Follow-up to analyses presented at 2005 EWA Workshop and Manly Report

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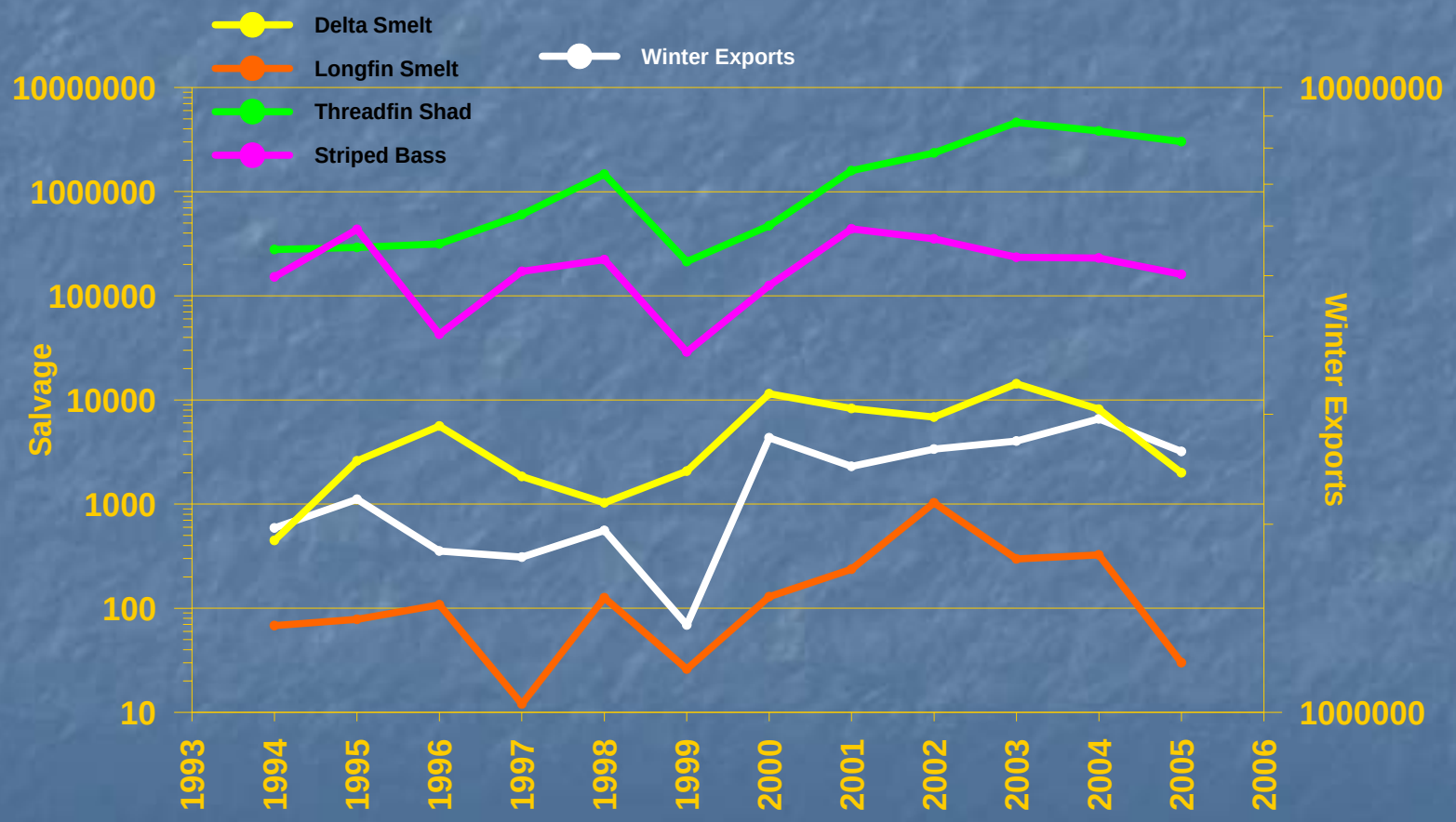
2006 EWA Review

