Discrete Water Quality Monitoring Report for Water Year 2023

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ENVIRONMENTAL MONITORING PROGRAM

Introduction

The Department of Water Resources (DWR) and the US Bureau of Reclamation (USBR) are required by Water Right Decision 1641 (D-1641) to collect discrete water chemistry data to monitor the water quality at select sites in the upper San Francisco Estuary (Estuary). This report describes the results of these monitoring efforts for water year 2023 (October 1st 2022 through September 30th 2023) which was classified as a wet year in the Sacramento and San Joaquin Valleys (source). Results are compared to the previous water year, which was classified as critically dry in both valleys.

Methods

Discrete water quality samples were collected monthly at 24 monitoring sites throughout the Upper Estuary and were grouped into regions based on their geographic location (Figure 1; Table 1). These sites represent a variety of aquatic habitats, from narrow, freshwater channels to broad, estuarine bays.

EMP collects data for six different field parameters and 18 different laboratory constituents. The analytes highlighted in this report are:

- Specific Conductance (S/cm)
- Turbidity (FNU)
- Dissolved Ammonia (mg/L)
- Chlorophyll *a* (g/cm)
- Dissolved Nitrate+Nitrite (mg/L)
- Total Phosphorus (mg/L)

Regional facet graphs were created for each parameter. The average, minimum and maximum values were determined for each analyte. Non-detect values were represented graphically via a vertical dashed line capped at the reporting limit. Average summary statistics are reported as the median (M) ± the median average deviation.

For more in-depth methodology, see here.

Results

Specific Conductance

The average specific conductance value was 538 ± 417 µS/cm; for comparison, the previous year average was 5530 ± 5270 µS/cm. Values ranged from 73 µS/cm to 44900 µS/cm. Per region average, minimum, and maximum values are shown in Table 2; time series plots are shown in Figure 2.

Turbidity

The average turbidity value was 11.10 ± 6.00 FNU; for comparison, the previous year average was 9.05 ± 5.00 FNU. Values ranged from 0.90 FNU to 161.00 FNU.

Per region average, minimum, and maximum values are shown in Table 3; time series plots are shown in Figure 3.

Dissolved Ammonia

The average dissolved ammonia value was 0.05 ± 0.00 mg/L; for comparison, the previous year average was 0.05 ± 0.00 mg/L. Values ranged from < 0.05 mg/L to 0.67 mg/L. 53.12% of samples were below the reporting limit. Per region average, minimum, and maximum values are shown in Table 4; time series plots are shown in Figure 4.

Chlorophyll *a*

The average chlorophyll a value was 2.20 ± 0.99 µg/L; for comparison, the previous year average was 2.00 ± 0.81 µg/L. Values ranged from < 0.50 µg/L to 23.70 µg/L. 0.69% of samples were below the reporting limit. Per region average, minimum, and maximum values are shown in Table 5; time series plots are shown in Figure 5.

Dissolved Nitrate + Nitrite

The average dissolved nitrate+nitrite value was 0.22 ± 0.11 mg/L; for comparison, the previous year average was 0.29 ± 0.14 mg/L. Values ranged from < 0.05 mg/L to 2.90 mg/L. 2.78% of samples were below the reporting limit. Per region average, minimum, and maximum values are shown in Table 6; time series plots are shown in Figure 6.

Total Phosphorus

The average total phosphorus value was 0.10 ± 0.02 mg/L; for comparison, the previous year average was 0.10 ± 0.03 mg/L. Values ranged from 0.03 mg/L to 0.50 mg/L. Per region average, minimum, and maximum values are shown in Table 7; time series plots are shown in Figure 7.

Interpretations

Water year 2023 in the Sacramento and San Joaquin Valleys was classified as wet after three years of drought. Many atmospheric river storms brought considerable amounts of rain starting in late December and colder average temperatures contributed to record snowpack.

