring Chinook programs (see HGMP Sections 1.10 and 11.0). The objectives and hypotheses of this M&E program are scheduled to be updated within the HCP HC by the end of 2013. The updated hatchery programs as described in this document will need to be finalized before the existing monitoring and evaluation program can be re-tooled to more effectively assess and manage the two new programs (Twisp and Methow).

Douglas PUD and Grant PUD will be responsible for implementing a joint M&E program to assess the Methow Hatchery spring Chinook programs in the Twisp and Methow rivers. WNFH, which releases the majority of the spring Chinook in the Methow Basin (400,000 smolts), is also expected to develop a new M&E program that is compatible with the HCP M&E program operated by Douglas PUD and Grant PUD. This is critical to ensure a comprehensive assessment of all programs in the basin. The HCP M&E plan is currently being updated, as per Section 8.5 of the Wells HCP, by the HCP Hatchery Committee. The objectives of the plan are expected to remain intact, with adjustments made to improve the performance or relevancy of some measures and the scope of implementation of the plans is also being adjusted to reflect changes in the size and management goals of the Douglas PUD and Grant PUD programs, and to strategically coordinate with the M&E program being developed and implemented for the WNFH spring Chinook program. The plan will estimate and report (in the annual M&E report submitted to the HCP Hatchery Committee and Priest Rapids Hatchery Sub-Committee) the following parameters: pHOS, pNOB, and PNI. The data required to estimate these parameters have been collected under the current plan, but estimates of pHOS, pNOB, and PNI have not been reported, as such, in the past. These data will continue to be collected in reaches influenced by the hatchery programs.

9.0 REFERENCES

Hood, G. M. (2011) PopTools version 3.2.5. Available on the internet. URL <http://www.poptools.org>

Snow, C., C. Frady, A. Repp, and A. Murdoch. 2011. Monitoring and Evaluation of Wells and Methow Hatchery Programs in 2010. Prepared for Douglas County Public Utility District and Wells Habitat Conservation Plan Hatchery Committee. Submitted by the Supplementation Research Team, Hatchery/Wild Interactions Unit, Science Division, WDFW, Twisp, Washington.