

Current Report

Methods

Continuous data were collected for the water quality and environmental parameters shown in Table 2. Each of the 15 monitoring stations collected continuous data for water temperature (WT), pH, dissolved oxygen (DO), surface specific conductance (SpC), chlorophyll a fluorescence, and turbidity. Additional sensors were installed at the Antioch, Mallard Island, and Martinez stations in the 1990's to monitor bottom SpC. These measurements, along with river stage data measured at the Mallard Island and Martinez stations, were needed to determine compliance with the salinity standard (also known as X2) that was mandated by the Bay-Delta Plan (SWRCB, 1995).

Environmental data, such as air temperature (AT), solar radiation (SRI), wind speed (WV), and wind direction (WD), were measured at all stations as part of D-1641's objectives (SWRCB, 1999). The only environmental parameter analyzed for this report was air temperature from a MET-1 Instrument Mod. 062 sensor.

Except for bottom specific conductance, all water samples were collected at 1-m below the water surface using a float-mounted YSI EXO2 multi-parameter water quality sonde. In contrast, bottom specific conductance was measured at 1.5 m above the channel bottom using a YSI EXO1 sonde. Water quality data and environmental data were recorded at 15-minute intervals.

Table 2: Parameters sampled by Continuous EMP

| Parameter | Units | Frequency |
|----------------------|----------|-------------------------|
| Water Temperature | °C | 15 minute instantaneous |
| Specific Conductance | μS/cm | 15 minute instantaneous |
| DO | mg/L | 15 minute instantaneous |
| pH | unitless | 15 minute instantaneous |
| Turbidity | NTU | 15 minute instantaneous |
| Fluorescence | FU | 15 minute instantaneous |

QA Status

On a monthly basis, quality assurance and control measures were applied using field verification data sheets. Data that did not pass quality control checks or were affiliated with instrument issues were flagged and excluded from the analysis.

Table 3: Rating criteria for continuous sonde calibration

| Analyte | Excellent | Good | Fair | Poor |
|------------------------------|------------------|---------------------------|-------------------------|----------------------|
| Water Temperature (°C) | <±0.2 | ±0.2-0.5 | ±0.5-0.8 | >±0.8 |
| Specific Conductance (μS/cm) | <±3% | ±3-10% | ±10-15% | >±15% |
| Dissolved Oxygen (mg/L) | <±0.3 or <±5% | ±0.3-0.5 or or ±5- 10% | ±0.5-0.8 or ±10- 15% | >±0.8 or >±15% |
| pH | <±0.2 | ±0.2-0.5 | ±0.5-0.8 | >±0.8 |
| Turbidity (NTU) | <±0.5 or <±5% | ±0.5-1.0 or ±5- 10% | ±1.0-1.5 or ±10- 15% | >±1.5 or or >±15% |

Regions

The daily averages of the continuous 15-minute data collected for air and water temperature, pH, DO, surface and bottom SpC, chlorophyll a fluorescence, and turbidity for calendar year 2020 are shown in Figures 3 to 34. The range of monthly DO values at the Stockton station is shown below.

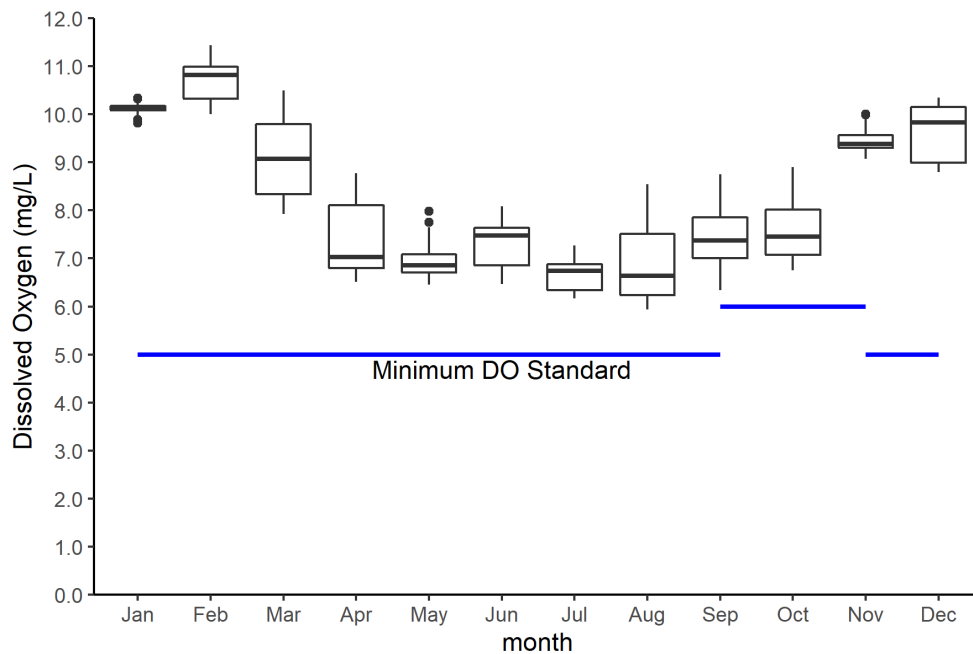


Figure 3: Range of daily dissolved oxygen Rough and Ready Isl. (P8), 2020

Northern Interior Delta

The Northern Interior Delta stations had surface specific conductance values that ranged from 125 $\mu\text{S}/\text{cm}$ (C3A in July) to 541 $\mu\text{S}/\text{cm}$ (D24A in November). Surface turbidity values ranged from 1.7 NTU (C3A in October) to 41.27 NTU (C3A in January). Surface water temperature values ranged from 8.57 $^{\circ}\text{C}$ (C3A in January) to 25.44 $^{\circ}\text{C}$ (D24A in August). Surface dissolved oxygen values ranged from 6.67 mg/L (D24A in August) to 11.19 mg/L (C3A in January). Surface pH values ranged from 7.12 (C3A in May) to 7.86 (D24A in March). Surface fluorescence values ranged from 0.12 $\mu\text{g}/\text{L}$ (D24A in November) to 10.90 $\mu\text{g}/\text{L}$ (C3A in April).

Table 4: Summary statistics for Northern Interior Delta, 2020

| Statistic | Specific Conductance (µS/cm) | Turbidity (NTU) | Water Temperature (°C) | Dissolved Oxygen (mg/L) | pH | Fluorescence (µg/L) |
|-----------|------------------------------|-----------------|------------------------|-------------------------|---------|---------------------|
| | Surface | Surface | Surface | Surface | Surface | Surface |
| MIN | 125 | 1.71 | 8.57 | 6.67 | 7.12 | 0.12 |
| MAX | 541 | 41.27 | 25.44 | 11.19 | 7.86 | 10.90 |
| AVERAGE | 188 | 5.24 | 17.04 | 8.93 | 7.56 | 1.48 |

Central Interior Delta

The Central Interior Delta stations had surface specific conductance values that ranged from 172 µS/cm (D29 in July) to 1484 µS/cm (D16A in August). Surface turbidity values ranged from 0.28 NTU (D19A in October) to 77.16 NTU (D19A in February). Surface water temperature values ranged from 8.64 °C (D19A in January) to 26.95 °C (D19A in August). Surface dissolved oxygen values ranged from 6.97 mg/L (D29 in August) to 13.69 mg/L (D19A in August). Surface pH values ranged from 7.40 (D29 in February) to 9.64 (D19A in June). Surface fluorescence values ranged from 0.55 µg/L (D19A in August) to 19.32 µg/L (D29 in August).

