

ESNERR Research



Improving conservation and restoration
through better understanding

WATER QUALITY MONITORING AND TRENDS

- ▶ ESNERR water quality monitoring
 - ▶ Spatial program since monthly 1989 (24 sites)
 - ▶ Temporal program every 15 mins since 1995 (4 sites)
- ▶ WQ report card
 - ▶ was tri-fold had out now interactive on website
- ▶ Recent summary of Spatial program 30 yr long term trends study

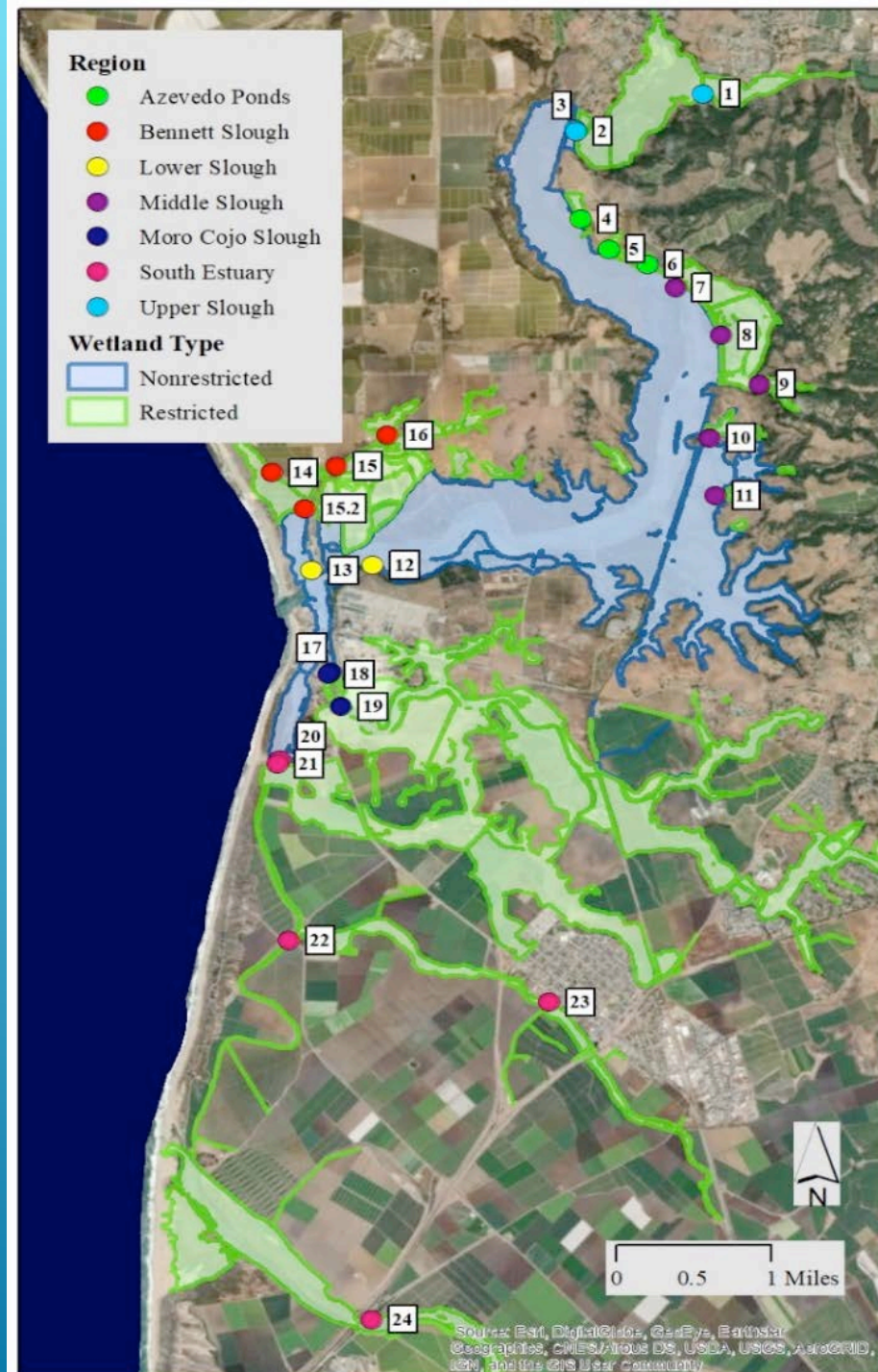


ESNERR Water Quality Monitoring



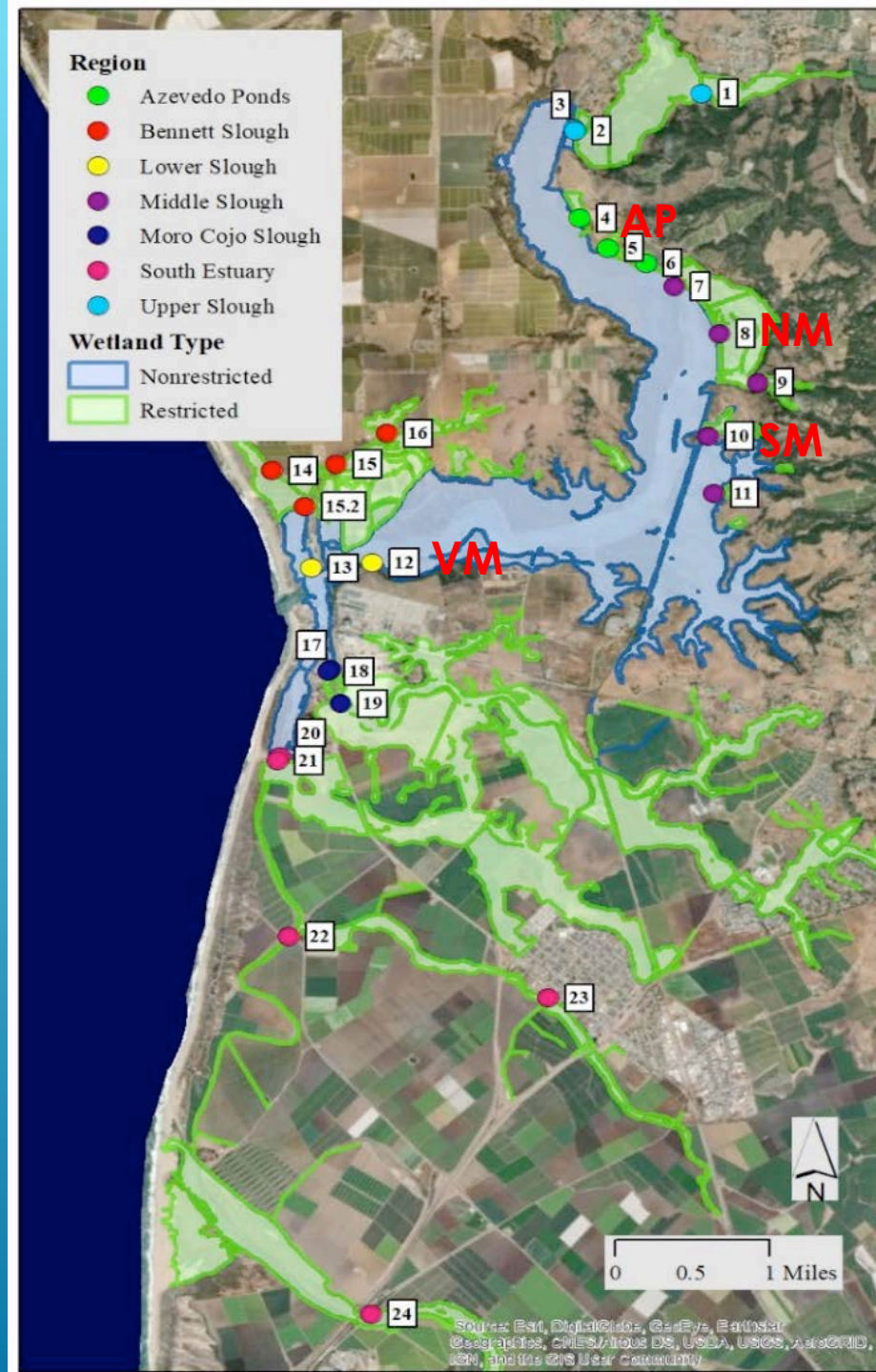
ESNERR WQ MONITORING PROGRAMS

- ▶ Volunteer Program
 - ▶ Great spatial coverage (24 stations)
 - ▶ Monthly sampling
 - ▶ Very long time series (since 1989)
 - ▶ Physical Parameters and nutrients



ESNERR WQ MONITORING PROGRAMS

- ▶ Volunteer Program
 - ▶ Great spatial coverage (24 stations)
 - ▶ Monthly sampling
 - ▶ Very long time series (since 1989)
 - ▶ Physical Parameters and nutrients
- ▶ NERR Program
 - ▶ Great temporal coverage (every 15 min!)
 - ▶ 4 stations
 - ▶ Since 1995