Specific conductance had a notable drop in all regions in January due to the influx of freshwater. Most regions continued to have low values throughout the rest of the water year due to snowpack runoff. The San Pablo, Suisun, and Grizzly Bay regions typically have higher values due to the strong marine influence from the Pacific Ocean, and they started to increase again in July. The average specific conductance in water year 2023 was much lower than the

previous year. Turbidity had a notable spike in all regions in January due to sediment re-suspension caused by the high flows after a long dry period. Every region (except the Central Delta) had maximum values above 100 FNU. The average turbidity in water year 2023 was higher than the previous year.

Dissolved ammonia, dissolved nitrate + nitrite, and total phosphorus had a notable spike in all regions in January due to increased runoff of organic matter and pollutants. The Southern Interior Delta region had the highest values of all three nutrients likely due to nearby agricultural land use. The average of each nutrient in water year 2023 was similar to the previous year.

Chlorophyll a followed seasonal trends in most regions with higher values in the warmer summer months. The San Pablo Bay region had a small harmful algal bloom of *Heterosigma akashiwo* in July. C10A in the Southern Interior Delta had a spike in August, which is typically shallow during dry periods of the year. The average chlorophyll a in water year 2023 was a little higher than the previous year. More information about the phytoplankton genera is described in the phytoplankton section.

Archived Reports

Previous EMP discrete water quality reports can be found here.