Table 5: Summary statistics for Central Interior Delta, 2020

| Statistic | Specific Conductance (µS/cm) | Turbidity (NTU) | Water Temperature (°C) | Dissolved Oxygen (mg/L) | pH | Fluorescence (µg/L) |
|-----------|------------------------------|-----------------|------------------------|-------------------------|---------|---------------------|
| | Surface | Surface | Surface | Surface | Surface | Surface |
| MIN | 172 | 0.28 | 8.64 | 6.97 | 7.40 | 0.55 |
| MAX | 1484 | 77.16 | 26.95 | 13.69 | 9.64 | 19.32 |
| AVERAGE | 463 | 3.68 | 17.50 | 9.45 | 7.92 | 2.28 |

Southern Interior Delta

The Southern Interior Delta stations had surface specific conductance values that ranged from 177 µS/cm (C10A in July) to 995 µS/cm (P8A in December). Surface turbidity values ranged from 1.20 NTU (P8A in November) to 57.83 NTU (C10A in April). Surface water temperature values

ranged from 8.65 °C (C10A in December) to 29.56 °C (C7A in August). Surface dissolved oxygen values ranged from 5.94 mg/L (P8A in August) to 15.06 mg/L (C10A in July). Surface pH values ranged from 7.3 (P8A in May) to 9.18 (C7A in July). Surface fluorescence values ranged from 0.73 µg/L (P8A in June) to 72.76 µg/L (C10A in July).

Table 6: Summary statistics for Southern Interior Delta, 2020

| Statistic | Specific Conductance (µS/cm) | Turbidity (NTU) | Water Temperature (°C) | Dissolved Oxygen (mg/L) | pH | Fluorescence (µg/L) |
|-----------|------------------------------|-----------------|------------------------|-------------------------|---------|---------------------|
| | Surface | Surface | Surface | Surface | Surface | Surface |
| MIN | 177 | 1.20 | 8.65 | 5.94 | 7.30 | 0.73 |
| MAX | 995 | 57.83 | 29.56 | 15.06 | 9.18 | 72.76 |
| AVERAGE | 553 | 7.30 | 18.10 | 9.42 | 7.83 | 8.99 |

Confluence

The Confluence stations had surface specific conductance values that ranged from 209 µS/cm (D22A in February) to 16,086 µS/cm (D10A in November). Bottom specific conductance values ranged from 410 µS/cm (D12A in April) to 16818 µS/cm (D10A in December). Surface turbidity values ranged from 3.56 NTU (D12A in October) to 95.4 NTU (D22A in December). Surface water temperature values ranged from 9.0 2 °C (D12A in January) to 24.42 °C (D22A in August). Bottom water temperature values ranged from 9.03 °C (D12A in January) to 24.24 °C (D12A in August). Surface dissolved oxygen values ranged from 7.56 mg/L (D22A in August) to 10.95 mg/L (D12A in February). Surface pH values ranged from 7.52 (D22A in February) to 8.07 (D12A in August). Surface fluorescence values ranged from 0.65 µg/L (D10A in April) to 6.87 µg/L (D22A in October).

Table 7: Rating criteria for Confluence, 2020

| Statistic | Specific Conductance (µs/cm) | Specific Conductance (µs/cm)_1 | Turbidity (NTU) | Water Temperature (°C) | Water Temperature (°C)_1 | Dissolved Oxygen (mg/L) | |
|-----------|------------------------------|--------------------------------|-----------------|------------------------|--------------------------|-------------------------|---------|
| | Surface | Bottom | Surface | Surface | Bottom | Surface | Surface |
| MIN | 209 | 410 | 3.56 | 9.02 | 9.03 | 7.56 | 7.56 |
| MAX | 16086 | 16819 | 95.40 | 24.42 | 24.24 | 10.95 | 8.87 |
| AVERAGE | 4382 | 6102 | 10.60 | 17.00 | 17.00 | 9.12 | 7.56 |

Grizzly/Suisun Bay

The Grizzly Suisun Bay stations had surface specific conductance values that ranged from 2,026 µS/cm (D9A in June) to 30,939 µS/cm (D6A in November). Bottom specific conductance values ranged from 2,026 µS/cm (D10A in January) to 33,350 µS/cm (D6A in November). Surface turbidity values ranged from 5.0 NTU (D6A in September) to 98.8 NTU (D7A in March). Surface water temperature values ranged from 8.97 °C (D9A in February) to 23.61 °C (D10A in August). Bottom water temperature values ranged from 9.11 °C (D10A in January) to 23.57 °C (D10A in August). Surface dissolved oxygen values ranged from 7.21 mg/L (D6A in August) to 10.6 mg/L (D9A in January). Surface pH values ranged from 7.54 (D9A in January) to 8.19 (D8A in May). Surface fluorescence values ranged from 0.62 µg/L (D9A in December) to 9.32 µg /L (D7A in November).

Table 8: Rating criteria for Grizzly/Suisun Bay, 2020

| Statistic | Specific Conductance (µs/cm) | Specific Conductance (µs/cm)_1 | Turbidity (NTU) | Water Temperature (°C) | Water Temperature (°C)_1 | Dissolved Oxygen (mg/L) | |
|-----------|------------------------------|--------------------------------|-----------------|------------------------|--------------------------|-------------------------|---------|
| | Surface | Bottom | Surface | Surface | Bottom | Surface | Surface |
| MIN | 1933 | 2026 | 5.00 | 8.97 | 9.11 | 7.21 | 7.21 |
| MAX | 30939 | 33350 | 98.80 | 23.61 | 23.57 | 10.60 | 8.87 |
| AVERAGE | 13913 | 18080 | 21.10 | 16.90 | 16.70 | 8.87 | 7.56 |

Parameters

Water Temperature

Average daily water temperatures in the estuary ranged from 8.57 °C to 29.6°C, with the lower values in the Northern Interior Delta location and the higher values found in the Southern Interior Delta stations. Average daily water temperatures at the Northern Interior Delta stations were usually lower in comparison to the Southern Interior Delta stations, with the greatest divergence occurring in the months of July through September at the Southern Interior Delta locations.



Figure 4: Average daily water temperature in the Northern Interior Delta, 2020



Figure 5: Average daily water temperature in the Southern Interior Delta, 2020



Figure 6: Average daily water temperature in the Central Delta, 2020



Figure 7: Average daily water temperature in the Confluence, 2020



Figure 8: Average daily water temperature in the Grizzly/Suisun Bays, 2020

Specific Conductance

DDaily average surface specific conductance for the estuary ranged from 125 $\mu\text{S}/\text{cm}$ to 30,939 $\mu\text{S}/\text{cm}$, with the lower values in the Northern Interior Delta stations and the higher values at the more tidally influenced Grizzly/Suisun Bay locations.

The Central Delta Stations showed increases in specific conductance from August onward. In addition, the Southern Interior Delta stations on the San Joaquin River showed a large decrease in surface specific conductance in October through November.

Bottom specific conductance measured in 2020 at D12A, D10A, and D6A stations exhibited seasonal patterns and ranges similar to the surface specific conductance.

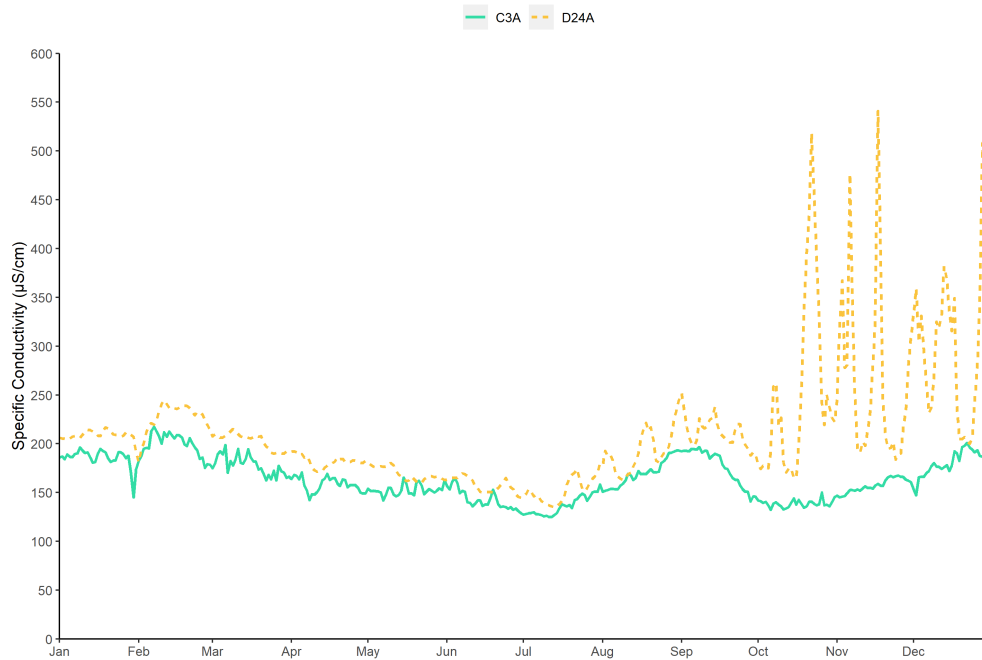


Figure 9: Average daily specific conductance in the Northern Interior Delta, 2020

