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MEMORANDUM FOR THE RECORD

FROM: Sean Tackley, USACE Portland District
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SUBJECT: Estimated benefits of operating the Ice and Trash Sluiceway (ITS) at The Dalles Dam from December 1-15 and March 1-April 10 for overwintering steelhead and out-migrating steelhead kelts

Steelhead trout (*Oncorynchus mykiss*) are unique among anadromous salmonids in the Columbia River Basin for several reasons; some life history characteristics have important implications relative to passage considerations. Summer-run steelhead typically migrate up the river from May – October, overwinter in the mainstem Columbia or tributaries, then spawn the following spring. Active migration typically slows significantly in November, followed by a winter period characterized by relative inactivity. Active migration typically resumes in the late winter or early spring, as river temperatures increase (Keefer et al. 2008). During the overwintering period, steelhead milling in mainstem reservoirs are known to pass The Dalles Dam and other projects, via turbines or (if provided) surface routes, such as the Ice and Trash Sluiceway (Keefer et al. 2008, Khan et al. 2010 a,b). Radiotelemetry studies completed from 1993-2004 suggested that up to 40% of overwintering steelhead that fallback past The Dalles Dam were unaccounted for and presumed dead (Matt Keefer, personal comm.). Concerns about the impacts of overwintering steelhead fallback and downstream passage of steelhead kelts via turbines prompted the Corps to evaluate the benefits of extending the ITS operation season (April 1 – November 30) to include December 1-15 and March 1-31. The benefits analysis included April 1-10 to include the current pre-spill period ITS operation.

A hydroacoustic evaluation of steelhead-sized target passage during these periods in 2008/09 and 2009/10 indicated that several thousand fish passed via the ITS when it was left open (Khan et al. 2010 a,b). Nearly all (96%) of the steelhead-sized targets passed via the surface-oriented ITS, and DIDSON acoustic video work completed in 2008/09 indicated that steelhead could readily move in and out of the ITS sluice gates, suggesting that ITS passage was fully volitional.

A special FFDRWG meeting was convened on 5 October 2010 to discuss the implications of the study results for ITS operation in December and March-April. Regional fish managers present agreed that keeping the ITS open (minimum of 4 sluice gates open) until December 15 and re-opening March 1 would likely provide a survival benefit to overwintering steelhead and kelts. BPA representatives indicated that a benefits analysis was needed to justify the operation, given the lost power generation associated with extending the ITS operation season. In a 2 November 2010 memo, Gary Fredricks (NOAA Fisheries) indicated that "improving overwintering and kelt steelhead survival at The Dalles and other dams can be credited against the 6% survival improvement required for Snake River B-run steelhead spawners over the life of the BiOp as defined in Section 8.5.5.8. of the 2008/2010 BiOp and Appendix J of the 2008/2010 BiOp Supplemental Comprehensive Analysis." NOAA's preliminary estimate of the benefits of the operation was 0.5-1%. In a follow-up memo dated 11 January 2011, NOAA indicated that upon further review, "the exercise of parsing down the potential survival benefits to only B-run steelhead resulted in a very small overall credit." The memo also noted that modifying the

ITS operation is "one of the few readily available methods the Action Agencies have to immediately improve survival of steelhead in the FCRPS."

Regional fish managers discussed potential operation of the ITS from March 1-April 10 at the January FFDRWG and FPOM meetings. Sean Tackley and David Clugston (Corps) and Jason Sweet and Eric Volkman (BPA) agreed to work on a new approach to the benefits analysis.