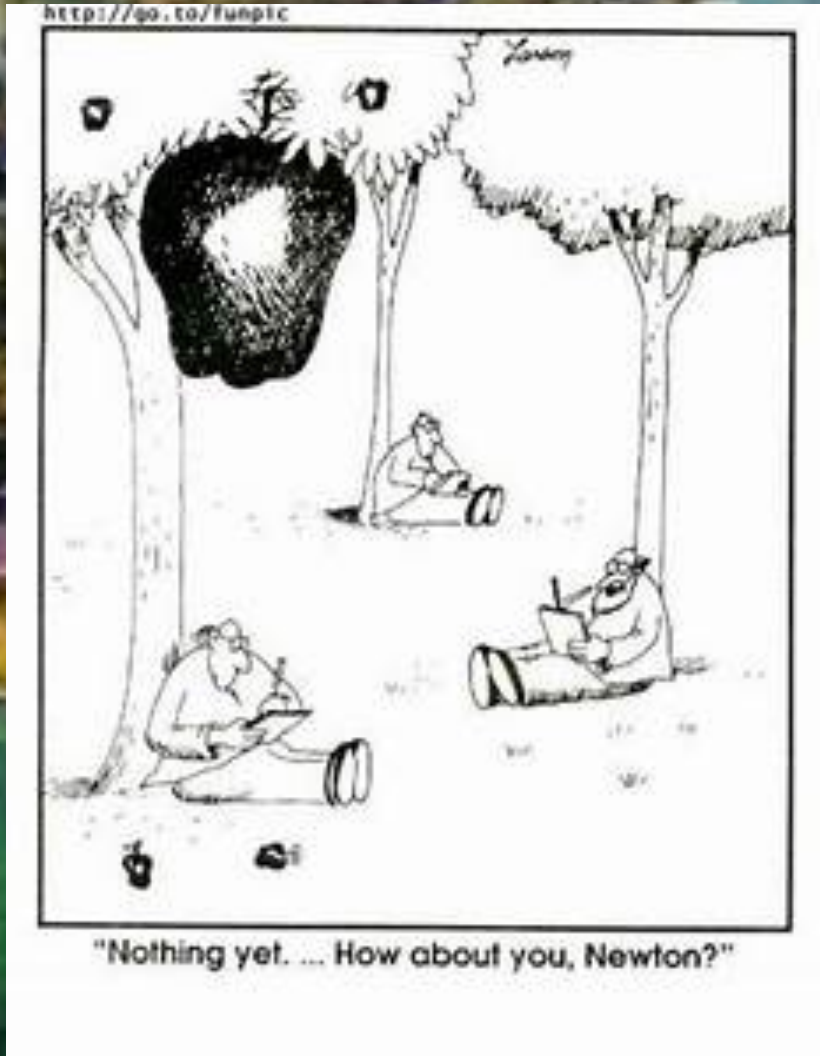


NERR SYSTEM-WIDE MONITORING PROGRAM

WQ DATA COLLECTED CONSISTENTLY AT FOUR STATIONS AT 28 NERR SITES



WATER QUALITY INDEX GRADING SYSTEM



Canadian Water Quality Index (WQI)

- ▶ Created by the Canadian Council of Ministers of the Environment in 2001
- ▶ Widely used: peer-review journals, UN, Bay Institute, Ventura County, CCAMP

HOW DOES IT WORK?

