Transport From The Sacramento / San Joaquin Delta During Large Resuspension Events:

> Recommendations for future characterization. Lester McKee San Francisco Estuary Institute



Mallard Island data supplied by David Schoellhamer USGS





Sediment concentrations in the Delta

- Suspended sediment concentrations (SSC):
- 1) Increase during flood.
- 2) Show first flush effects.
- 3) Vary with the daily tides.
- 4) Vary with spring-neap tide patterns.
- 5) Vary with the ebb-flood tide and these are even evident during flood flow.
- 6) Vary seasonally associated with wind-wave action in the summer months.
- 7) Vary throughout the cross-section of a channel.

Tide at Mallard Island for the 1997 water year



Tide and sediment at Mallard Island during the first 14 days of 1997



SSC during non-flood periods



Mallard Island SSC data

- Optical Back Scatter (OBS) data are currently collected 1m below the water surface every 15 minutes.
- Water samples are collected and analyzed for suspended sediment concentration (SSC).
- Concentration data is regressed against OBS data to give a continuous calculation of SSC in (mg/L).
- Data collection is funded (by CALFED) to continue at least until 2004.

Methodology for calculating loads

- On days with recorded SSC data, data were averaged and combined with Delta outflow (the DWR modeled estimate) to derive a load for each day.
- On days without SSC data, load was estimated by one of four methods:

Linear interpolation.
Rising stage regression.
Falling stage regression.
Dry season regression.

Discharge of suspended sediment at Mallard Island



Year

Sediment loads entering the Bay from the Delta

Author	Calculation period	Average (M t/y)
Smith (1963)	?	3.7
Schultz (1965)	?	4.9
USACE (1967)	?	4.5
Krone (1979)	?	3.35
Porterfield (1980)	1909-66	3.8
Ogden Beeman (1992)	1956-90	3.5
This study	1995-98	2.4±0.6
		$(1.3\pm0.3 - 3.0\pm0.7)$

Testing for a trend



Year

Another trend test



Year

Quantifying the trend



Conclusions

- There is much known about the sediment dynamics and sediment loads entering the Bay from the Delta.
- The methodology used here for calculating loads is simple (C*V).
- Numerical filters can be applied to time series concentration data to remove tidal and other temporal effects and produce tidally averaged daily SSC data.
- However, error analysis provides confidence in the results shown here.

SSCcontaminant relationships

(Schoellhamer 1996)



Figure 2. Correlation of SSC and total or near-total concentrations of silver (Ag), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), and zinc (Zn). Outliers from samples taken from influent waters are indicated with an 'x' and were not used to develop the correlations given in Table 1.

Contaminant loads based on SSC and "Schoellhamer" regressions

	Previous estimate (t/y)	This study (t/y)
	Davis et al 2000	
Silver	0.5*	1.14±0.26
Chromium	550	383±88
Copper	270	240±55
Mercury	0.71	0.90±0.21
Nickel	410	315±72
Lead	64	85±20
Zinc	428**	439±101

Problems with the existing methodologies

- The regressions developed by Schoellhamer were for a different purpose
- The "calibration space" for the regression models do not cover the full range of sediment concentrations / OBS that occurs at Mallard Island
- The data used by Davis et al was uncharacteristic of the variability of the Delta (even the 1997 flood)
- Loads of sediment related pollutants of concern are likely to be underestimated and the precision is unreliable



Recommended next steps

- 1) Continue to use Mallard Island data for estimates of Delta loads.
- 2) Work with DWR to improve our understanding of Dayflow errors.
- 3) Receive advice and review from appropriate experts and determine appropriate sampling design for loads monitoring and episodic toxicity at Mallard Island.
- 4) Collect water samples and analyze these for sediment related pollutants of concern and toxicity as in (3).
- 5) Develop regressions using the Mallard Island data.
- 6) Estimate time continuous (one day time step) pollutant concentration data for Mallard Island and combine these data with Delta outflow to determine pollutant loads entering the Bay from the Delta.