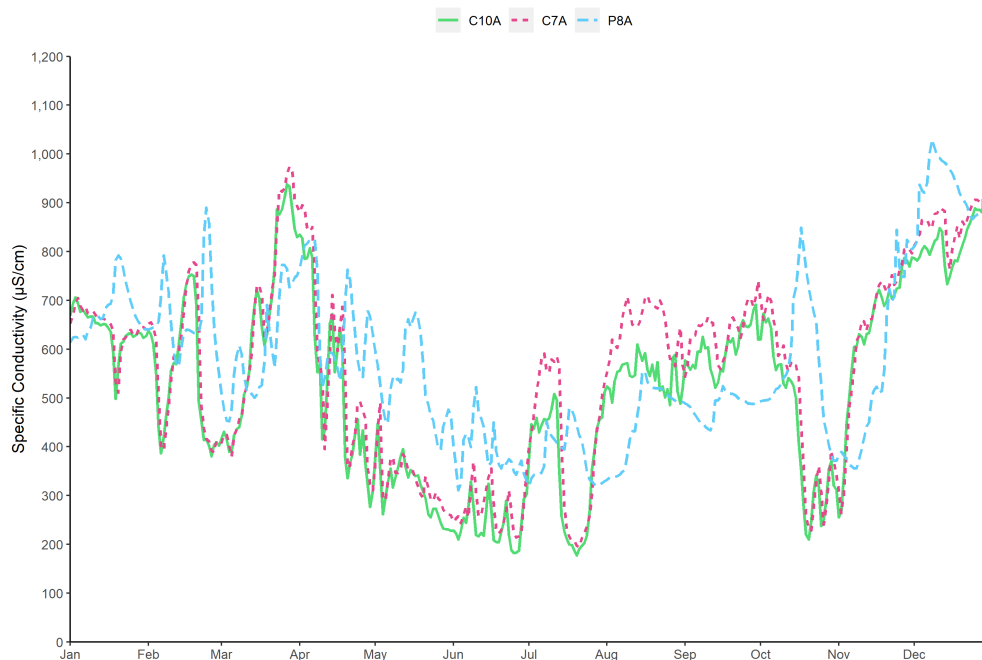


Figure 10: Average daily specific conductance in the Southern Interior Delta, 2020

