Comments on Analysis of Phase I Delta Habitat (12 Aug draft)

Salmon principles:

1. The current list of wetland habitats does not include "tidal wetlands," and I think a case can be made that this habitat type should be emphasized. In his review of chinook salmon life history, Healey (1991) describes a pattern of estuarine habitat use that varies seasonally and tidally; basically, juvenile chinook move up to the highest inundated edge areas with the high tide, and retreat into channels and deeper water with the low tide. Healey also notes that young chinook prefer tidal channels with low banks and many subtidal refugia. My interpretation of this habitat preference is that tidal action is an important component of habitat complexity. Use of shallow edges at high tide may increase both foraging success, and ability to escape large bodied predators that cannot enter very shallow water. Low banks increase the edge length of tidally flooded marsh. Subtidal complexity is critical for providing refugia from predation at low tide when shallow-water refuges are more limited. I agree with the arguments you present regarding the advantages of restoring seasonal floodplains. However, with the variety of chinook races present in this system, juveniles may be present in the Delta from October to July, and rearing habitat should be available throughout this period.

2. Regarding habitat patch size: I'm not aware of any studies that address this issue. Your suggested criterion of large enough to sustain channels is unclear to me; does this mean sustain channel meander over time? "Large enough to contain distributary side channels" is another criterion to consider in keeping with comment (1) above. Your estimate of 0.5 km in minimum dimension is probably large enough to provide for a small network of distributary channels, and is a reasonable place to start. This issue is likely to be constrained severely by levee configuration.

3. Regarding inter-patch distance. This is a WAG masquerading as a quantitative solution. Kjelson et al. (1982) found the maximum residence time for fry in the Delta to be 64 days in 1980 and 52 days in 1981. The majority of the Delta is within 50 km (linear) of Chipps Island. Assuming an average sinuosity index of 1.5 for Delta channels, total transit distance would be about 75 km. If you use 60 days as an upper-range estimate of residence time, 75 km/60 days = 1.25 km/day for relatively slow moving fry. Estimated velocity of fry movements vary with outflow and degree of maturation, but estimates from the Rogue River range from 0.3 to 24 km/day (Cramer and Lichatowich 1978), so at least we're in the ballpark. This leads me to a very rough guestimate that habitat nodes should be about 2 km apart rather than 5 km, in order to accommodate slower moving juveniles. Having laid this out, I'll be the first to admit that the practicality of this solution is as questionable as its derivation. Nonetheless, the important point is that the path the CalFed program is on demands a great deal from habitat restoration, and therefore starting with a short and protective suggested distance between habitat nodes seems appropriate. Levee configuration again is a major constraint.

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4. Waterside benches on levees may substitute adequately for seasonal floodplain habitat, but they are unlikely to provide tidal habitat function over the duration of juvenile salmon use of the Delta.

5. I'd suggest moving the 5th bullet under Native species Principles, regarding salmon fry rearing habitat, up to the Salmon Principles section. In the leader to the Native Species Principles you could include "and chinook salmon" after "delta smelt."

6. Experimental Principles, Pilot projects, second bullet, first sentence. I agree with the principle that action should be taken despite uncertainty. I do not agree with the value judgement that immediate action is "more beneficial" than increased understanding; e.g., despite the best intentions, immediate actions based on incomplete information may have adverse effects.

7. Experimental principles, habitat size and location, second bullet. Rather than "small pieces of habitat should be endorsed with hesitation" you may want to consider a slightly less vague criterion relating to the degree to which small restoration pieces contribute to increasing connectivity among larger units.

8. Is the apparent redundancy between Linkage principle 3, and Principle on recreation and public appreciation, intentional?

9. Implementation principles; most native fish *species*, may be more clear than the present wording, which can be misinterpreted as the greatest number of individuals.

References

Cramer, S.P., and J.A. Lichatowich. 1978. Factors influencing the rate of downstream migration of juvenile chinook salmon in the Rogue River, P. 43-48. *In*: B.C. Shepherd and R.M.J. Ginetz (rapporteurs). Proceedings of the 1977 Northeast Pacific chinook and coho salmon workshop. Fish. Mar. Serv. (Can.) Tech. Report 759: 164 p.

Healey, M.C. 1991. Life history of chinook salmon (*Oncorhynchus tshawytscha*). Pages 313 - 393. *In*: C. Groot and L. Margolis, (eds.). Pacific salmon life histories. UBC Press, Vancouver.

Kjelson, M.A., P.F. Raquel, and F.W. Fisher. 1982. Life history of fall-run juvenile chinook salmon, *Oncorhynchus tshawytscha*, in the Sacramento-San Joaquin estuary, California. Pages 393 - 411. *In*: V. S. Kennedy (ed.). Estuarine comparisons. Academic Press, New York.