Figures

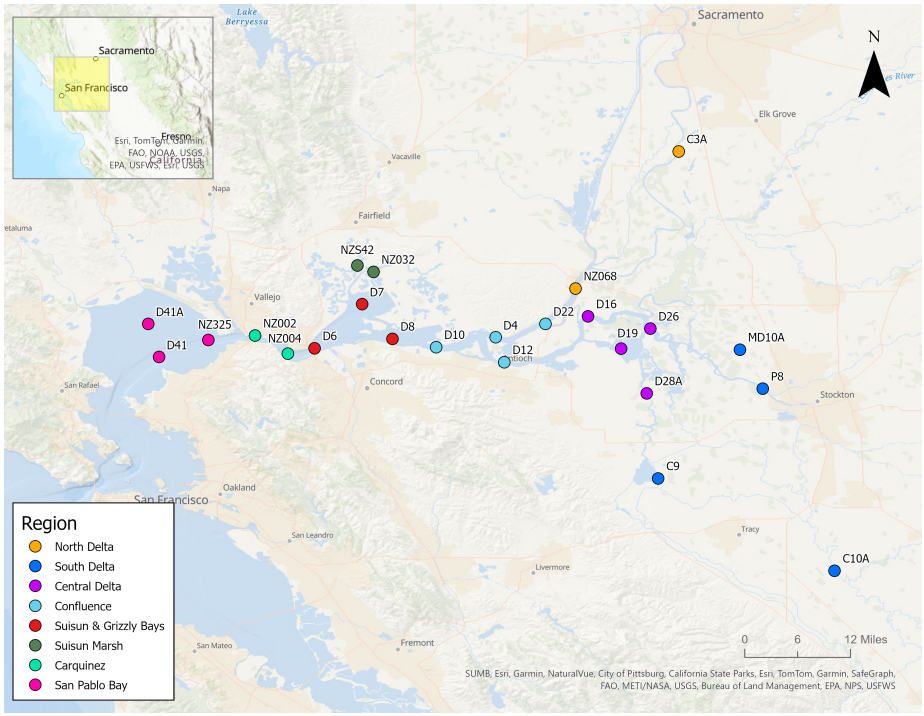

Figure 1: Map of EMP's discrete WQ field sites

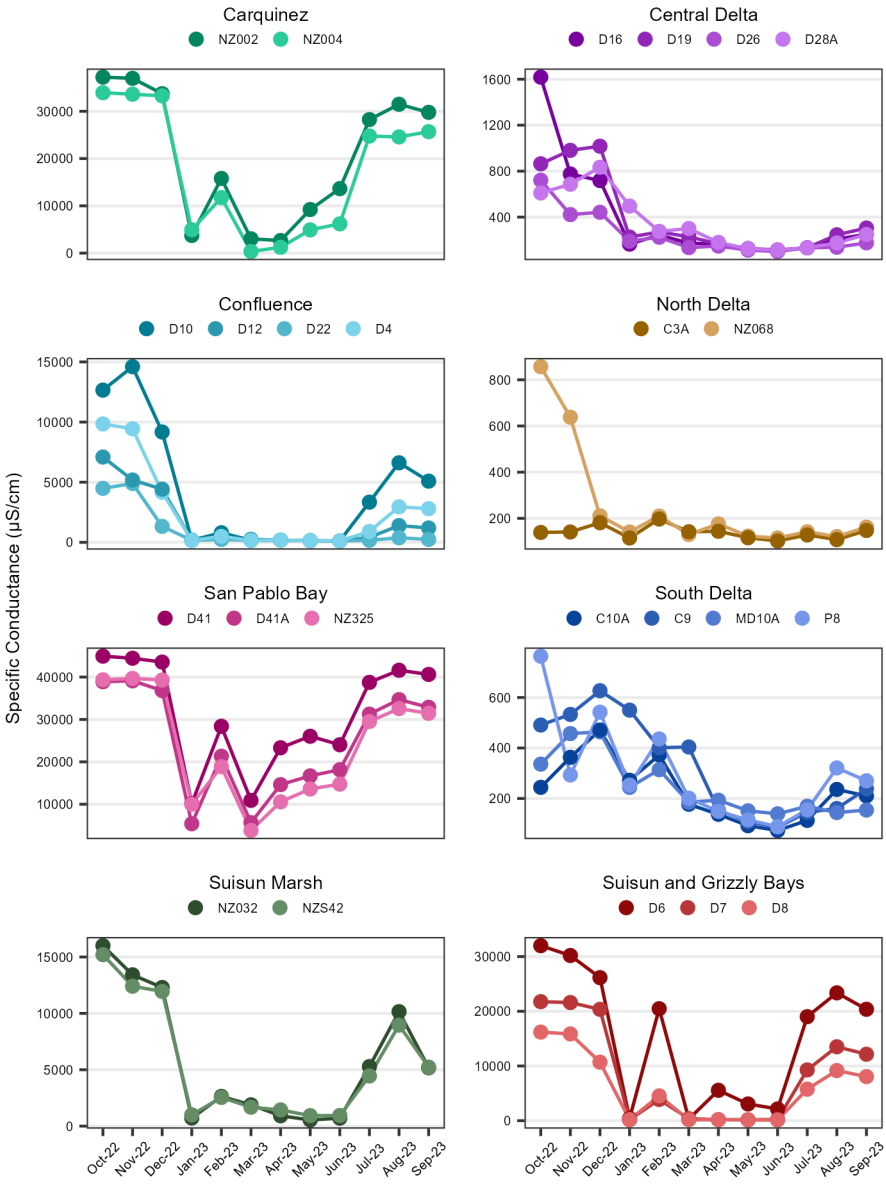

Figure 2: Specific conductance by region in the San Francisco Bay-Delta estuary.