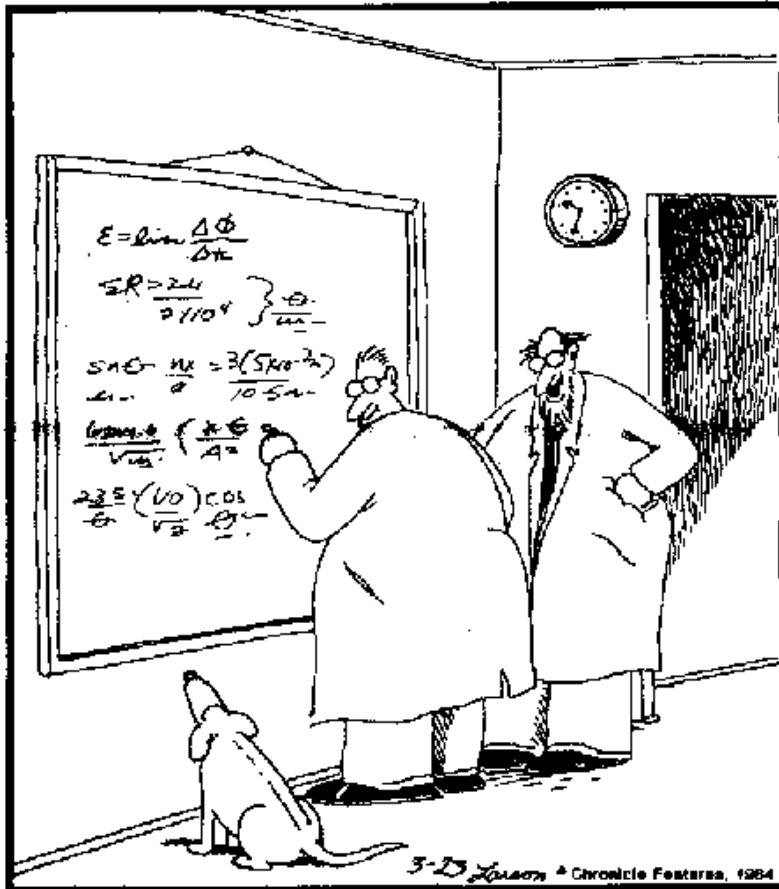
ALL COMES DOWN TO THRESHOLDS

Parameter	Threshold
Ammonia	0.1 mg/L
Ammonia (Unionized)	0.025 mg/L
Algal Cover	20%
Chlorophyll a	15 µg/L
Nitrate as N	1.0 mg/L
Orthophosphate as P	0.13 mg/L
Turbidity	25 NTU
Dissolved Oxygen	7 to 13 mg/L
pH	7 to 8.5

Normalizing each component to scale to 100

THE FAR SIDE

By GARY LARSON



"Ohhhhhhh ... Look at that, Schuster ...
Dogs are so cute when they try to comprehend
quantum mechanics."

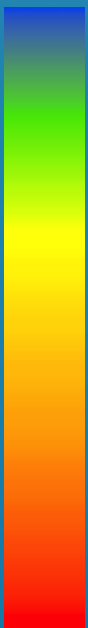
Scope: percentage of failing parameters

Frequency: percentage of time that thresholds are not met

Amplitude: amount by which thresholds are not met

$$\text{Grade} = 100 - \left(\frac{\sqrt{\text{Scope}^2 + \text{Frequency}^2 + \text{Magnitude}^2}}{1.732} \right)$$

GRADING SCALE



Index Value	Condition	Grade	Description
95 – 100	Excellent	A	No virtual threat or impairment. Water quality conditions very close to natural or pristine levels.
80 – 94	Good	B	Only minor degree of threat or impairment. Water quality conditions rarely depart from natural or desirable levels.
65 – 79	Fair	C	Occasionally threatened or impaired. Water quality conditions sometimes depart from natural or desirable levels.
45 – 64	Marginal	D	Frequently threatened or impaired. Water quality conditions often depart from natural or desirable levels.
0 – 44	Poor	F	Almost always threatened or impaired. Water quality conditions usually depart from natural or desirable levels.