Reminder of Herbold Analysis



Manly's Conclusions on Herbold's Analyses

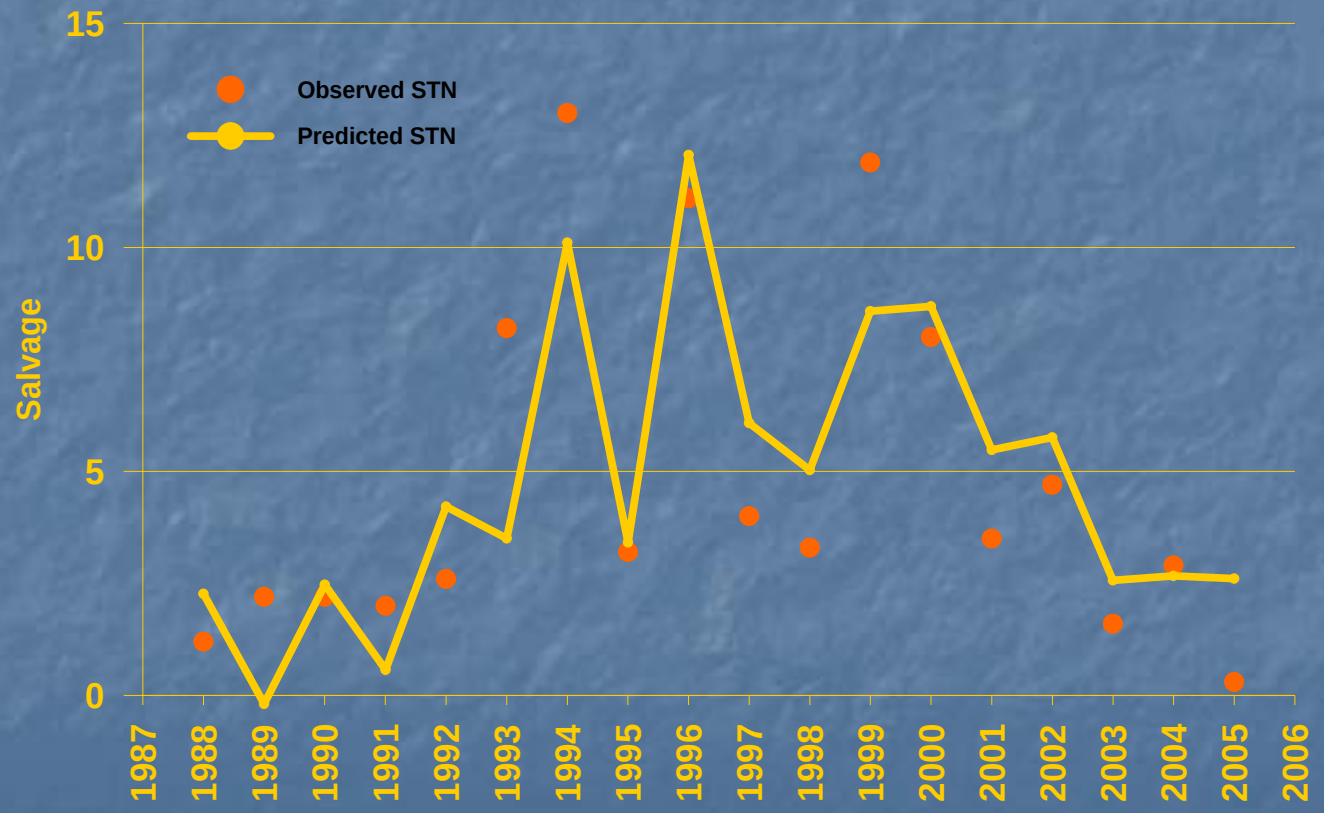
- Salvage related parameters started increase in 2000, but can't be associated statistically with export rates or EI ratio in a simple linear regression
- Manly's conclusions about EI ratio
  - Salvage is low at low EI ratio, low at high EI ratio, and very variable at intermediate EI ratios
  - Log-linear analysis indicates relationship between adult salvage and water year, month of the year, and finally, EI ratio
  - If EI has an effect on salvage, it is more complicated than simple linear regression
  - Recommended more statistical work be done around the EI ratio of 0.2 to determine if there are parameters interacting with EI that are affecting salvage that are not involved at high or low EI ratios