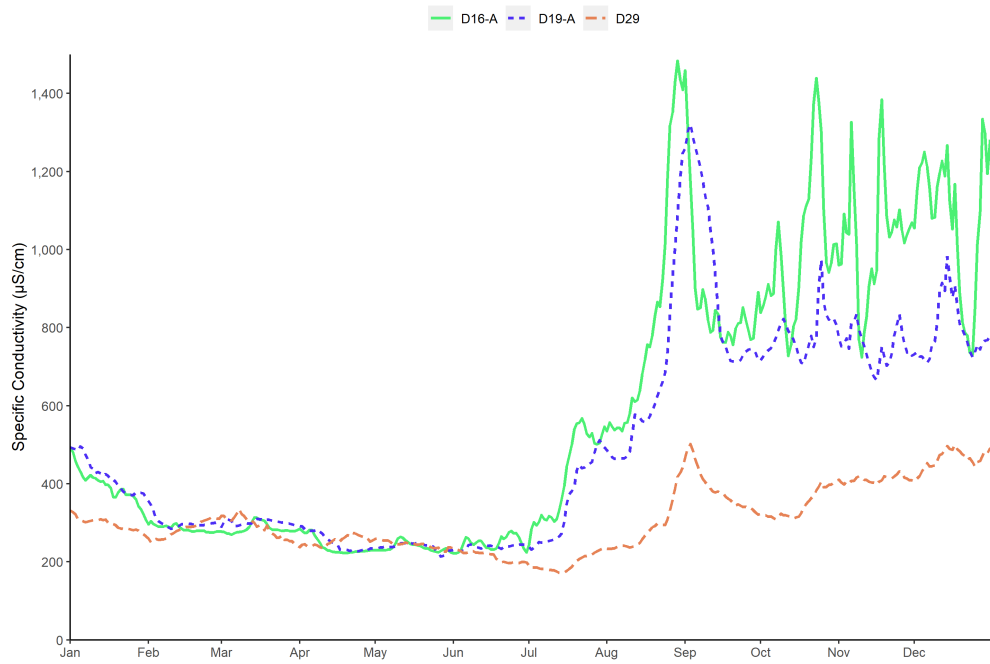


Figure 11: Average daily specific conductance in the Central Delta, 2020

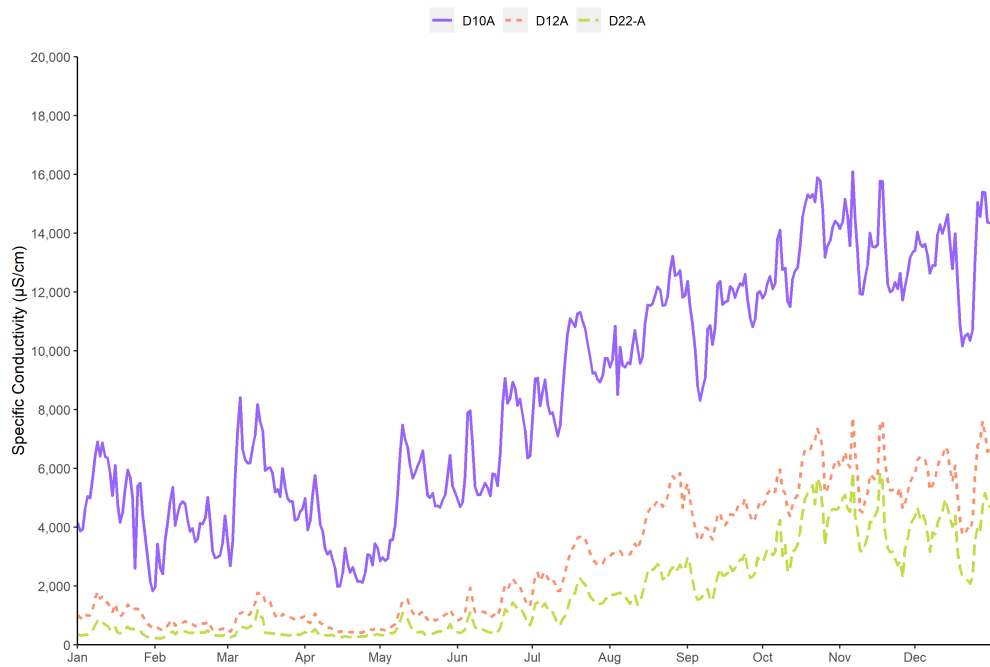


Figure 12: Average daily specific conductance in the Confluence, 2020

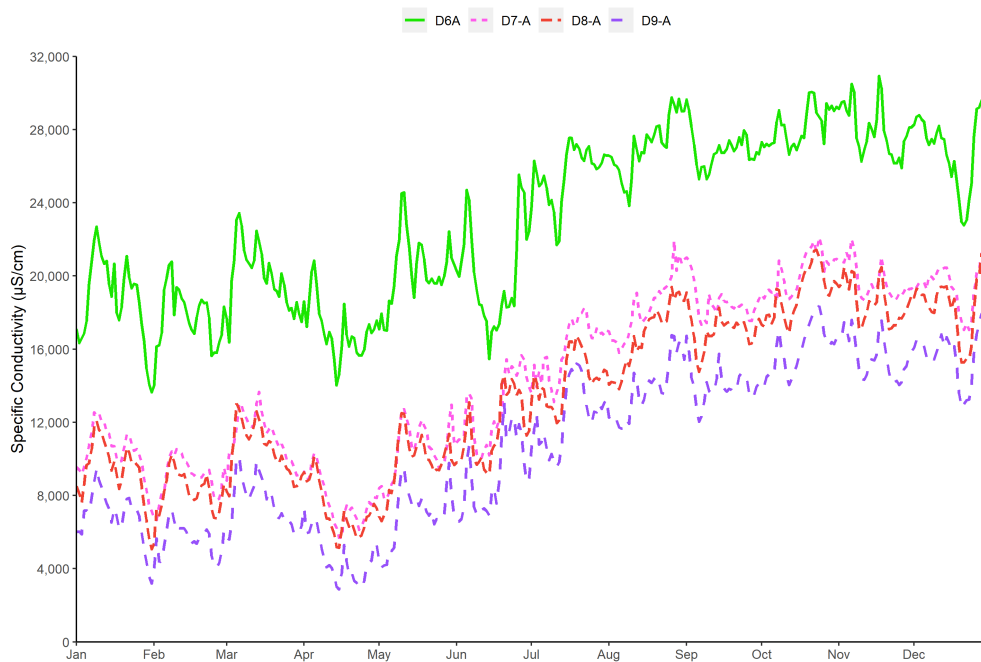


Figure 13: Average daily specific conductance in the Grizzly/Suisun Bays, 2020

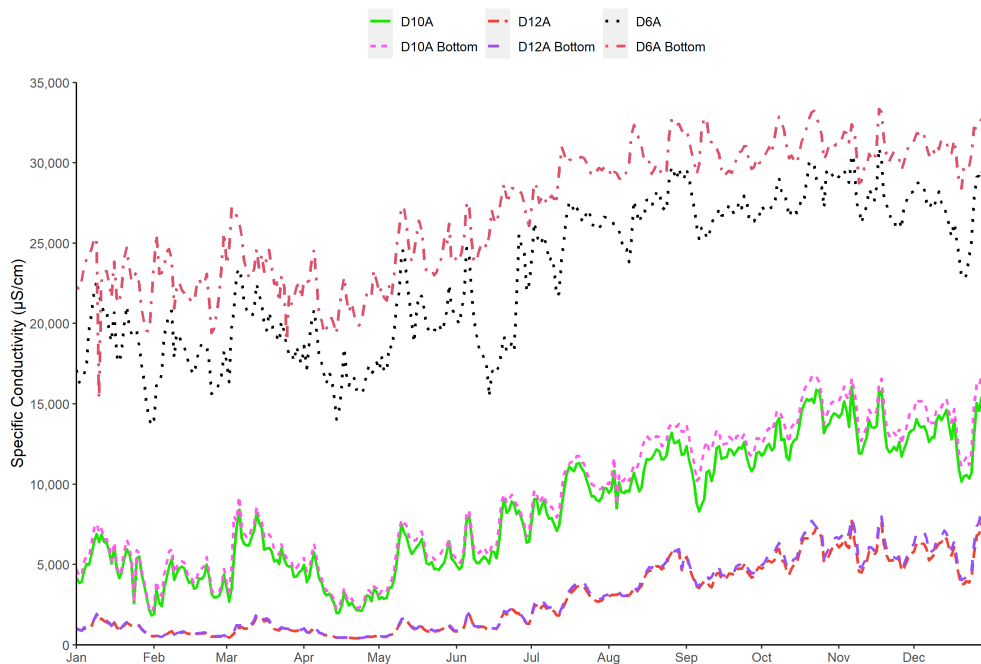


Figure 14: Average daily specific conductance Surface-Bottom, 2020

Dissolved Oxygen

Average daily DO values in the estuary ranged from 5.94 mg/L to 15.1 mg/L. The greatest degree of variability was seen at the Southern Interior Delta stations.

All compliance monitoring stations recorded daily averages above the standard of 5.0 mg/L that was set by the CVRWQCB in the Basin Plan (CVRWQCB, 1998). The monthly average DO levels at the Stockton station did not fall below the 5.0 mg/L standard that was set by the CVRWQCB

(1998). The monthly average DO levels did not drop below the 6.0 mg/L standard (SWRCB, 1995) for the passage of fall-run Chinook salmon through the ship channel for the September through November 2020 control period.