2013 RESULTS

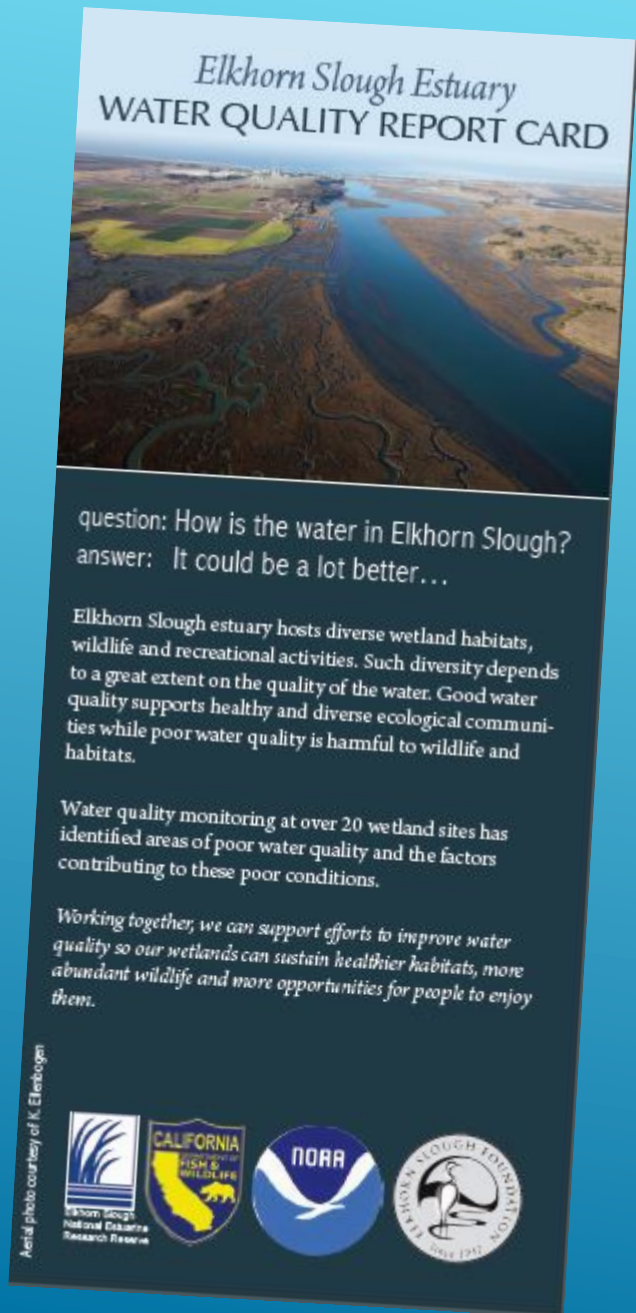
Upper Elkhorn Slough			
1	Carneros Creek*	34	F
2	Blohm Porter Marsh*	43	F
3	Hudson Landing	51	D
4	Azevedo Pond, North*	74	C
5	Azevedo Pond, Central*	46	D
6	Azevedo Pond, South*	43	F
7	Kirby Park	67	C
8	Reserve North Marsh*	67	C
9	Strawberry Rd*	22	F
Lower Elkhorn Slough			
10	Whistlestop Lagoon*	73	C
11	South Marsh	80	B
12	Vierra	80	B
13	Skipper's Landing	72	C
Bennett Slough			
14	Bennett Slough West*	66	C
15	Bennett Slough East*	50	D
16	Struve Pond*	43	F
Southern Estuary			
17	Moss Landing Road, North	44	F
18	Moss Landing Road, South*	27	F
19	Moro Cojo Slough*	32	F
20	Potrero Road, North	34	F
21	Potrero Road, South*	30	F
22	Monterey Dunes Way*	36	F
23	Tembladero Slough*	21	F
24	Salinas River Bridge	37	F
* Site behind water control structure			