From Herbold

- *Herbold has not pursued observations further, but they have raised questions that others have addressed with further particle tracking models and analyses of changes in project operations. Recent catches of POD species in salvage have fallen off -- partly due to the wetter conditions of this year, conditions when salvage has historically been lower and, probably partly due to continuing declines in the abundance of some of the POD species. This pattern of decreased abundance both in the field sampling and in salvage has made impossible some of the comparisons of conditions, feeding, disease, and contaminants that were intended in the work plan for POD this year*

Reminder of Guerin's Analysis

$$STN = 7.7821 - 4.2835(JPEC/1000) + 0.5901(FMWT/100)$$



Manly's Conclusions on Guerin's Analyses

- Significant regression between STNS and fall salinity + previous FMWT sub-adult delta smelt index
  - After fall salinity and FMWT was modeled, winter exports were not significant
  - Statistically insignificant, but visual negative trend between STNS residuals and winter exports
  - Marginally positive statistically significant regression between fall salinity and winter exports
- Guerin's regression doesn't account completely for the recent large declines. Some of the equations do indicate some expected reductions in numbers in recent years, but not big drops like we have seen. The equation over-estimates too much in the more recent years, particularly 2005.

From Guerin

- *Guerin and CCWD appreciated the opportunity to have its work reviewed by Dr. Manly.*

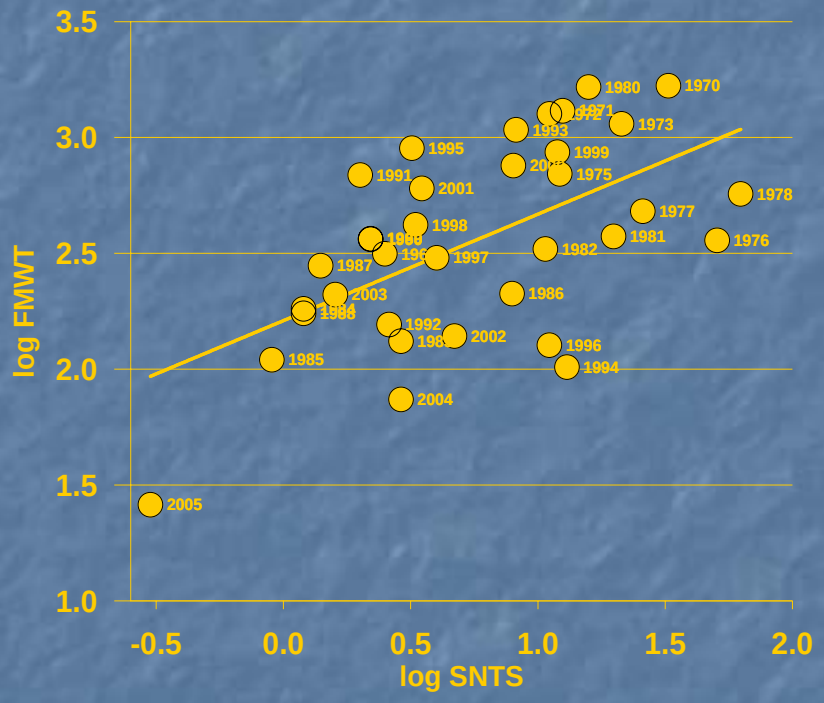
  CCWD has continued doing analyses using the delta smelt FMWT and STN indices, including updating the hydrodynamic and salinity data to produce new regressions. In addition, to clarify the seasonal salinity observations, CCWD has been examining Delta operations, such as reservoir releases, to determine the reason fall salinity has increased in the western Delta in recent years. We have been communicating with staff scientists at MET and the SWC on this issue, as they have started similar work characterizing historical patterns of reservoir releases.