Figure 15: Average daily dissolved oxygen in the Northern Interior Delta, 2020

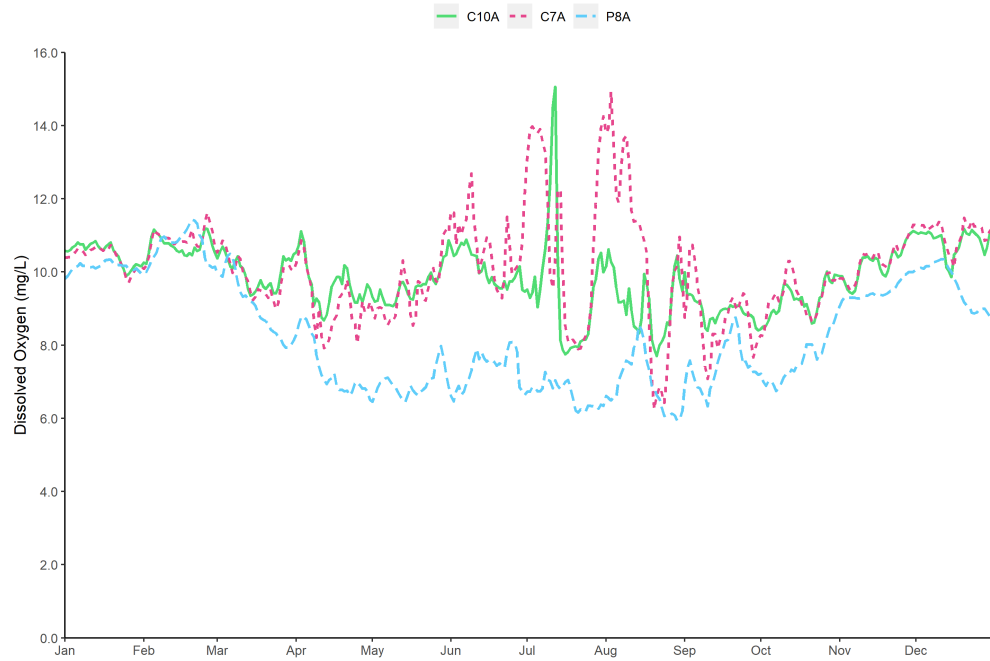


Figure 16: Average daily dissolved oxygen in the Southern Interior Delta, 2020

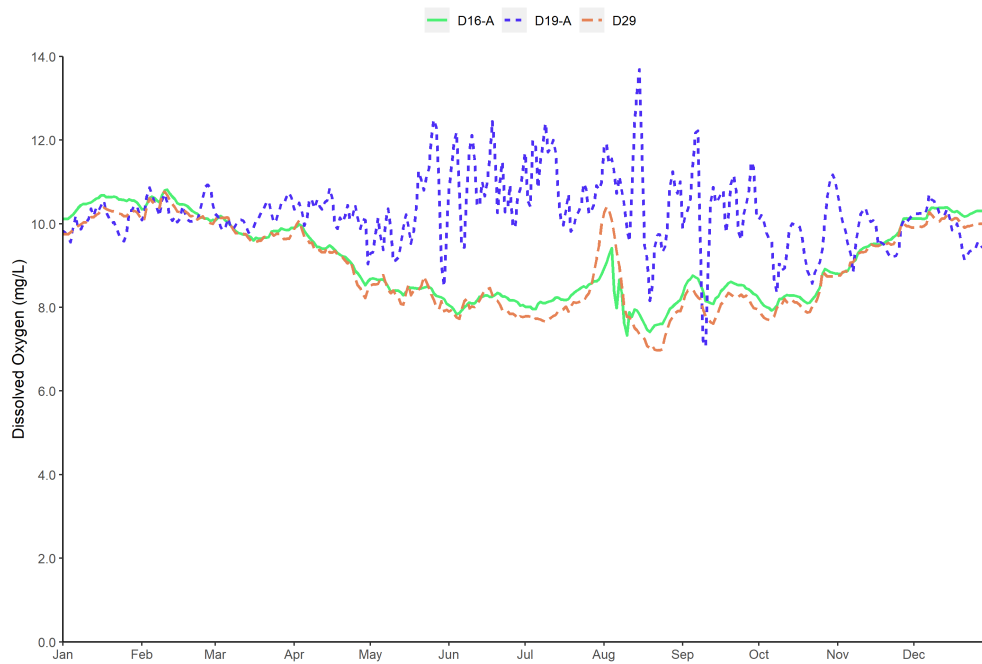


Figure 17: Average daily dissolved oxygen in the Central Delta, 2020



Figure 18: Average daily dissolved oxygen in the Confluence, 2020



Figure 19: Average daily dissolved oxygen in the Grizzly/Suisun Bays, 2020

pH

Daily average pH levels at all stations in the estuary ranged from 7.12 to 9.64. The Southern Interior Delta stations showed a large increase in daily average pH beginning June 2020 to September 2020. The Central Delta station D19A showed an increase in pH values beginning April 2020 until the end of October 2020.