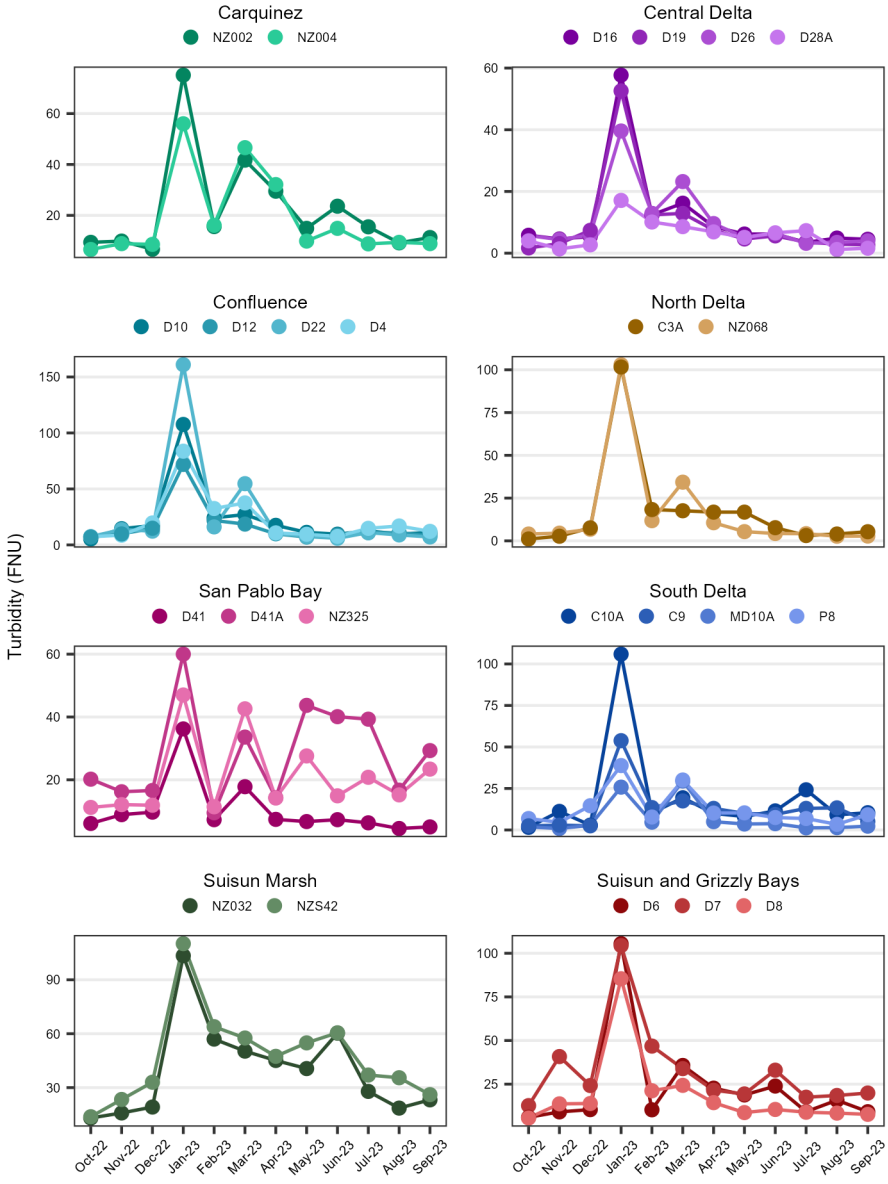

Figure 3: Turbidity by region in the San Francisco Bay-Delta estuary.

