

## **2017 Phytoplankton, Chlorophyll *a*, and Pheophytin *a***

The EMP sampled 13 to 27 sites during calendar year 2017. Some sites were added during the year to improve spatial coverage in the estuary. Graphed values for chlorophyll *a*, pheophytin *a*, and organism counts are monthly averages because different regions have differing numbers of stations. However, means, medians, minimums, and maximums were calculated on the full dataset for each region. Table 1 lists each region and the stations in that region. Freshwater regions are the Northern Interior Delta, Southern Interior Delta, and Central Delta. The Confluence region runs from fresh to brackish water depending on outflow. The Grizzly Bay/Suisun Bay region is typically brackish water, while the San Pablo Bay region is more marine.

### Northern Interior Delta

Average chlorophyll *a* was stable most of the year, with a peak in July (Figure 1). The mean chlorophyll *a* value was 3.05 micrograms/L, and the median was 2.45 micrograms/L. The minimum for this region in 2017 was 0.96 micrograms/L, and the maximum was 10.58 micrograms/L.

Average pheophytin *a* was very low (below 2 micrograms/L) all year (Figure 1). The mean was 1.06 micrograms/L, and the median was 0.92 micrograms/L. The minimum was 0.59 micrograms/L, and the maximum was 2.27 micrograms/L.

Cyanobacteria dominated in 2017, but there were also peaks of green algae from February through April (Figure 2). All phytoplankton numbers were fairly low after April.

### Southern Interior Delta

Average chlorophyll *a* was lower in the first half of the year, then peaked in July and remained high through September (Figure 3). The mean chlorophyll *a* in this region was 4.72 micrograms/L, and the median was 3.63. The minimum was 0.65 micrograms/L, and the maximum was 14.35 micrograms/L.

Average pheophytin *a* was low and stable all year, with most values below 3 micrograms/L (Figure 3). The mean was 1.81 micrograms/L, and the median was 1.61 micrograms/L. The minimum was 0.59 micrograms/L, and the maximum was 3.43 micrograms/L.

Cyanobacteria were dominant most of the year, with peaks of green algae in spring and summer (Figure 4). Cryptophytes and centric diatoms also had small peaks in spring and summer.

### Central Delta

Average chlorophyll *a* was low (below 3 micrograms per mL) all year, except for a large peak in July (Figure 5). The mean was 2.77 micrograms/L, and the median was 1.52 micrograms/L. The minimum was 0.69 micrograms/L, and the maximum was 22.33 micrograms/L.

Average pheophytin *a* was low all year, though there was a small peak in July that corresponded with the large peak in chlorophyll *a* (Figure 5). The mean was 1.25 micrograms/L, and the median was 0.82 micrograms/L. The minimum was 0.55 micrograms/L, and the maximum was 5.48 micrograms/L.

Cyanobacteria dominated early in the year, with peaks of green algae from February through May, and again in August (Figure 6). A small peak of centric diatoms occurred in July.

### Confluence

Average chlorophyll *a* in the Confluence was similar to the Central Delta, with low values most of the year and a large peak in July (Figure 7). The mean was 4.53 micrograms/L, and the median was 2.43 micrograms/L. The minimum was 0.81 micrograms/L, and the maximum was 30.04 micrograms/L.

Like average chlorophyll *a*, average pheophytin *a* was similar to the Central Delta, with low values all year, and a small peak corresponding with the chlorophyll *a* peak in July (Figure 7). The mean was 1.41 micrograms/L, and the median was 1.11 micrograms/L. The minimum was 0.50 micrograms/L, and the maximum was 4.77 micrograms/L.

Cyanobacteria were present all year, with the highest peaks early in the year (Figure 8). Green algae had a large peak in February, followed by smaller peaks the rest of the year. There was a small peak of cryptophytes in March.

#### Grizzly Bay/Suisun Bay

Average chlorophyll *a* increased steadily until peaking in May, and then steadily decreased the rest of the year (Figure 9). The mean chlorophyll *a* was 3.97 micrograms/L, and the median was 3.44 micrograms/L. The minimum was 0.83 micrograms/L, and the maximum was 18.10 micrograms/L.

Average pheophytin *a* values were stable most of the year before declining sharply in August (Figure 9). The mean was 1.87 micrograms/L, and the median was 1.45 micrograms/L. The minimum was 0.50 micrograms/L, and the maximum was 5.36 micrograms/L.

There were peaks of cyanobacteria early in the year, and a smaller peak in June (Figure 10). A large peak of green algae occurred in February, with small peaks of cryptophytes in February, March, May, and July.

#### San Pablo Bay

Average chlorophyll *a* had peaks in April and June, with lower, stable values the rest of the year before declining slightly beginning in October (Figure 11). The mean was 2.41 micrograms/L, and the median was 1.99 micrograms/L. The minimum was 0.80 micrograms/L, and the maximum was 11.15 micrograms/L.

