

## Summary of Turbidity Trend Analysis in Elkhorn Slough by Marc Los Huertos

### *Introduction*

In spite of efforts to restore Elkhorn Slough, it is difficult to discern whether water quality has improved or declined in the last few decades. Turbidity is a measure of water clarity and is an important indicator of water quality. High turbidity has been linked to a decline in eel grass beds in many estuaries due the reduction of available light for photosynthesis. Elkhorn Sough has had an active water quality monitoring program for 15 years which I used to test for a long-term trend in turbidity.

Water quality parameters are sampled from 24 locations in the slough and vary dramatically spatially. Since most water quality parameters have highly skewed distributions, they are often best analyzed using non-parametric statistics. To determine a long-term trend, I used the Seasonal Kendall test described by (Helsel and Hirsch 1992). Briefly, this is a distribution free (non-parametric test) to compare water quality parameters over time (years) but partitions data into seasonal categories.

### *Spatial Patterns*

Turbidity in the in the upper slough, harbor areas, north mouth areas, and the Salinas-Tembladero complex are greatest in the winter months (usually February and March). These months correspond to times of consistent freshwater flow into the slough. In contrast the central marshes have maximum turbidity measures in the early spring to summer months, which may correspond to phytoplankton activity. Turbidity in the Azevedo Ponds are variable and may reflect a combination of phytoplankton growth, wind driven bottom sediment turbidity, and erosional processes that occur from surrounding farming activity and runoff .

### *Long-term trends and impacts*

Every site increased in turbidity during the sampling period between 1.3 to 39 NTUs/year (Table 1). The sites with the highest turbidity increases where Azevedo Ponds (Mid and Lower), Old Salinas River at Monterey Dunes Way, Salinas River at Highway 1 and Tembladero Slough. These sites receive water from agriculturally dominated areas.

The turbidity of the slough has increased throughout the slough but the cause is uncertain. Water column turbidity changes may be due to increasing phytoplankton biomass and/or suspended sediments. This implies the reduction of reduces eelgrass habitat. A better understanding of algae production and a focused study on suspended sediment in the slough would be useful to evaluate these turbidity changes. It is particularly important to understand the relative role of tidal scour, terrestrial erosion sources, harbor activity, and water column generated processes (microbial production and decomposition).

### *Literature Cited*

Helsel, D. R., and R. M. Hirsch. 1992. *Statistical Methods in Water Resources*. Elsevier, New York.

Table 1. Turbidity: Mean, Median, Distribution Free 95% Confidence Interval (CI), and Trend (Seasonal Kendall test).

Site	N	mean	skewness	median	95% CI		trend
Carneros Creek	115	40.69	3.67	23	17.8	34.4	+ 9.2 NTUs yr-1 (p<0001)
Hudson Landing, West	120	22.48	2.64	13.65	10	18.7	+ 6.0 NTUs yr-1 (p<0001)
Hudson Landing, East	121	23.69	3.49	9.5	7	11	+ 6.4 NTUs yr-1 (p<0001)
Azevedo Pond-North	92	8.58	3.55	5.25	3.5	6.1	+ 4.0 NTUs yr-1 (p<0001)
Azevedo Pond-Central	82	63.24	4.10	27.35	15.8	45	+ 39 NTUs yr-1 (p<0001)
Azevedo Pond-South	92	78.86	5.87	33.85	23	55.4	+ 35 NTUs yr-1 (p<0001)
Main Channel--Kirby Park	124	9.82	2.33	7	5.5	8	+ 2.2 NTUs yr-1 (p<0001)
North Marsh	93	33.78	4.16	9.3	20	13	+ 2.3 NTUs yr-1 (p<0001)
South Marsh	123	7.16	3.15	5	4.5	6	+ 1.3 NTUs yr-1 (p<0001)
Reserve Bridge	123	10.94	4.04	6.5	5.5	8	+ 2.3 NTUs yr-1 (p<0001)
Struve Pond	134	35.94	3.28	19.15	15	25	+ 9.5 NTUs yr-1 (p<0001)
Bennett Slough, West	134	21.34	2.03	9.75	6.3	14	+ 4.8 NTUs yr-1 (p<0001)
Bennett Slough, East	120	18.10	1.74	9.25	7.3	12	+ 6.9 NTUs yr-1 (p<0001)
Jetty Road	137	13.16	1.92	8	5.5	10.4	+ 3.3 NTUs yr-1 (p<0001)
Skipper's Landing	143	12.13	2.85	4.7	3.5	6.7	+ 9.2 NTUs yr-1 (p<0001)
Moss Landing Road, North	107	14.30	2.28	5.8	4.5	9.3	+ 3.0 NTUs yr-1 (p<0001)
Moss Landing Road, South	111	22.67	1.86	8.8	6.5	13	+ 6.7 NTUs yr-1 (p<0001)
Moro Cojo Slough	139	17.86	2.27	6.5	4.8	8.2	+ 3.3 NTUs yr-1 (p<0001)
Potrero Road, South	126	44.65	3.62	23	15	36.7	+ 11 NTUs yr-1 (p<0001)
Potrero Road, South	125	60.17	4.34	34	25.3	41.8	+ 15 NTUs yr-1 (p<0001)
Monterey Dunes Way	101	100.02	3.91	62.6	52	79.6	+ 28 NTUs yr-1 (p<0001)
Salinas River Lagoon	99	52.10	5.96	24	15.1	32	+ 5.7 NTUs yr-1 (p<001)
Salinas River Bridge	124	46.07	4.92	24.5	18	35	+ 32 NTUs yr-1 (p<0001)
Tembladero Slough	68	68.45	0.12	73.2	54.2	24.5	+ 31 NTUs yr-1 (p<0001)