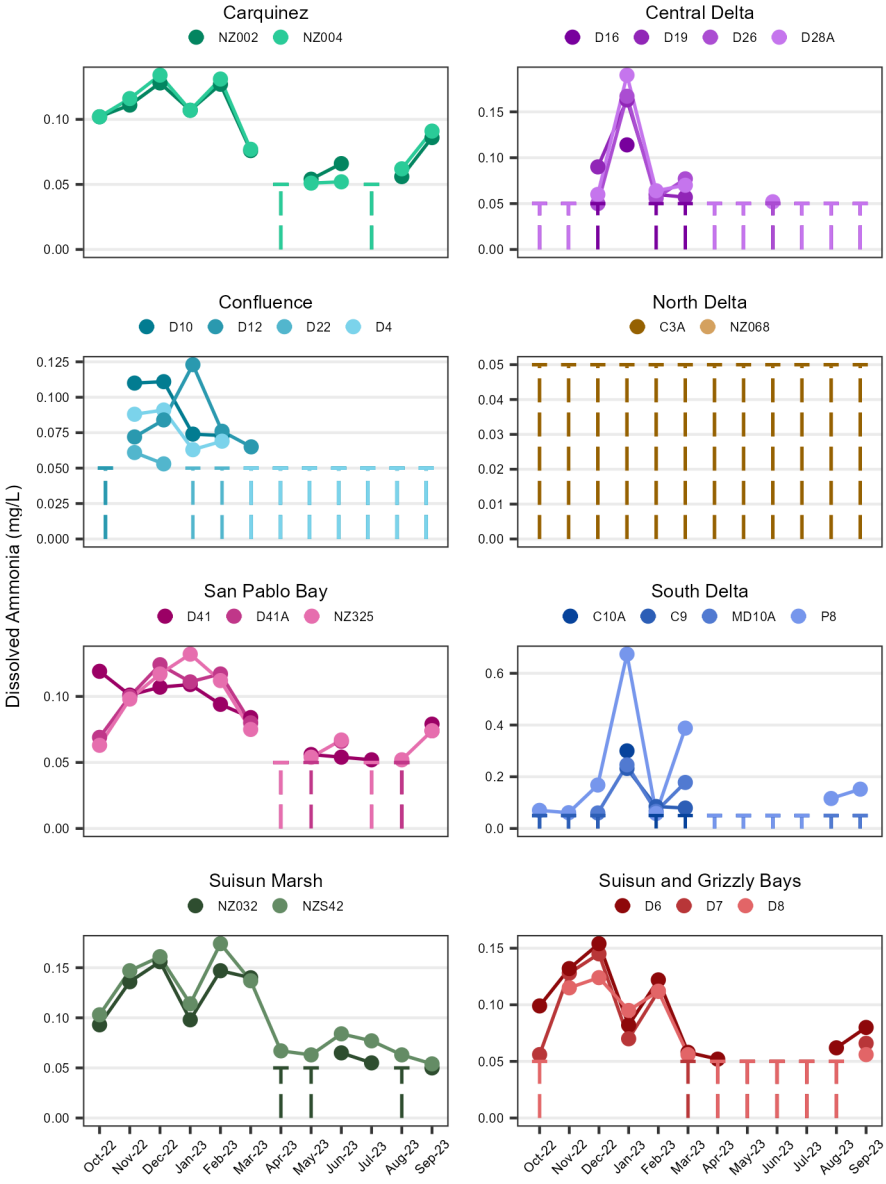

Figure 4: Dissolved ammonia by region in the San Francisco Bay-Delta estuary.