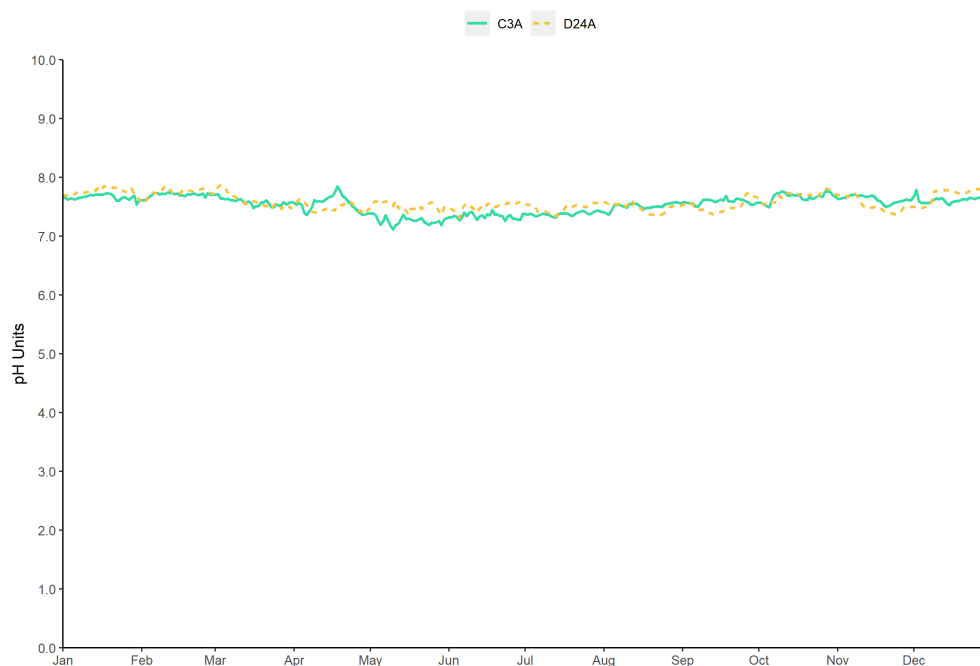


Figure 20: Average daily pH in the Northern Interior Delta, 2020



Figure 21: Average daily pH in the Southern Interior Delta, 2020

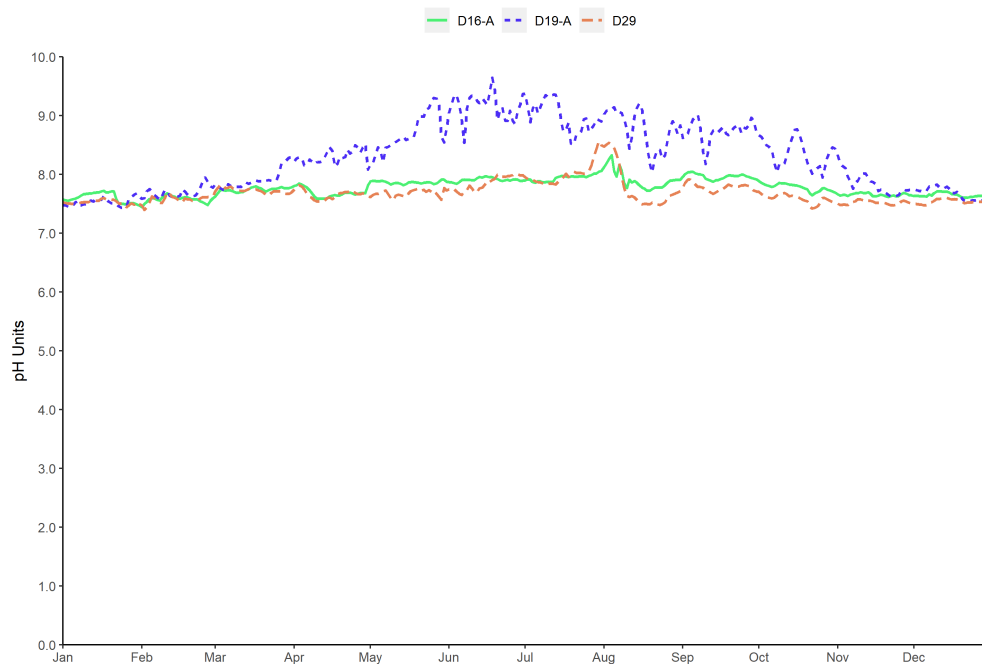


Figure 22: Average daily pH in the Central Delta, 2020



Figure 23: Average daily pH in the Confluence, 2020

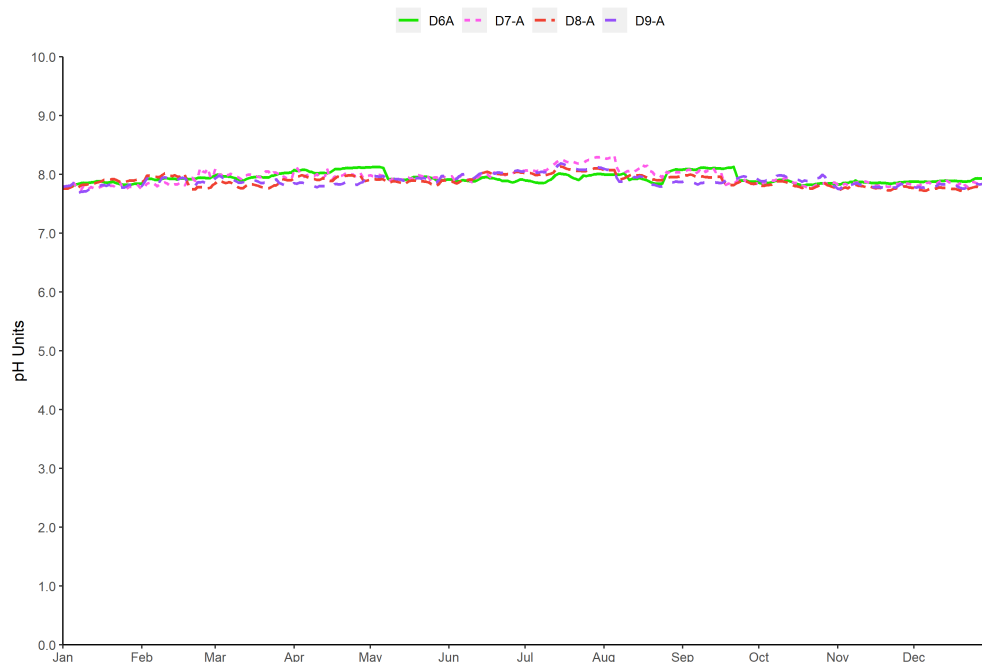


Figure 24: Average daily pH in the Grizzly/Suisun Bays, 2020

Turbidity

DDaily average turbidity levels at all stations in the estuary ranged from 0.28 to 98.8. The Northern Interior Delta stations showed a large increase in turbidity in January and February, peaking at 41.27 FNU. The Southern interior Delta stations all showed a significant spike in turbidity readings in mid-April which gradually decreased through May.