We calculated the estimated survival improvement (for Snake River B-run wild female steelhead) attributable to the operation of the Ice and Trash Sluiceway (ITS) at The Dalles Dam (TDA), from December 1-15 and March 1-April 10. The total estimated benefit was approximately 0.9%. The overall approach to this approximation was to back-calculate the potential survival improvements associated with the operation. Several important assumptions are made throughout the process; the result is intended to be a conservative (relatively low) estimate of the benefits. It is important to note that these estimates *were not* adjusted for the kelt component of March-April fallbacks/downstream migrants. This analysis also *does not* include benefits to other ESA-listed steelhead ESUs, although all overwintering steelhead and kelts would be expected to benefit from an extension of the ITS operation. The following is a step-by-step description of our analysis:

1. Total number of overwintering steelhead-sized targets that passed via the ITS (December 1-15 and March 1-April 10) (Khan et al. 2009, Khan et al. 2010). For the purposes of this exercise, all targets were assumed to be overwintering summer steelhead (no kelts) and it was assumed that fallback estimates in 2008/09 and 2009/10 were typical.

   Mean total # of fallback events from December 1-15 (2008/09, 2009/10) = 476
   Mean total # of fallback events from March 1 – April 10 (2009, 2010*) = 1,876

   TOTAL = 2,352

   ** In 2010, operation of the ITS was delayed until March 8, so the total March 2010 estimate should be considered a minimum estimate.*

2. 95% ITS passage efficiency (Khan et al. 2010).

   December 1-15: 0.95 x 476 = 452
   March 1-April 10: 0.95 x 1,876 = 1,782

   TOTAL = 2,234

3. At TDA, steelhead that fell back past the dam typically did so slightly more than once, so we must assume that some of the steelhead-sized targets observed falling back are being double-counted. Estimate based on pooled radio-telemetry data (1996-1997, 2000-2003) for TDA steelhead fallbacks is 1.05 fallbacks/fish (Matt Keefer, pers. comm.).

    December 1-15: ***452 / 1.05 = 431***
    March 1-April 10: ***1,782 / 1.05 = 1,697***

    TOTAL = 2,128

4. Radio-telemetry studies conducted in 6 years (1996-1997, 2000-2003) suggested that approximately 40% of tagged overwintering steelhead were ultimately unaccounted for after falling back at TDA (Keefer 2007). For the purposes of this analysis, we assumed that 100% of these lost fish were mortalities associated with turbine passage.

    December 1-15: ***431 x 0.40 = 172***
    March 1-April 10: ***1,697 x 0.40 = 679***

    TOTAL = 851

5. Survival benefits (to Lower Granite Dam) to kelts and overwintering steelhead likely differ significantly. The relative composition of steelhead-sized targets passing the turbines and ITS in 2008-09 and 2009-10 is uncertain. For the purposes of this analysis, we excluded 30% of the steelhead-size targets from further analysis with the assumption that this approximates the proportion of kelts passing during the March-April time period.

    December 1-15: ***172 x 1.0 = 172***
    March 1-April 10: ***679 x 0.70 = 475***

    TOTAL = 647

    The radiotelemetry studies were all conducted at a time when the ITS was closed during the dates in question, so most fallbacks were almost certainly via turbines. While the fate of these fish is undetermined, for the purposes of this exercise, we assume 100% of the losses were turbine passage-related mortalities (this estimate is not based on empirical data). If we assume that sluiceway passage survival is 100%, the above estimates represent the *total* improvement in overwintering summer steelhead conversion at The Dalles Dam during the periods in question (if the ITS is opened).

6. Not all overwintering summer steelhead at The Dalles Dam are Snake River B-run fish. We do not have stock-specific data on the run at large for these very specific time periods, but we can use known-source RT-tagged overwintering steelhead records to approximate the percentage of B-run fish. Pooled data from the RT studies showed that on 1 January the overwintering fish in the TD pool and Deschutes R (but not DES fish) were: **35% Clearwater**, **14% Salmon, 15% Snake**, 12% John Day, 15% Deschutes, and 6% other (mid C, Yakima, Lower C). The 'Snake' and 'Salmon' groups certainly included A-group fish (M. Keefer, pers. comm.). For this exercise, we assumed 100% of Clearwater fish were B-run and 6% of Salmon River fish were B-run (IDFG 2010).