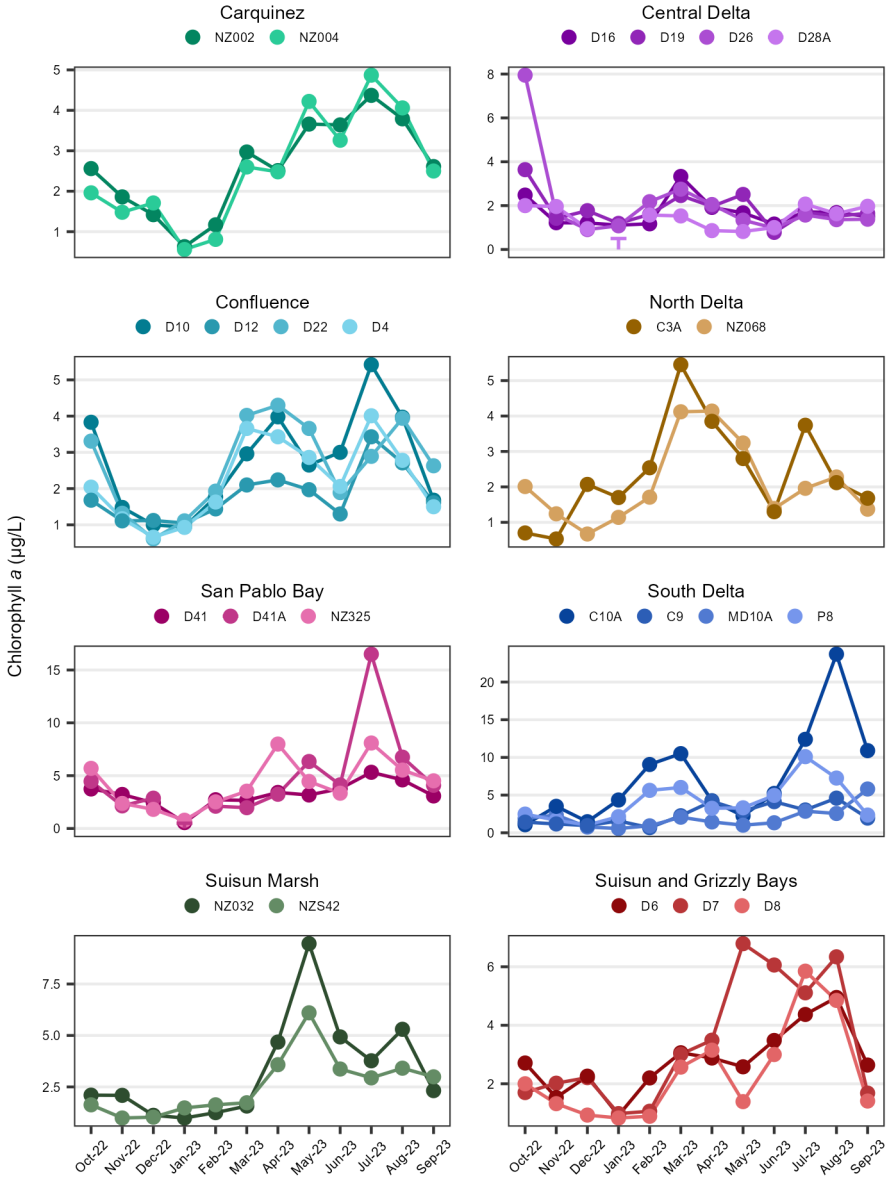

Figure 5: Chlorophyll a by region in the San Francisco Bay-Delta estuary.

