Goals , Objectives, Performance Measures of EWA for salmon and recommended relevant analyses October 2003

I. Goal: Determine effective and efficient methods to implement existing regulatory requirements.

A. Objective 1: Avoid Exceeding Regulatory Take Levels and Minimize Take

1. Conceptual Model - How minimizing take would improve survival in the Delta and in the population.
2. Performance Measures (Did we meet a, b and c.?)
   a. Did we avoid Ayellow light@ and Ared light@?
      (1) Continue to improve LOSS estimate calculation.
         (a) Document limitations of LOSS estimate calculation.
            i) DFG report by statistician.
            ii) OCAP.
         (b) Determine mortality in forebay. Delegate to South Delta Fish Facilities Forum (not directly an EWA issue).
            i) Make DFG report available. Determine if previous analyses are applicable to present conditions.
            ii) Measure prey biomass flux across forebay using releases of tagged prey under variety of flow conditions and prey densities. Report results of predation experiments to panel.
            iii) Develop new research initiatives?
            iv) Measure predator biomass and species composition?
            v) Quantify predator diets and growth rates. Already done?
            vi) Develop bio-energetics model?
            vii) Quantify prey biomass as it enters and exits the forebay.
      (2) Incorporate genetics into run separation.
      (3) Continue to refine NMFS JPE.
         (a) Document limitations of NMFS JPE including confidence levels.
         (b) Refine in-river production/survival estimates.
            i) Evaluate escapement to RBDD juvenile counts.
            ii) Compare JPE to in-river monitoring estimates of abundance at RBDD, Knights Landing, Sacramento and Chipps Island.
               a) Recalculate KL absolute abundance estimates using weekly efficiencies.
            iii) Use RBDD and KL estimates of abundance for in-river survival estimates.
            iv) Correlate late-fall in-river survival from Battle Creek to Ryde, and Ryde to Chipps to flow, temp, and other environmental variables.
         (c) Develop better monitoring techniques for each element of the JPE estimate.
            i) First need to compile existing monitoring and techniques.
            ii) Investigate PIT tagging of wild winter run at RBDD to measure survival to downstream locations?

iii) Investigate applying fall run information to winter run. Involves making Newman=s paired survival model into a spreadsheet.

b. Did we take actions at appropriate times?
   (1) Based on loss?
      (a) Analyze historic loss data annually.
         i) Calculate percentage saved annual trend compared to base case.
   (2) Based on abundance in the Delta?
      (a) Compare loss trend to Chipps Island abundance trend.
c. Did Decision Process lead to appropriate decisions?
   (1) Document decision process - what is criteria based on?
      (a) Evaluate DWR particle tracking model to refine decision tree.
      (b) Incorporate data analyses and confidence limits.
      (c) Investigate formal risk assessment. Kenny Rose advised RA for biological systems hasn=t been successful.
      (d) Incorporate new analyses.
      (e) Evaluate relationship between decision criteria and designated take levels.
   (2) Are the numeric criteria appropriate?
   (3) Are the protocols appropriate?
   (4) Are there conflicting priorities, such as, water quality and limited assets?
      (a) Are hydrologic forecasts adequate.
   (5) Are action criteria appropriate?
      (a) Duration of DCC closure.
      (b) Determine most effective magnitude and duration of export reduction to reduce loss.

3. What factors influence take or episodes of take? Can they be predicted and avoided?
   a. Review Jones and Stokes evaluations and Real time analyses.

B. Objective 2: Maximize Survival of Emigration in Context of Exports and DCC Operations.
   1. Conceptual Model - How would maximizing survival in the Delta affect populations.
   2. Performance Measure (Did we improve survival in the Delta - By how much?)
      a. Determine optimal export curtailments in time and magnitude.
         (1) Further develop FWS DA8 experiments (exports versus relative survival) with more rigorous statistical analysis. Incorporate confidence limits.
         (2) Implement Newman Delta paired survival model for export effects.
         (3) Discuss Ryde as appropriate control group for relationship.
         (4) Ryde/GS loss relationship with exports.
         (5) Discuss fall run Ryde relationship with ocean survival, but not Chipps survival. Why is there a difference?
      b. Determine optimal DCC operations.

(1) Evaluate DCC experiments to determine effects of DCC gate operations on Chinook emigration patterns into DCC and GS.
(2) Model real time salinity impacts from gate operations and river flows.

c. Determine passage at several locations in the lower river and Delta for magnitude of benefits and for predictive capabilities.
(1) Standardize catches, at least by station.
(2) Re-analyze KL and Sacramento CWTs.
(3) Incorporate standard errors at Sacramento and KL.
(4) Incorporate more environmental variables into passage analysis, such as, water temperature, turbidity, emigration timing.
(a) Recommend continuous temperature and turbidity at Sacramento.
(5) Contact Jim Anderson, again, about applicability of Columbia Passage models.

II. Goal: Determine if Minimizing Take and Maximizing Survival through the Delta Provides the Greatest Population Benefits Relative to other Uses of EWA Water.

A. Objective 1: To use EWA water to maximize its population benefits.
1. Conceptual model - What are the most limiting factors that additional water could help. Is it possible to use the water for other things if take is exceeded in the process?
2. Performance Measure - Did we get the greatest relative population benefit from the water? What other actions are leveraged by the water?
a. How else could we use the water compared to reducing exports for take ?
(1) Base case versus closing the DCC gates more frequently - what benefit.
(2) Base case versus using water upstream for spawning to reduce temperature.
(3) Release of water during juvenile outmigration period to improve survival.
(4) Use water to minimize river fluctuations during egg incubation or juvenile rearing.
(5) Use of water to minimize benefits to non-native species.
(6) Use of water to increase spawning attraction flows.
(7) Use of water to maintain water temperature during rearing period.
b. Estimate benefits of alternative uses of EWA with a common point of reference (i.e. Smolt equivalents or adult equivalents).