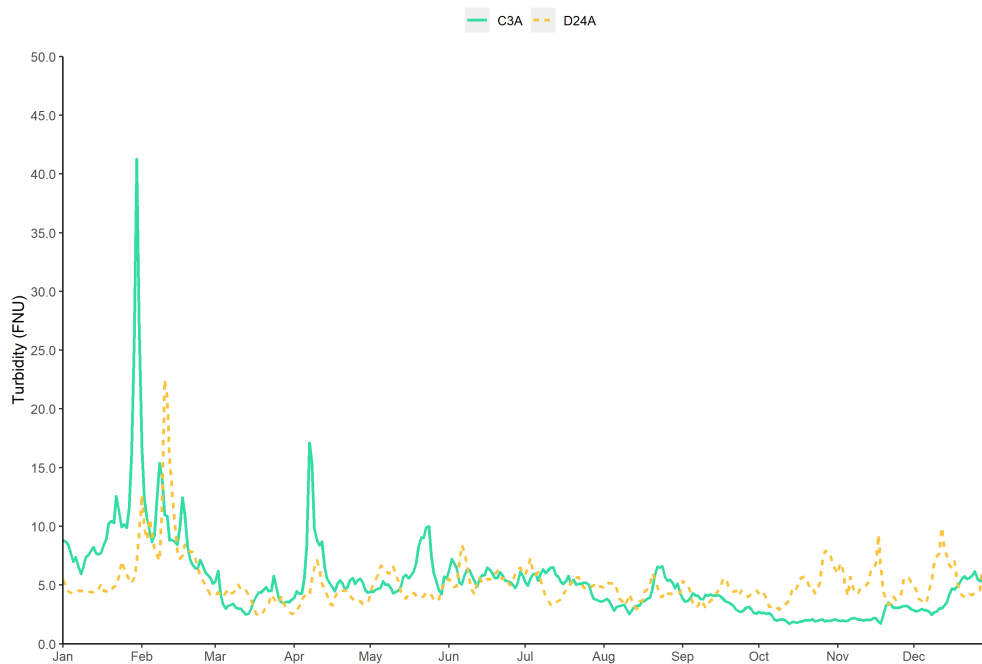


Figure 25: Average daily turbidity in the Northern Interior Delta, 2020

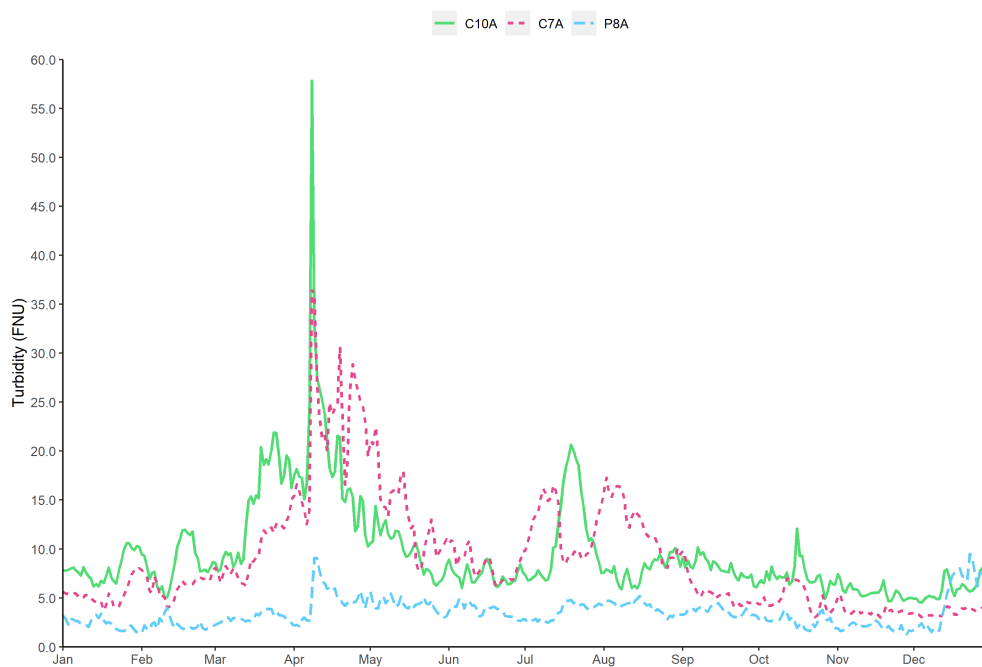


Figure 26: Average daily turbidity in the Southern Interior Delta, 2020

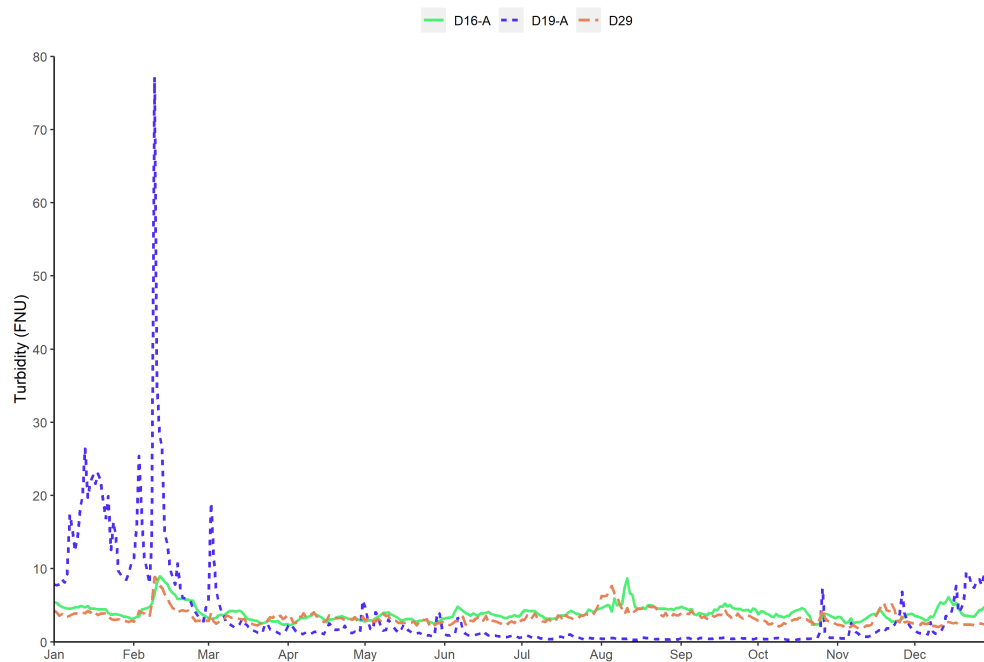


Figure 27: Average daily turbidity in the Central Delta, 2020

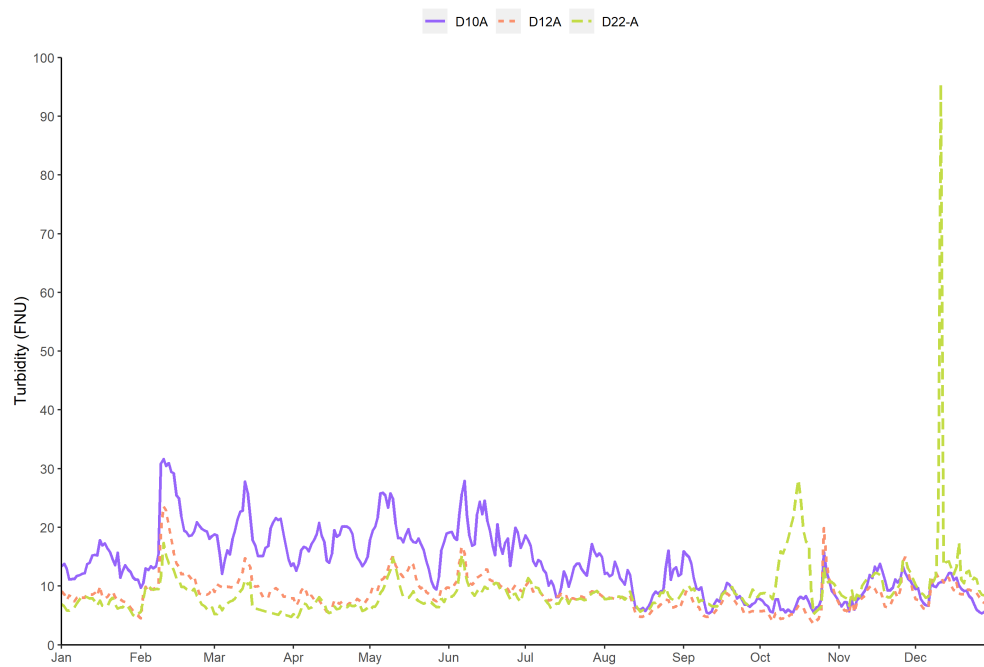


Figure 28: Average daily turbidity in the Confluence, 2020

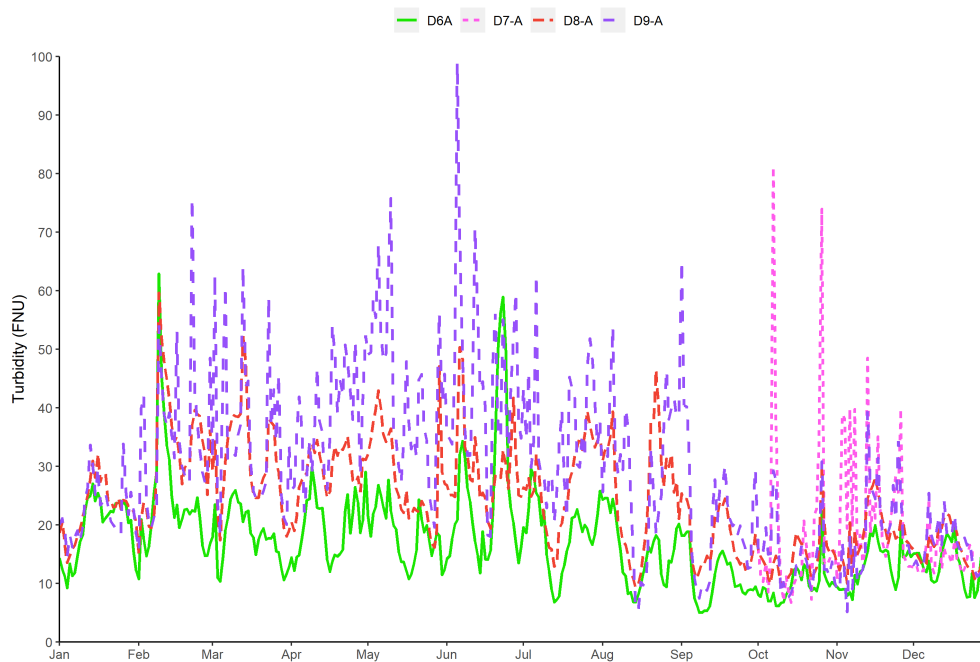


Figure 29: Average daily turbidity in the Grizzly/Suisun Bays, 2020

Chlorophyll a Fluorescence

Daily average chlorophyll a fluorescence recorded at all the stations ranged from a low of 0.12 ($\mu\text{g/L}$) in December 2020 for the Northern Interior station D24A to a high of 72.8 ($\mu\text{g/L}$) in July 2020 for the Southern Interior Delta station C10A.

For most of the 2020 calendar year, daily fluorescence averages at Southern Interior Delta stations were higher than other regions with sustained higher values, with the exception of P8A.