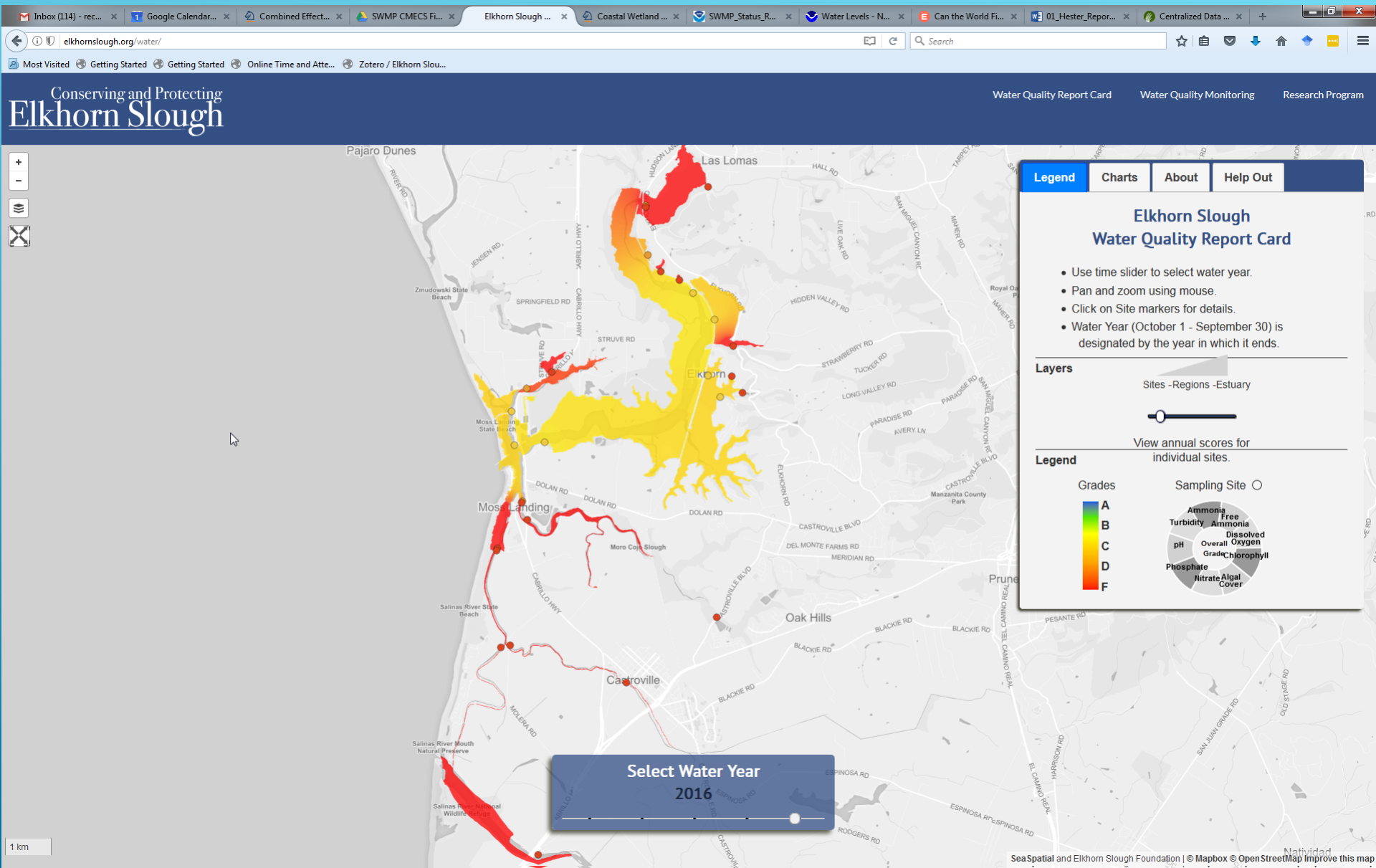
FINAL PRODUCT

Includes a summary of:

- ▶ Elkhorn Slough ecological importance
- ▶ Water quality monitoring program
- ▶ Grading system
- ▶ Results
- ▶ Ways to improve water quality



NOW THE FINAL PRODUCT IS ON THE WEB!



Monitoring Water Quality

A HUGE Part of What We Do

Why it Matters

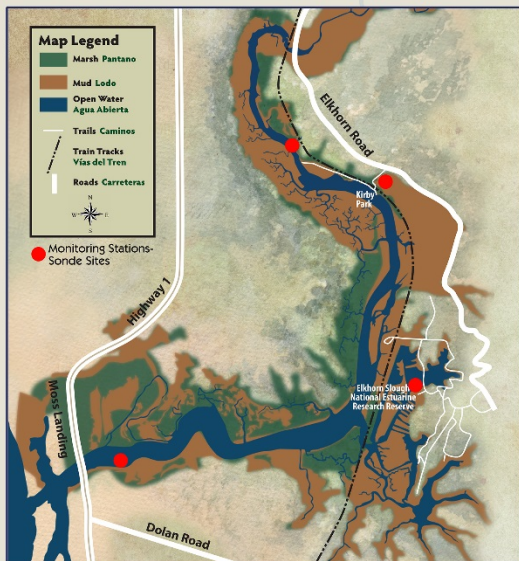
Good water quality is essential to the health of the slough. Healthy waters support many kinds of wetland habitats, providing safe homes for birds, fish, and wildlife.

Why we monitor

- NOAA requires that we monitor and share water quality data
- What we learn helps us understand wetland systems
- The information directs research and management decisions

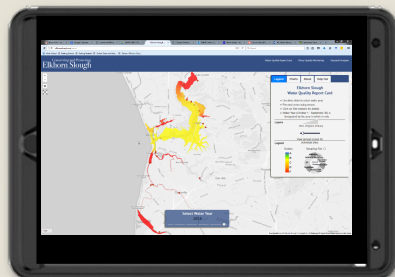
How we monitor

- Four sites equipped with sondes take measurements every 15 minutes, another 26 sites are sampled monthly by volunteers
- Data is uploaded to NOAA satellite in real-time
- Anyone can access the data - scientists, decision makers, and citizens like you
- National Estuarine Research Reserve system uses the same methods all over the country.



You Can Be A Scientist!

Check out Elkhorn Slough's water quality report card. Track water quality changes over time. What do you think it will look like in 3 years, 5 years?



Let's Work Together

Water quality will improve when we work together. Speak out! Share your knowledge and spread the word about protecting our waters and wetlands!

What we're doing

- Restoring wetlands (see project at Hester Marsh)
- Reducing polluted runoff (working with farmers)
- Improving water control structures (Whistlestop Restoration)

What you can do

- Limit the use of fertilizers in your garden
- Maintain your septic system to avoid leaks
- Dispose of household chemicals and medications properly – not down the drain
- Buy sustainably and organically grown produce
- Support policies that protect wetlands

Our new display in the Visitor Center Coming Soon!