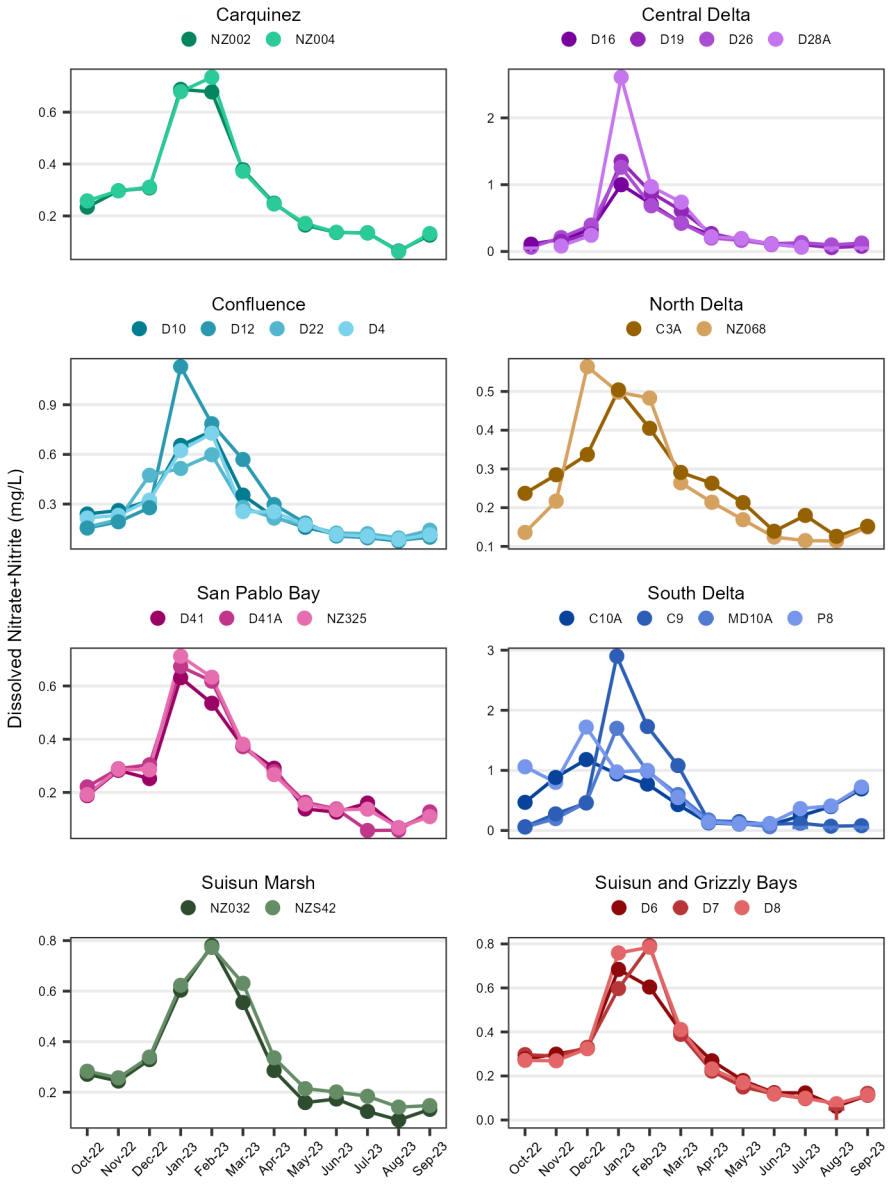

Figure 6: Dissovled nitrate nitrite by region in the San Francisco Bay-Delta estuary.

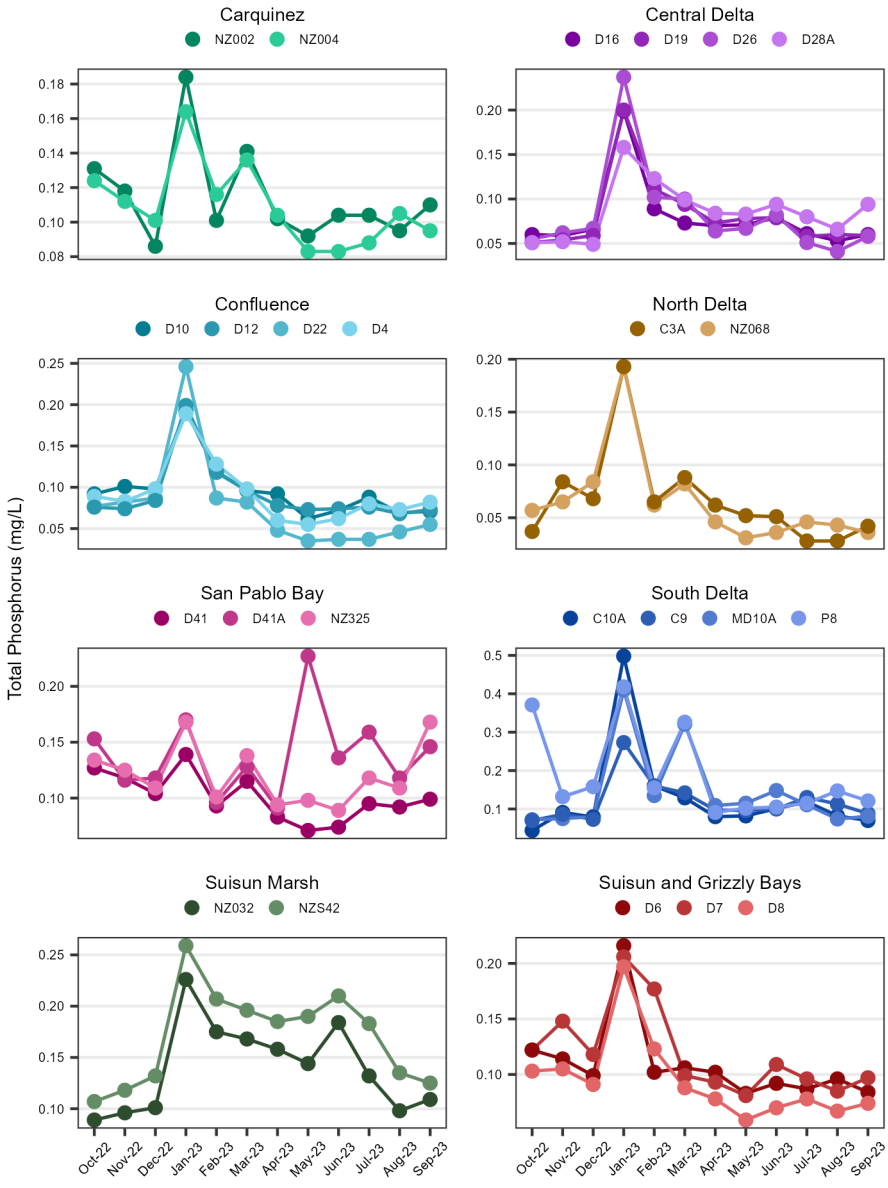

Figure 7: Total phosphorus by region in the San Francisco Bay-Delta estuary.