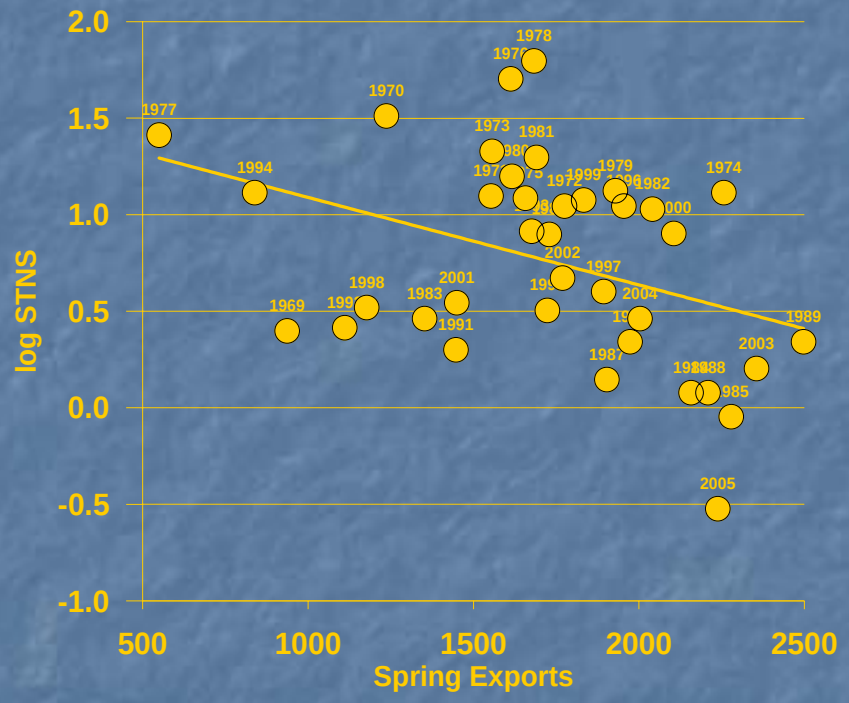
  We have also combined some of our analyses with B.J. Miller's 'co-occurrence' analysis from the Manly EWA analysis, and with some analyses Pete Smith (USGS) has done on reverse flows on Old and Middle River in his investigations of salvage data. Finally, we submitted a proposal to CALFED science to combine some our work on delta smelt with Chinook salmon issues. Our concern is that some of the actions taken to protect Chinook salmon may inadvertently be harming delta smelt.

  CCWD would like to see the EWA used for purposes other than simply shifting export timing. Instead, EWA water could be used directly to benefit endangered or threatened species for water quality needs, temperature control or flow supplementation. EWA should consider doing some research on what uses of EWA water give the biggest bang for the buck on each of the target species, and ensure that we are not protecting one species at the expense of any others.

  One of the important results from this process was indirect. After Manly's review was made public, several people worked with the Jersey Point EC data. To make a long story short, it turns out that the data in the IEP and CDEC databases, although taken from the same equipment, are different. I've attached a couple of graphs for you to see just HOW different they are. So, one major result from Bryan's analysis is a QA/QC'd dataset for the JP EC data, which I've been distributing freely.