Average pheophytin *a* was stable most of the year, then showed a decline in the fall similar to chlorophyll *a* (Figure 11). The mean was 1.47 micrograms/L, and the median was 1.27 micrograms/L. The minimum was 0.50 micrograms/L, and the maximum was 4.12 micrograms/L.

There were peaks of cyanobacteria from January through March, and again in July (Figure 12). There were large peaks of green algae in February and July, and smaller peaks of cryptophytes in February and July. Phytoplankton numbers dropped sharply starting in August.

<b>Region</b>	<b>Stations</b>
Northern Interior Delta	C3A, NZ068/D24
Southern Interior Delta	C9, C10A, MD10A, P8
Central Delta	D16, D19, D26, D28A
Confluence	D4, D10, D12, D22
Grizzly Bay/Suisun Bay	D7, D8, NZ032, NZS42
San Pablo Bay	D6, D41, D41A, NZ002, NZ004, NZ325

Table 1. List of stations by region.

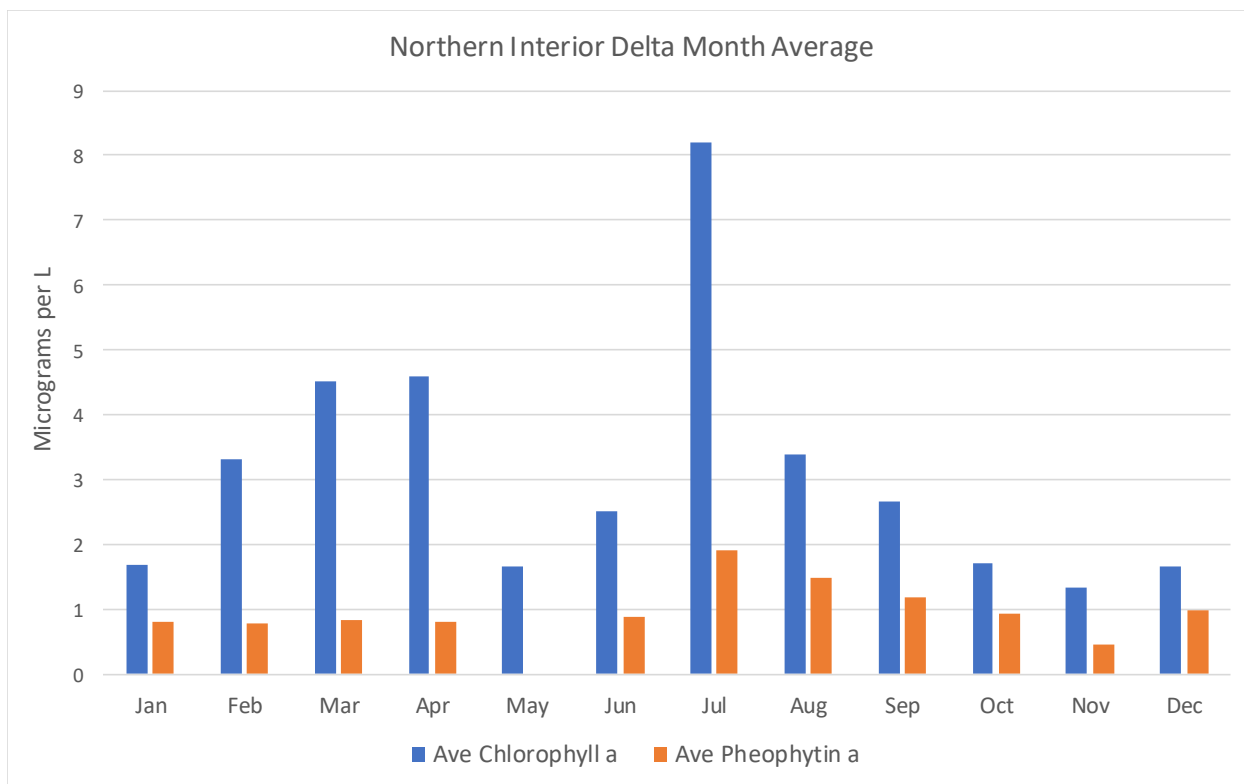


Figure 1. 2017 average monthly chlorophyll *a* and pheophytin *a* in the Northern Interior Delta.