III. Goal: Relate Population Benefits of EWA Actions to Other Potential Actions.

A. Objective 1: Take most effective actions to protect the salmon population.
1. Conceptual Model - Determine sensitivity of changes at any one lifestage by race.
2. Performance Measures - How did EWA benefits compare to other selected potential actions and what were the combined benefits with and without EWA?
a. Evaluate life cycle or life stage models for use in assessing EWA benefits relative to other actions within or between lifestages.

(1) Investigate utility existing models.
  (a) CPOP
  (b) DFG Fisher.
  (c) NMFS Odenweller.
  (d) NMFS Winter Run Chinook Cohort Reconstruction Model - CWT based - Dan Viele.
  (e) NMFS Steve Lindley Smolt Model.
  (f) Fractional Marking - Alan Hicks, Dave Hankin and Ken Newman.
  (g) Discuss BJ Miller=s model.
  (h) Ken Newman models.
(2) Further develop existing or create new models.
  (a) Develop AFish Tracking Model@ from particle tracking model and behavior estimates from radio tagging and CWT tagging.
  (b) Continue to develop data for models
(3) Continue to improve accuracy of spawning population estimates
  (a) Document limitations of carcass survey estimate.
  (b) Investigate skewed sex ratio in winter run escapement (genetics?).
  (c) Estimate age in spawning escapement.
(4) Continue to develop in-river survival estimates (by lifestage and race).
  (a) Eggs to fry.
  (b) Fry to smolts.
  (c) Smolt survival to the Delta.
  (d) Incorporate data from GCID monitoring.
  (e) Incorporate data from Balls Ferry.
(5) Continue to develop Delta survival estimates.
  (a) Use Newman paired survival model to estimate survival through the Delta.
  (b) Continue DA8 experiments and use relationship with measures of uncertainty.
  (c) Determine gear efficiencies at Sacramento and Chipps Island trawls. Hydroacoustics?
(6) Compare EWA benefits or other actions by using a common lifestage reference (i.e. smolt/adult equivalents).

b. Determine factors affecting in-river survival by race and lifestage.
  (1) Analyze relationship between juvenile survival from RBDD to Ryde and flow, temperature and bypass flooding.
  (2) Assess growth and mortality using NMFS EFH guidelines.
  (3) Quantify benefits of gravel restoration.
  (4) Quantify benefits of habitat restoration.
  (5) Determine Sutter and Yolo bypass survival rates.
  (6) Determine benefits of upstream rearing water temperature.

c. Determine factors affecting Delta survival by race and lifestage.
  (1) SWP/CVP exports
    (a) Evaluate the effect of take on juvenile survival in the Delta.

(2) Use DWR Fingerprinting Model to correlate flow contributions with loss.
(a) What are mechanisms for the effects of exports on survival in the Delta?
(3) Evaluation of indirect effects of SWP/CVP exports using DA 8 equation.
(4) Incorporate several averaging periods for describing environmental parameters.

d. DCC operation
(1) Use Newman paired survival model for evaluating DCC effects.
(a) Evaluate DCC gate operations to determine effects on Chinook emigration patterns.
(2) Determine Chinook response to tide, flows and channel morphology.
(a) Consider effect of Franks Tract on tidal prism and Chinook emigration.(Relevance?)
(b) Investigate hydrodynamics at specific junctions. (Relevance?)
(3) Habitat limitations
(a) Develop habitat suitability models (from tagging data?).
(4) Predation
(a) Explain why predation may be higher in the Central Delta than in the mainstem Sacramento River.
(b) Document predation in Georgiana Slough (Vogel radio tag studies).
(5) Residence time
(a) Determine extent of Delta rearing.
(6) More analyses of Bay, seine, and 1970's data
(a) Determine fry and smolt distribution and abundance in the Delta.
(7) Incorporate hydroacoustics and otolith experiments.
(8) Determine smoltification in monitoring program and at SWP/CVP to determine if Chinook at pumps are rearing or emigrating.
(a) What is the importance of the Delta for fry and smolt rearing?
(9) Combine late fall and fall-run paired survival experiment data.
(a) Update late-fall paired survival experiment data set.
(b) Update ocean survival data.
(10) Incorporate Mokelumne Hatchery yearling fall-run survival experiments.
(11) Impacts of unscreened agricultural diversions.
(12) Water quality.

e. Use DWR Fingerprinting Model to correlate flow contributions with survival.

f. Determine factors affecting ocean survival.
(1) PDO (NMFS).
(2) El Ninos (NMFS)
(3) Harvest rate (NMFS)

g. Determine factors affecting adult immigration success
(1) Improve adult escapement estimates. Implement constant fractional marking.
(2) Analyze Coleman late-fall hatchery returns.

(3) Immigration barriers.
(4) Reverse flow patterns.
(5) Determine benefits of spawning attraction flows.

h. Determine factors affecting adult spawning success.
   (1) Habitat limitations.
      (a) Quality
   (2) Temperature
   (3) Flows
   (4) Substrate
      (a) Quantity - is habitat limiting?

i. Correlate survival indicators or conditions to adult production and spawning escapement.

j. Link our models to conceptual models identified and discussed in fundamental CALFED process.

k. Designate group to determine population benefits of all CALFED programs, e.g., ERP, EWP, AFRP.