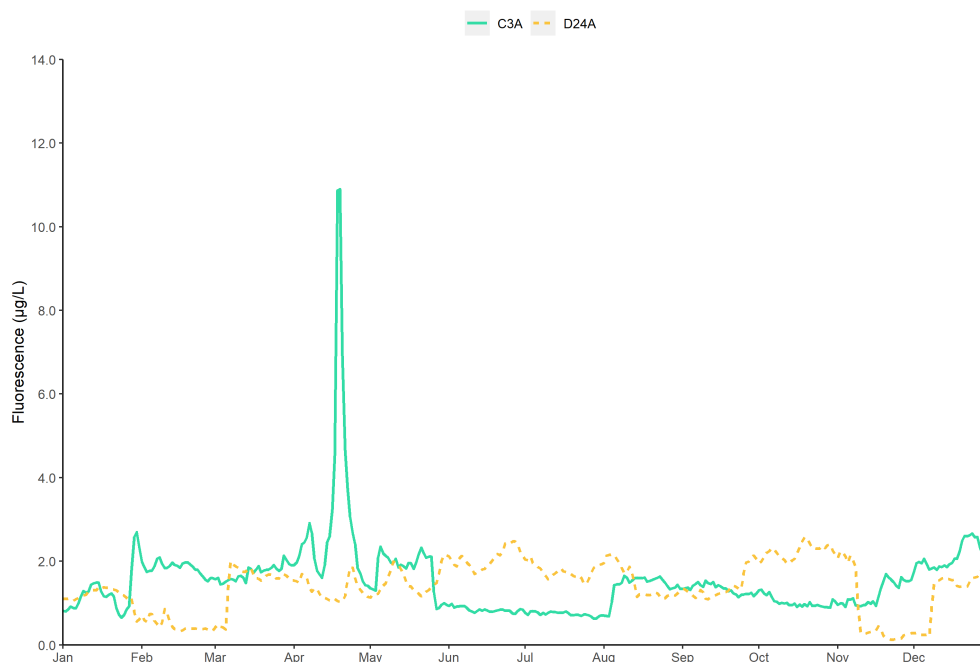


Figure 30: Average daily fluorescence in the Northern Interior Delta, 2020

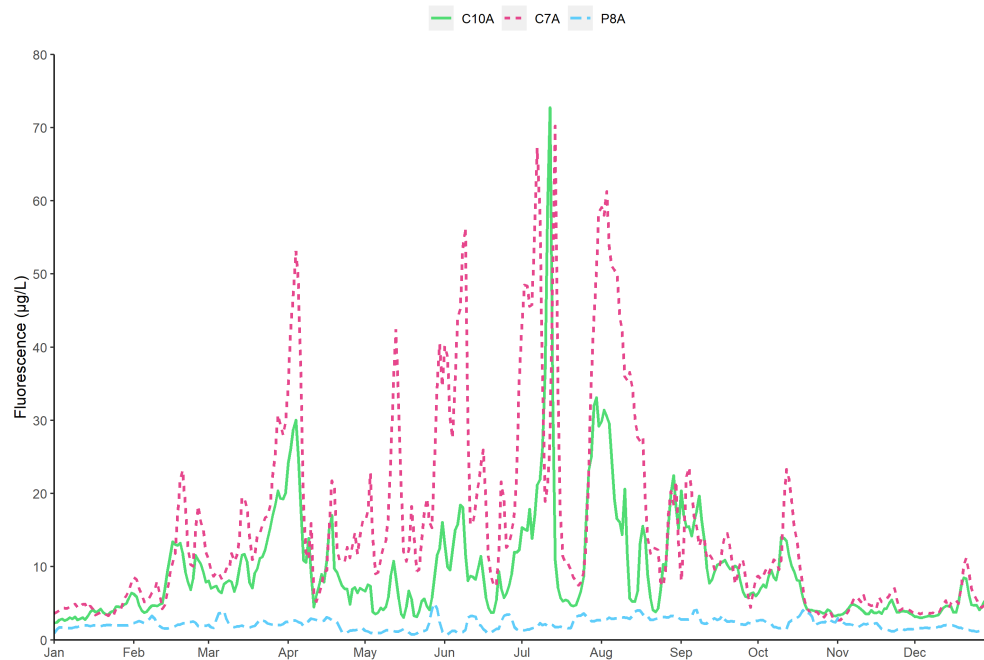


Figure 31: Average daily fluorescence in the Southern Interior Delta, 2020

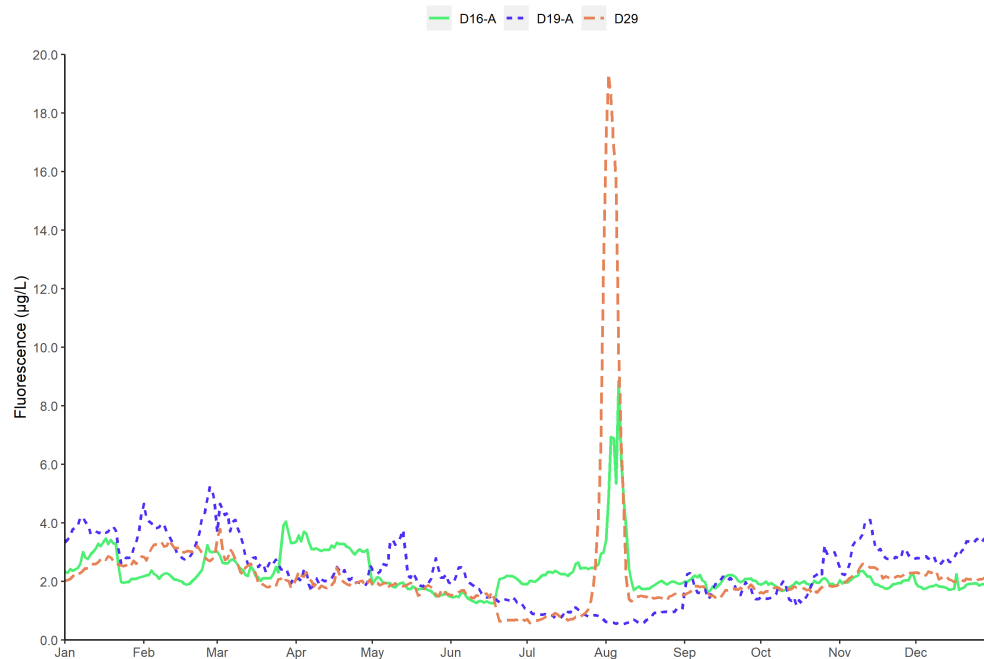


Figure 32: Average daily fluorescence in the Central Delta, 2020

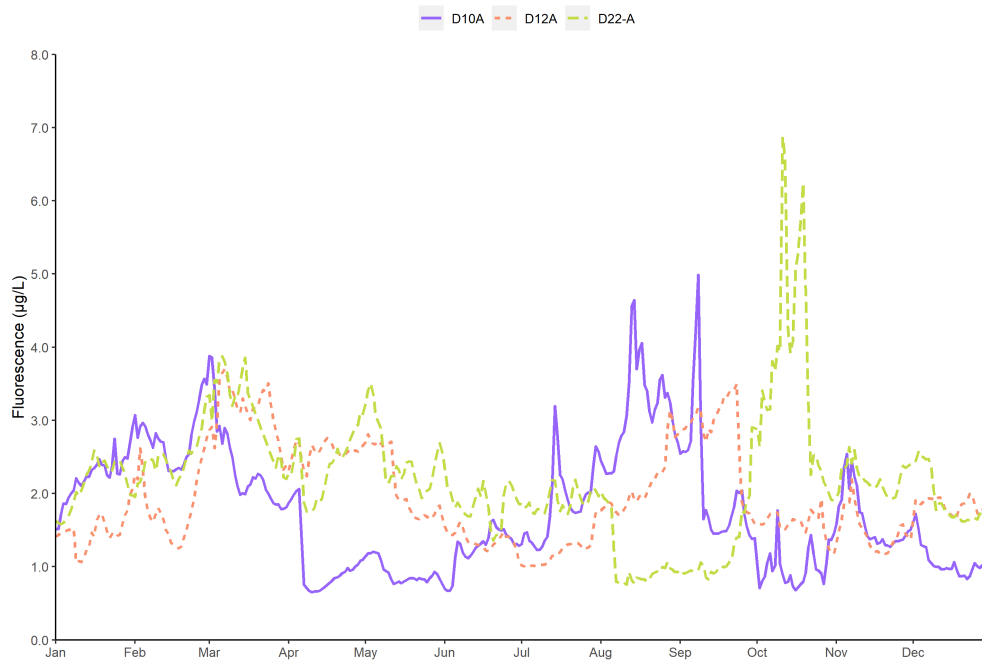


Figure 33: Average daily fluorescence in the Confluence, 2020

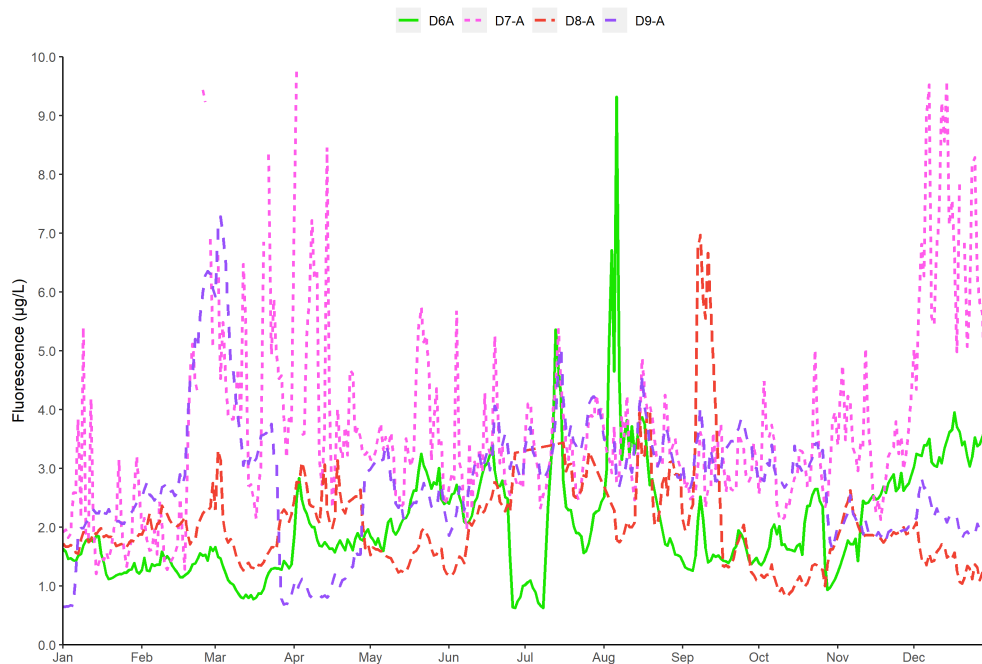


Figure 34: Average daily fluorescence in the Grizzly/Suisun Bays, 2020

Air Temperature

Daily average air temperatures in the estuary ranged from 3.38 °C in December 2020 at Northern Interior station C3A to 33.27 °C in August 2020 at the Southern Interior Delta station C7A.

References

[CVRWQCB] Central Valley Regional Water Quality Control Board. (1998). Water Quality Control Plan for the California Regional Water Quality Control Board Central Valley Region, the Sacramento River Basin, and San Joaquin River Basin [Basin Plan] (4th ed.).

[SWRCB] State Water Resources Control Board. (1995). Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Estuary [Bay-Delta Plan] (Adopted May 22, 1995, pursuant to Water Right Order 95-1). Sacramento, CA.

[SWRCB] State Water Resources Control Board. (1999). Water Rights Decision 1641 for the Sacramento-San Joaquin Delta and Suisun Marsh (Adopted December 29, 1999, Revised in Accordance with order WR2000-02 March 15, 2000). Sacramento, CA.

Contact Info

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