- Dedicated touch screen
- Visitors can interact with the report card and do their own research!
- Individual curiosity to investigate areas, parameters or years of interest
- Currently High School module to learn about water quality and do their own investigations as to why some areas get better scores than others



30 TRENDS STUDY OF SPATIAL PROGRAM

ELKHORN SLOUGH **TECHNICAL REPORT SERIES 2019: 1**

*Sponsored by the Elkhorn Slough National Estuarine Research Reserve
and the Elkhorn Slough Foundation*


Long-term trends and spatial patterns of water quality in estuarine wetlands of central California

Kathleen Hicks, Rikke Jeppesen, John Haskins, Kerstin Wasson

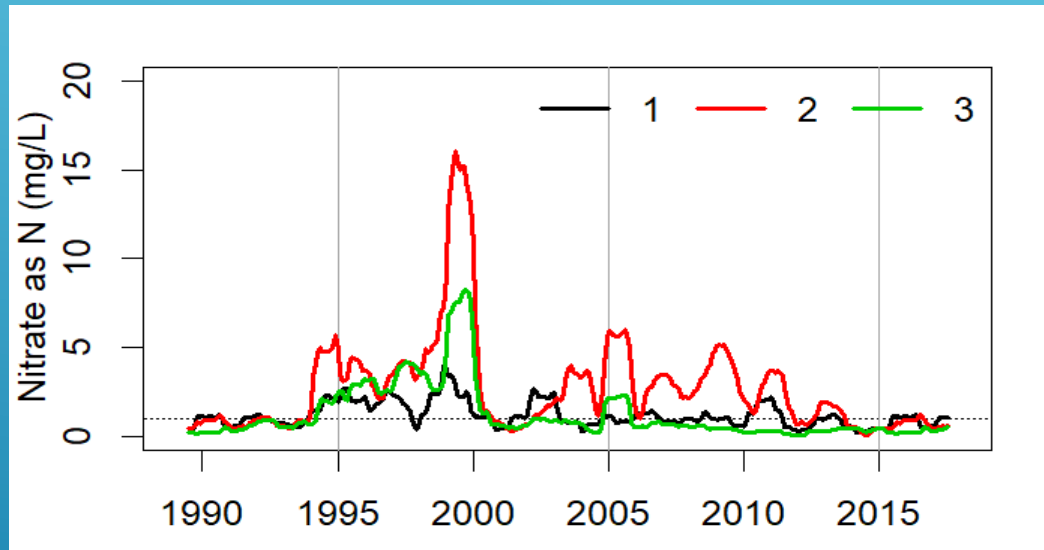
March 2019



HIGHLIGHTS OF THE STUDY

- ▶ • Variability was not generally correlated to weather or oceanography, suggesting that local factors have strong and rapid effects on wetland water quality
 - ▶ • Water quality remains highly impaired at many sites, especially those with artificial tidal restriction resulting in increased residence times
- 
- A series of three parallel white diagonal lines in the bottom right corner of the slide, extending from the middle of the right edge towards the bottom left.