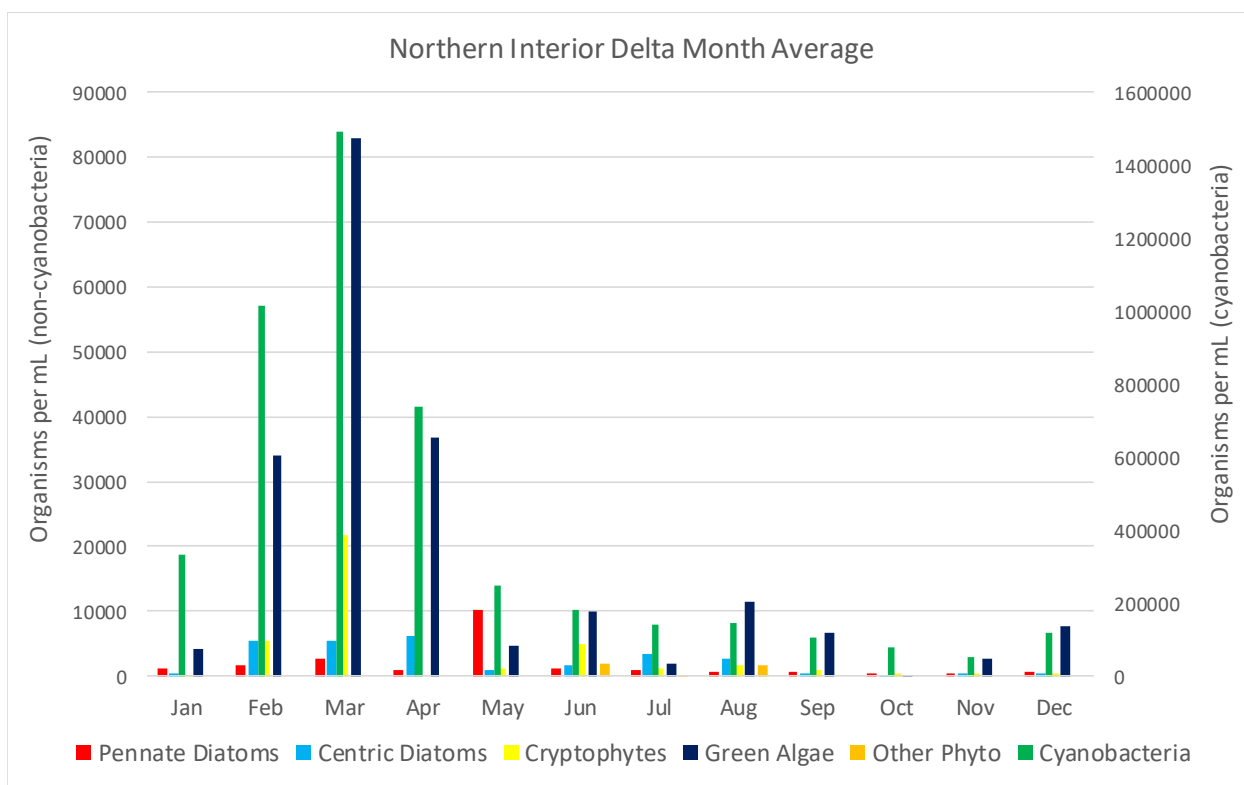


Figure 2. 2017 average monthly phytoplankton composition in the Northern Interior Delta.

