2081

Proposed outline of items to present to Quinn/Spear
16 July 99

I. Results (focus on games 4 and 5)
  A. Shifting baseline through time
    1. Effects on interpretation of EWA benefits
  B. Survival (direct and indirect effects)
    1. Sacramento
    2. San Joaquin
  C. Salvage
    1. San Joaquin
  D. Upstream
    1. "Flow equivalents" and flexibility

II. Lessons learned
  A. Operational strategies that worked
  B. Unmet needs

III. Recommendations (negotiation points, critical elements, guidance to CMARP)
  A. What specific additional questions need to by addressed by subsequent gaming efforts (if any) ?
  B. What specific physical assets or operational flexibility features were most useful?
  C. What additional features are most likely to ensure the EWA adequately conserves salmonids?

Text for Outline

I. A. 1. A temporal trend exists in the historical conditions due to the addition of winter run chinook salmon requirements in NMFS Biological Opinion in 1993, delta smelt requirements in a FWS Biological Opinion in 1994 and with addition of the Bay-Delta WQCP (Accord) in 1995. Cross channel gate closures and limits on winter and spring export pumping are the primary new features. Juvenile salmon migrating in February through June are the main beneficiaries. This trend in regulatory requirements in the five-year gaming period is accentuated somewhat by the sequence of hydrological conditions in these five years, two very dry years followed by a wet, a dry and finally another wet year. The combination of regulatory trend and hydrology sequence complicates the comparison between the historical and modeled base conditions and, in turn, the interpretation of EWA outcomes.

Three different baselines were used in the gaming exercises. Game 4 represented early Stage 1 with in-Delta AFRP actions, Game 5 represented early Stage 1 without in-Delta AFRP actions, and Game 2 and the NMFS/FWS prescriptive run (Rx) used a common base representing the end of Stage 1 (or later) with in-Delta AFRP.

I. B. 1. Sacramento River basin salmon survival in the Delta

Change from Historical to Model Base Runs

1. The general pattern for all three base runs is higher survival indices compared to the historical survival indices for all races in 1991 and 1992 and mostly lower survival indices in 1993 -1995. The number of races affected and the percent reductions in survival indices in the latter three years were larger in the Game 2 base which had higher export pumping capacity and in the Game 5 base which had fewer fish protective actions than in the Game 4 base.

Changes due to the EWA

1. Changes in salmon survival indices from the base run due to EWA actions were mostly positive and ranged in magnitude from negligible to slightly over 50%.

2. Most survival index increases were in the 5-20% range.

3. The largest increases (± 50%) were for fall-run in 1993 and 1995 in Game 5, however, these coincided with decreases in survival indices from historical to Base of about 30%.

4. In all games, survival indices for some races in some years were below the indices for either the historical conditions, the baseline conditions or both. This suggests inadequate attention was paid to conditions affecting salmon survival or actions to improve survival were either insufficient or poorly timed. For example, in 1995, EWA improvements in winter-run and spring-run (YOY) survival indices were not large enough to offset survival index decreases in the base run. Based on typical timing of these runs in the Delta this outcome was the result of conditions in the Delta in February, March and April. (A few deleterious results from EWA actions are due to apparent errors in record keeping during Game 4 which have not been reconciled.)

5. The FWS/NMFS prescription produced the most survival index increases in the 10-20+ % range, with the salmon races benefitting most varying from year to year. From the same base, in Game 2 the EWA produced fewer and smaller survival index improvements.

6. In Game 4, the EWA produced consistent but generally more modest survival improvements than the prescriptive rules.

7. In Game 5, where the EWA was relied on to provide the VAMP export restrictions and other in-Delta AFRP actions such as late-May flow and export ramping, spring-time migrants were the primary beneficiaries. EWA actions were apparently detrimental to several races in 1994, probably the result of increased winter exports to repay an EWA debt to the projects from the previous year.

8. Small reductions in survival due to EWA appear in a few other cases, most commonly for late-fall run salmon indicating detrimental change in conditions in November, December, or January as the EWA sought either to build up assets south of the Delta or to repay water borrowed from the projects.

I. B. 2. San Joaquin River Basin fall-run salmon

Change from Historical to Model Base Runs

1. Delta survival indices are computed differently for the San Joaquin basin salmon than for salmon from the Sacramento basin. Survival is a function of Vernalis flow and Delta export rate. Survival index values are not comparable with those produced by either method used for the Sacramento Basin.

2. Field measurements indicate San Joaquin salmon survival through the Delta is consistently much lower than on the Sacramento River side. Historical survival indices during the gaming period are consistently low except for 1995 when the index was about six times higher than any other year, probably due mostly to hydrology.