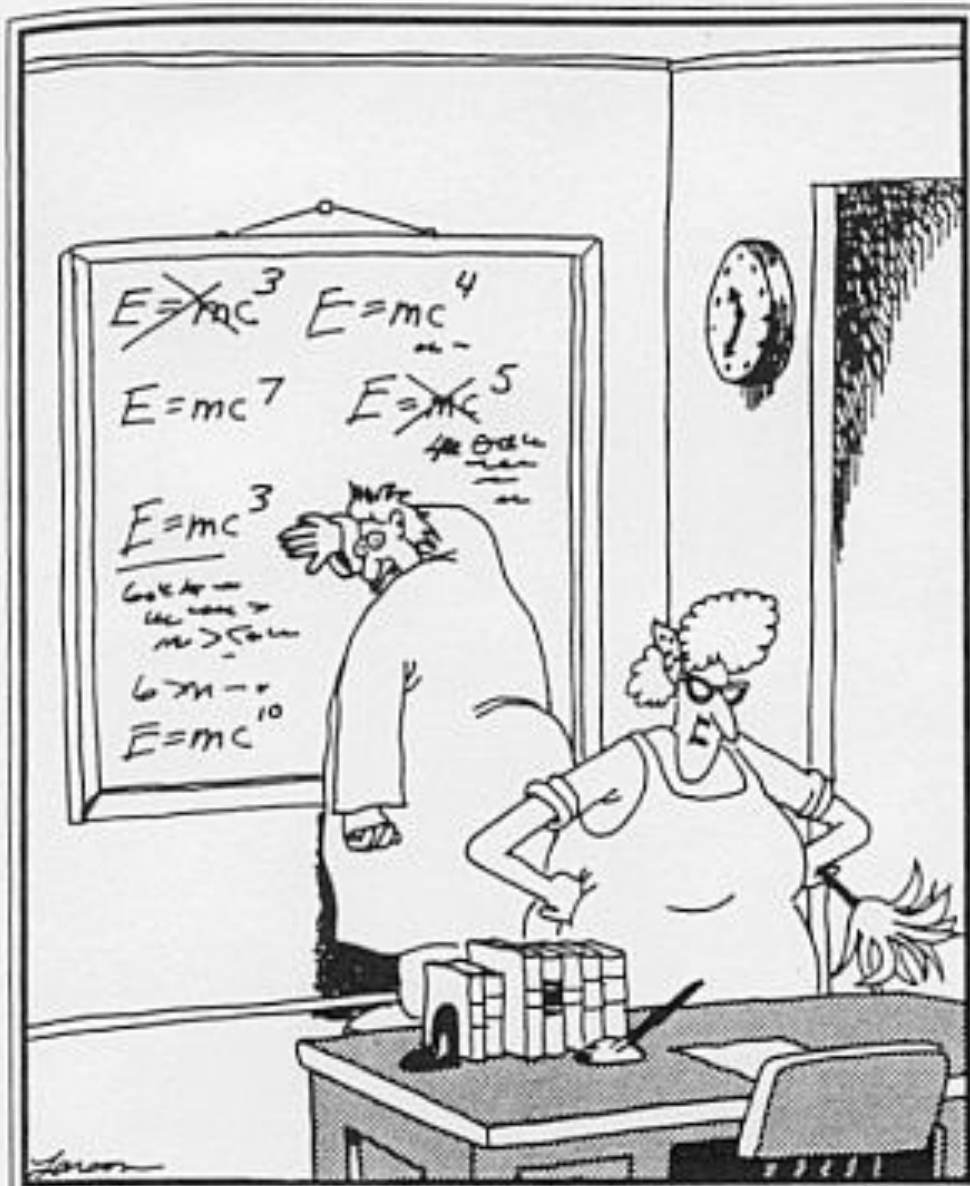
LOCAL RESTORATION IMPROVES WATER QUALITY



- The significant improvements documented in regions with high conservation and restoration investments provide hope for the future, and illustrate that, despite the potential for slow response times due to legacy effects from nutrient enrichment, water quality can be improved relatively quickly when resources are appropriately directed

		Ammonia	Nitrate	Phosphate	Numeric Grade	Letter Grade
Upper Slough	1 ^r	+	---	ns	30.1	F
	2 ^r	ns	ns	--	46	F
	3	ns	---	---	61	D
Azevedo	4 ^r	---	---	---	60.4	D
	5 ^r	---	---	---	41.8	F
	6 ^r	---	---	ns	30.4	F
Middle Slough	7	---	---	---	73.1	C
	8 ^r	+++	++	ns	70	C
	9 ^r	ns	---	ns	23.4	F
	10	--	---	---	76.7	C
	11	---	---	---	76.9	C
Bennett Slough	16 ^r	---	--	---	39.9	F
	15 ^r	---	---	---	44.6	D
	14 ^r	ns	ns	ns		
	25 ^r	++	ns	---	66	C
Lower Slough	12	+	++	--	78.6	C
	13	++	ns	-	73.7	C
Moro Cojo Slough	19 ^r	ns	ns	++	35	F
	18 ^r	++	ns	+	37.3	F
	17	ns	+++	ns	57.5	D
South Estuary	24 ^r	ns	ns	+++	30.2	F
	23 ^r	---	+++	---	25.5	F
	22 ^r	---	ns	ns	27.2	F
	21 ^r	-	+++	ns	32.1	F
	20	ns	+++	+	34.9	F

- Overall water quality is improving with significant improvements in water quality over time outnumbering significant deterioration in water quality, for 25 sites and three nutrient water quality parameters
- The Middle and Upper regions of Elkhorn Slough highest frequency of water quality improvements, while the Lower region of Elkhorn Slough, highest frequency of water quality deterioration



"Now that desk looks better. Everything's squared away, yessir, squaaaaared away."