   December 1-15
   - Estimated # of Clearwater B-run Steelhead = (172 x 0.35) x 1.0 = 60
   - Estimated # of Salmon River B-run Steelhead = (172 x 0.14) x 0.06 = 1

   Subtotal = *61*

   March 1 – April 10
   - Estimated # of Clearwater B-run Steelhead = (475 x 0.35) x 1.0 = 166
   - Estimated # of Salmon River B-run Steelhead = (475 x 0.14) x 0.06 = 4

   Subtotal = *170*

   TOTAL = 231 ◄ This estimate represents the total improvement in overwintering B-run steelhead conversion at The Dalles Dam during the periods in question (if the ITS is opened).

7. Not all steelhead that successfully pass The Dalles Dam will make it over Lower Granite Dam. Thus, the next step is to adjust for escapement (survival) from The Dalles Dam to above Lower Granite Dam. For the purposes of this analysis, we assumed 83% escapement from The Dalles to Lower Granite (2009 FCRPS BiOp Progress Report).

   December 1-15: ***61 x 0.83 = 51***
   March 1-April 10: ***170 x 0.83 = 141***

   TOTAL = 192

8. According to the Idaho Department of Fish and Game (IDFG), the unclipped proportion of total steelhead passage at Bonneville Dam and Lower Granite Dam is 29% (IDFG 2010).

   December 1-15: ***51 x 0.29 = 15***
   March 1-April 10: ***141 x 0.29 = 41***

   TOTAL = 56

9. Based on Table 1 in Bellerud et al. (2007), the Action Agencies interpret the BiOp-prescribed 6% increase in B-run survival to be a 6% increase to the average B-run steelhead female run. For the purposes of this exercise, we assumed a 50/50 sex ratio.

    December 1-15: ***15 x 0.50 = 7***
    March 1-April 10: ***41 x 0.50 = 20***

    TOTAL = 27

10. Excerpt from the 2009 Draft Kelt Management Plan:

    In Chapter 8.5 (FCRPS Biological Opinion, 2008), it is stated that NOAA's analysis of Prospective Actions (Supplemental Comprehensive Analysis Hydro Modeling Appendix) that a combination of transportation, kelt reconditioning, and in-stream passage improvements (e.g. spill-flow modifications) could increase kelt returns enough to increase the number of returning Snake River B-run steelhead spawners to Lower Granite Dam by about 6% (Supplemental Comprehensive Analysis Steelhead Kelt Appendix- Bellerud et al. 2007). Based on Table 1 in Bellerud et al. (2007), the Action Agencies interpret this 6% increase to be a 6% increase to the average B-run steelhead female run.

    The potential increase of 27 fish (above, Step 9) should be applied to this prescribed improvement.

    The baseline for wild female B-run steelhead above Lower Granite Dam, as identified in the 2008 FCRPS Biological Opinion is 3,000 fish. Thus, we divided the estimated total survival improvements (above) by 3,000 to estimate the % benefit of the December and March-April operation of the ITS at The Dalles.

    December 1-15: ***7 / 3,000 = 0.233%***
    March 1-April 10: ***20 / 3,000 = 0.667%***

    TOTAL = 0.9%

Key Assumptions

1. 2008/09 and 2009/10 downstream passage/fallback estimates derived from hydroacoustic data were representative of a typical passage year.
2. All of the unaccounted fallback fish in the studies died as a result of the fallback event.
3. Zero mortality as a result of fallback through the sluiceway.
4. 30% of downstream migrants/fallbacks from March 1 – April 1 were kelts
5. Relative (source) composition of overwintering steelhead, as estimated from RT data, was consistent from December 1 – April 1.
6. All Clearwater-origin and 6% of Salmon River-origin overwintering steelhead at The Dalles were B-run fish.
7. Steelhead escapement from The Dalles Dam to Lower Granite Dam was 80%.
8. 29% of overwintering steelhead at The Dalles Dam were wild fish.
9. Sex ratio is approximately 1:1.

References

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