3. Game 2 and Game 4 base survival index values were very similar. Survival improvements in 1991 exceeded 200% from the historical condition in both bases, however, index values are still very low. Although the facilities were different, the VAMP conditions (6 weeks) were part of both bases so the added export capacity in Game 2 was not used much, if at all, in April and May when most San Joaquin salmon emigrate.

4. Survival index improvements in the Game 5 base were consistently lower than in the other two base runs, ranging up to 100% in 1991, due to the absence of VAMP and AFRP Delta actions in April through June. Reduced in survival in the wetter years in the Game 5 base indicate an undesirable departure from the historical condition (lower river flow and/or higher export rate).

5. A pattern of progressively smaller improvements in survival through the five years in all the base runs may result from a trend of improved conditions and survival in the historical period.

Changes due to the EWA

1. Compared to the base run, the EWA produced small improvements in survival in Games 2 and 4. In Game 4, survival was actually reduced in the EWA run in 1993, however, as noted in the Sacramento salmon discussion, an error in recording the export rate in April and May 1993 in Game 4 is the cause of this outcome.

2. The EWA produced about 20-120% increases in survival indices in Game 5 where the EWA had to provide the export reductions for the 6 weeks of VAMP and other spring actions included in all other base runs but missing from the Game 5 base run. Survival index increases were about 15-20%, except in 1993 (+80%) and 1995 (+120%), both wet years in which the base run survival indices were lower than historical values.

3. The FWS/NMFS prescription produced similar results to the EWA in Game 2, with which it shares a common base run, both having a negligible effect on survival in 1991 and 1992 and the prescriptive rules producing slightly better results than the EWA in 1993-1995. With minor EWA-related improvement compared to the base run, salmon survival in 1995 was still slightly less than the historical level.

I. C. 1. San Joaquin salmon salvage

1. Given the same water supply assumptions as described for delta smelt, all games increased average April through June water supply, while reducing the average salvage of San Joaquin salmon below historic levels (benefits attributable to Accord, AFRP, and EWA; 14% in Game 2, 30% in Game 4, 26 % in Game 5, and 36% with prescriptive standards). Increased EWA assets in Game 5 were sufficient to provide protections similar to VAMP export restrictions in Game 4. The variation among years in salvage, however, was broad and late Stage 1 game outcomes did not improve on historic levels in 3 of 5 years. A similar pattern was apparent in comparisons of EWA game outcomes to baseline salvage (benefits attributable to EWA operations only). Again, in Game 2, EWA salvage did not improve on baseline salvage in 3 of 5 years. Greater success in reducing salvage in games 4 and 5 reflect 1) the lower cost of VAMP extensions early in Stage 1 relative to late in Stage 1, and 2) inability to account accurately for expected late Stage 1 benefits of improved screening and salvage capabilities for Delta exports.

I. D. 1. EWA Upstream Effects

1. Gaming did not provide adequate resolution to assign specific biological benefits to specific upstream releases. The mean volume of annual EWA water releases from upstream storage across all games was about 100 TAF in the Sacramento basin (standard deviation = 110 TAF) and 75 TAF in the San Joaquin basin (standard deviation = 57 TAF). Releases varied by a factor of three among games for the Sacramento basin, but were relatively consistent (350 to 400 TAF) in the San Joaquin basin. Careful timing and distribution of upstream releases of EWA water has the potential to enhance the expected upstream benefits of the AFRP upstream water acquisition program [(b)(3)] up to three times in the Sacramento basin in some years. Assessment of enhancement in the San Joaquin basin is complicated by the wide range of acquisition goals among CVPIA alternatives, and differences among games regarding In-Delta AFRP actions. Relative to upstream AFRP acquisition targets, EWA releases could double upstream benefits in the San Joaquin basin in some years.

2. This assessment assumes that EWA water acquisitions do not constrain other water acquisition programs intended to improve instream flows.

3. Benefits of upstream EWA releases, like Delta EWA benefits, derive largely from increased flexibility and capacity to improve upstream conditions.

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II. Lessons learned

A_1. Upstream benefits accrued primarily from release of purchased water in early games, but in later games, benefits were increasingly derived from water backed into reservoirs. Backing water avoids the uncertainties of the water market, but is constrained by dry hydrology. More creative and beneficial "backing water" strategies may be possible. Of course, providing the EWA with a proportion of upstream storage yields the highest certainty of upstream EWA benefits.

A_2. In progress.

B_1. Increasing export capacity through time makes it more costly to achieve reductions in salvage later in Stage 1. EWA asset allocations need to be linked to export capacity to ensure continuation of adequate levels of protection.

III. Recommendations

A. {???We should investigate shifting annual asset allocation to the EWA by carryover asset distribution and hydrological forecast. Applying the same asset allocation to all years, primarily a designated amount of money, increases accounting ease, but may limit EWA effectiveness. Further analysis of existing game results could provide guidelines for adjusting annual asset allocations.????}

B&C. In progress.