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# **Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh**

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## **Chapter 9: Refinement of Carriage Water Routine**

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## 9 Refinement of Carriage Water Routine

Work continued by Delta Modeling staff to refine the carriage water routine used in DWRSIM's Minimum Delta Outflow (MDO) submodel. To date, a modeling approach superior to the current routine has not been developed. This chapter summarizes work that has been conducted over the past year to develop a refined model.

### Statistical Analysis of Data

While under contract with DWR, R. Shumway and R. Azari of the University of California at Davis used time series analysis techniques to analyze historic flow and electrical conductivity data collected at several Delta locations (*R.H. Shumway Consulting 1993*). The consultants examined various approaches to selecting transformations and filters for linearizing flow concentration dynamics. Using 14-day moving averages, sampled weekly, they developed a linear transfer function model for predicting log proportional changes in concentration from past log proportional changes in concentrations and flows. It was noted that model uncertainty increases rapidly as the length of the forecast window increases. Therefore, the consultants concluded that the model is most applicable for making one- or two-week forecasts for given increases in flow or exports.

### Transition Matrix Model Proposal

G. Bogle, a consultant for Water Engineering and Modeling, submitted a proposal to develop a simplified Delta hydrodynamic/water quality model to replace MDO (*Water Engineering 1993*). The key idea behind the use of the "transition matrix" model (TRANSAL) as a carriage water routine is that it offers the advantages of a more sophisticated numerical model (e.g. accuracy) along with much greater computational speed. Computational speed can be attained by saving and reusing simulation results from DWRDSM in matrix form. Because matrix development and TRANSAL calibration depends on a numerical Delta model, Delta Modeling staff determined that further consideration of this approach should be postponed until the Four-Point Model is operational.

### CCWD's Antecedent Outflow Model

Delta Modeling staff have studied the Antecedent Outflow (G) model developed by Contra Costa Water District (*Denton 1993*). This modeling approach is being used by staff to develop salinity-outflow relationships for several western Delta stations. The G model was applied to the analysis of EPA's proposed X2 standards (*DWR 1994*). It was observed to be quite sensitive to the weighting scheme selected to estimate model parameters. A project is currently being undertaken to compare the abilities of the G model and MDO in predicting salinity and required outflow to meet salinity standards at Rock Slough.

## Two-Straw Analysis

Delta Modeling staff undertook a study to develop a modified form of MDO while maintaining the basic net flow/Delta pool logic intact (*DWR 1993*). The main modification was to set western Delta salinity equal to Jersey Point salinity according to a salinity-outflow relationships developed by E. Winkler (*DWR 1985*). Possible extensions to this modeling approach might be to (1) incorporate the G model to predict Jersey Point salinity and (2) modify the MDO logic to incorporate tidal mixing and exchange (*Denton and Hunt 1986*).

## References

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