Tables

Table 1: Discrete WQ stations included within each region of the Delta

Region	WY Index	Stations
Carquinez	Sacramento	NZ002, NZ004
Central Delta	San Joaquin	D16, D19, D26, D28A
Confluence	Sacramento	D4, D10, D12, D22
North Delta	Sacramento	C3A, NZ068
San Pablo Bay	Sacramento	D41, D41A, NZ325
South Delta	San Joaquin	C9, C10A, MD10A, P8
Suisun and Grizzly Bays	Sacramento	D6, D7, D8
Suisun Marsh	Sacramento	NZ032, NZS42

Table 2: Summary statistics for specific conductance by region in the San Francisco Bay-Delta estuary.

Statistic	Carquinez	Central Delta	Confluence	North Delta	San Pablo Bay	South Delta	Suisun and Grizzly Bays	Suisun Marsh
Average	20200	217	327	142	29000	237	6910	3540
Min	350	101	113	102	3810	73	131	544
Max	37200	1620	14600	857	44900	764	32000	16000

Table 3: Summary statistics for turbidity by region in the San Francisco Bay-Delta estuary.

Statistic	Carquinez	Central Delta	Confluence	North Delta	San Pablo Bay	South Delta	Suisun and Grizzly Bays	Suisun Marsh
Average	13.10	5.75	11.10	6.10	15.00	9.16	18.00	38.80
Min	6.60	1.20	5.30	1.10	4.50	0.90	5.60	13.10
Max	75.10	57.70	161.00	103.00	60.00	106.00	106.00	110.00

Table 4: Summary statistics for dissolved ammonia by region in the San Francisco Bay-Delta estuary.

Statistic	Carquinez	Central Delta	Confluence	North Delta	San Pablo Bay	South Delta	Suisun and Grizzly Bays	Suisun Marsh
Average	0.0815	0.05*	0.05*	0.05*	0.074	0.05*	0.056	0.0885
Min	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*
Max	0.134	0.19	0.123	0.05*	0.132	0.674	0.154	0.174

* value is RL

Table 5: Summary statistics for chlorophyll a by region in the San Francisco Bay-Delta estuary.

Statistic	Carquinez	Central Delta	Confluence	North Delta	San Pablo Bay	South Delta	Suisun and Grizzly Bays	Suisun Marsh
Average	2.54	1.58	2.05	1.98	3.375	2.52	2.58	2.21
Min	0.56	0.50*	0.61	0.53	0.50*	0.57	0.83	0.99
Max	4.87	7.95	5.42	5.45	16.5	23.70	6.79	9.46

* value is RL

Table 6: Summary statistics for dissolved nitrate nitrite by region in the San Francisco Bay-Delta estuary.

Statistic	Carquinez	Central Delta	Confluence	North Delta	San Pablo Bay	South Delta	Suisun and Grizzly Bays	Suisun Marsh
Average	0.25	0.178	0.21	0.22	0.24	0.3805	0.269	0.26
Min	0.06	0.05*	0.08	0.11	0.06	0.05*	0.05*	0.09
Max	0.73	2.61	1.13	0.56	0.71	2.9	0.792	0.78

* value is RL

Table 7: Summary statistics for total phosphorus by region in the San Francisco Bay-Delta estuary.

Statistic	Carquinez	Central Delta	Confluence	North Delta	San Pablo Bay	South Delta	Suisun and Grizzly Bays	Suisun Marsh
Average	0.10	0.07	0.08	0.05	0.12	0.11	0.10	0.15
Min	0.08	0.04	0.04	0.03	0.07	0.04	0.06	0.09
Max	0.18	0.24	0.25	0.19	0.23	0.50	0.22	0.26