Reminder of Swanson's Analysis





Manly's Conclusions on Swanson's Analyses

- Added 2005 data point, and it was extreme
- Correlations significant using 1969 - 2005, but residuals are not random
  - Residuals may be serially correlated in time
  - Important parameter may be missing
  - Equation may have changed over the time period
- Residuals serially correlated in time on one year time step for FMWT/STNS and two year time step for STNS/FMWT; after serial correlation in time is modeled
  - Unsure why the serial correlation is a two year time step for STNS/FMWT correlation
  - FMWT and STNS marginally significant after serial correlation modeled
- Apparent step change between 1982 and 1983 for STNS/Spring Exports
  - Consistent positive residuals prior to 1982 and negative after 1983 refutes possibility of correlated residuals
- Models don't accounting for recent large decline in population indexes

From Swanson

- *Manly's statistical re-analysis of the delta smelt abundance v export relationships was a valuable exercise to confirm the reported patterns, to examine the residuals of the regression models and, to a limited extent, to explore some of the other factors that also affect delta smelt abundance (e.g., stock recruitment relationships, the influence of population abundance measured the previous year). However, the analyses presented by Swanson last year were intended to serve as a starting point, not an end - therefore Manly's analysis should be similarly interpreted. His analysis did not (and was not intended to) address several of the key issues raised in the original presentation and in the following year by Swanson and others, including:*
  - *exports are a coarse estimate of overall effects of water management operations in the Delta and upper estuary;*
  - *many more related variables need to be examined for their effects on delta smelt abundance and habitat; and*
  - *hypotheses regarding possible mechanisms underlying the export-abundance patterns should be tested.*
- *Since last year, the more useful contribution to our understanding of the factors driving delta smelt abundance have been developed based on more complete analysis of multiple water management and habitat related variables.*

Analyses by B.J. Miller

- Kodiak Trawl adult delta smelt index expanded to Population Abundance, 2002-2005
- Juvenile delta smelt and prey overlap, 1985 - 2004
- Regression between adult delta smelt salvage and Kodiak Trawl adult delta smelt abundance east of Franks Tract regression, 2002-2005
- Estimated Adult Entrainment at the Banks and Tracy Pumping Stations, 2002-2005
- Adult Salvage Measures Related to the Subsequent FMWT Index, 1994-2005

Manly's Conclusions on Miller's Analyses

- Adult delta smelt population estimate should be considered an estimate of an index of relative population abundance rather than an estimate of absolute population abundance, but indexes are as adequate as absolute abundances for many trend and change analyses
- Juvenile delta smelt and two prey overlap model most significant; P. forbesi and E. affinis
  - Some residual patterns, but modeling residual correlation doesn't change outcome of the smelt/prey overlap; the correlation is still significant
  - Deserves additional investigation
- Adult delta smelt salvage and Kodiak Trawl adult delta smelt abundance east of Franks Tract regression significant, accounts for 72% of variation
- Estimated adult entrainment at Banks and Tracy pumping stations based on simple principles, but various assumptions; the estimates are reasonable given the assumptions
- Adult delta smelt salvage measures and the subsequent FMWT Index not significantly correlated

From Miller

1. What is affecting Pseudodiamptomus forbesi density in the core summer habitat area for delta smelt?

2. Why, in 2005, did smelt abundance drop when P.f. densities were higher?

3. Is there another factor starting to act?

4. Can we find food limitation in the spring? There are some signs of that.

5. Is there really a salinity-clam-smelt link? How do Corbicula fit into that picture?

6. What is going on in the ship channel with adult smelt? Why is such a high percentage of them there?

7. Given all we have learned about smelt and exports, how should we be managing exports?

Dr. Bryan Manly's Conclusions

- Salvage parameters for several delta fish species have increased since 2000, but can't be explained by exports, EI ratio, or population indexes in a simple linear regression
- Among exports, salinity and prey co-occurrence, the prey co-occurrence is the best at explaining the large recent declines in the delta smelt population indexes
- Report available at http://wwwoco.water.ca.gov/calfedops/misc/bmanly200607.pdf

Conclusions on the process

- Participants appreciated opportunity to have their analyses reviewed by, and to work with Manly
- Provided an educational experience in a non-confrontational environment
  - Each worked with Manly individually on their own analyses
  - Group reviewed the results together prior to making them available to the public
- We have a wonderful statistical evaluation on these data
- Facilitated participants to improve their analyses