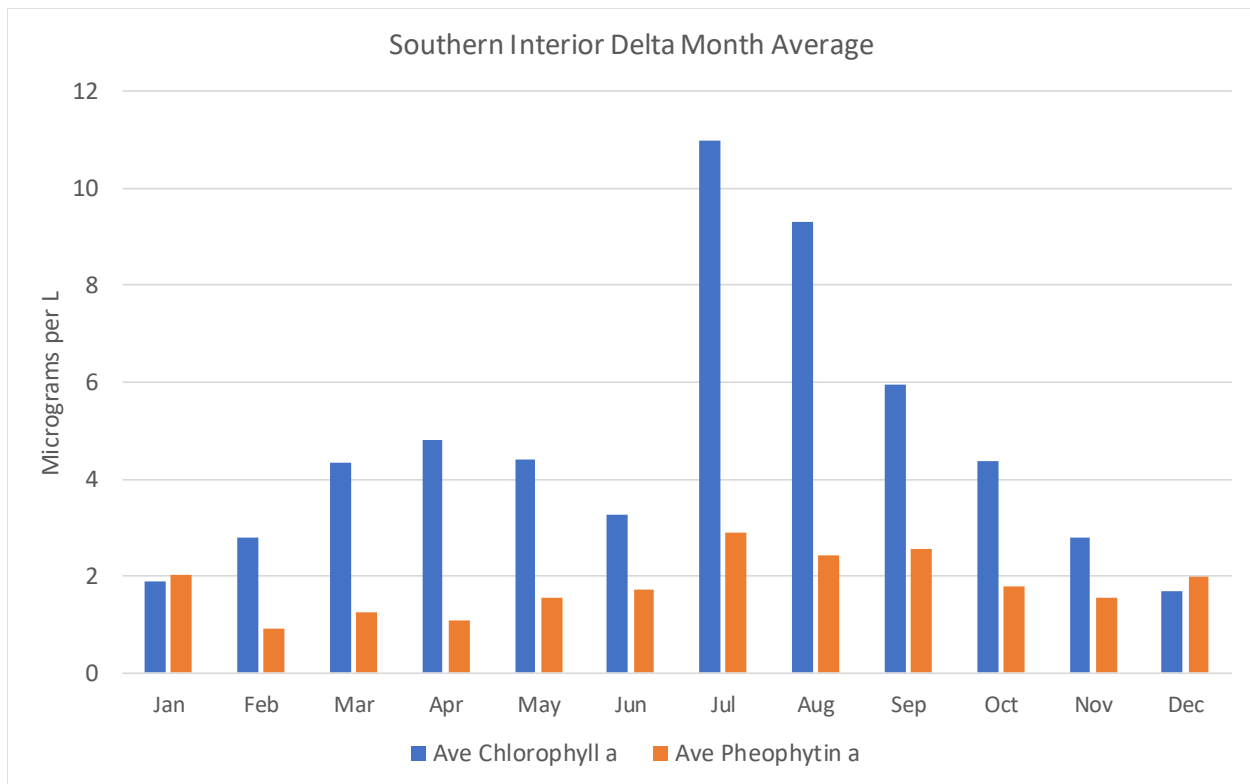


Figure 3. 2017 average monthly chlorophyll *a* and pheophytin *a* in the Southern Interior Delta.

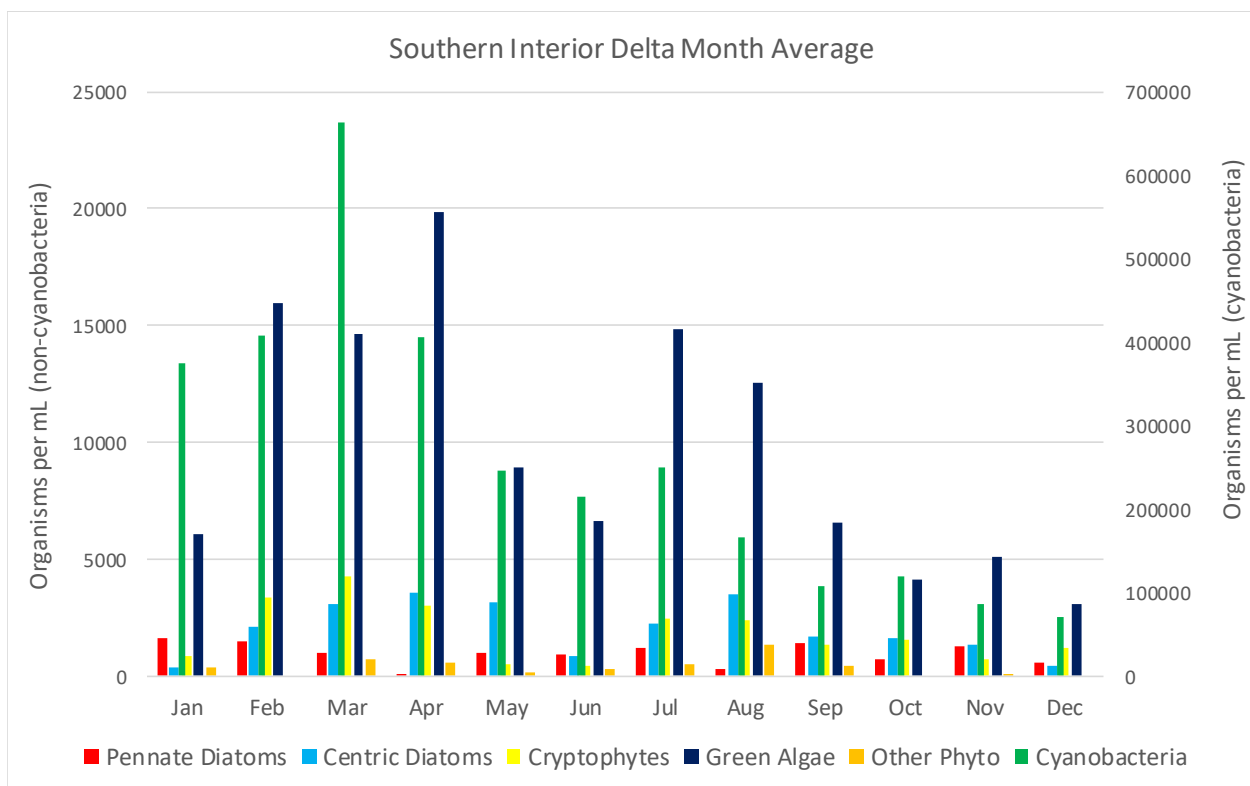


Figure 4. 2017 average monthly phytoplankton composition in the Southern Interior Delta.

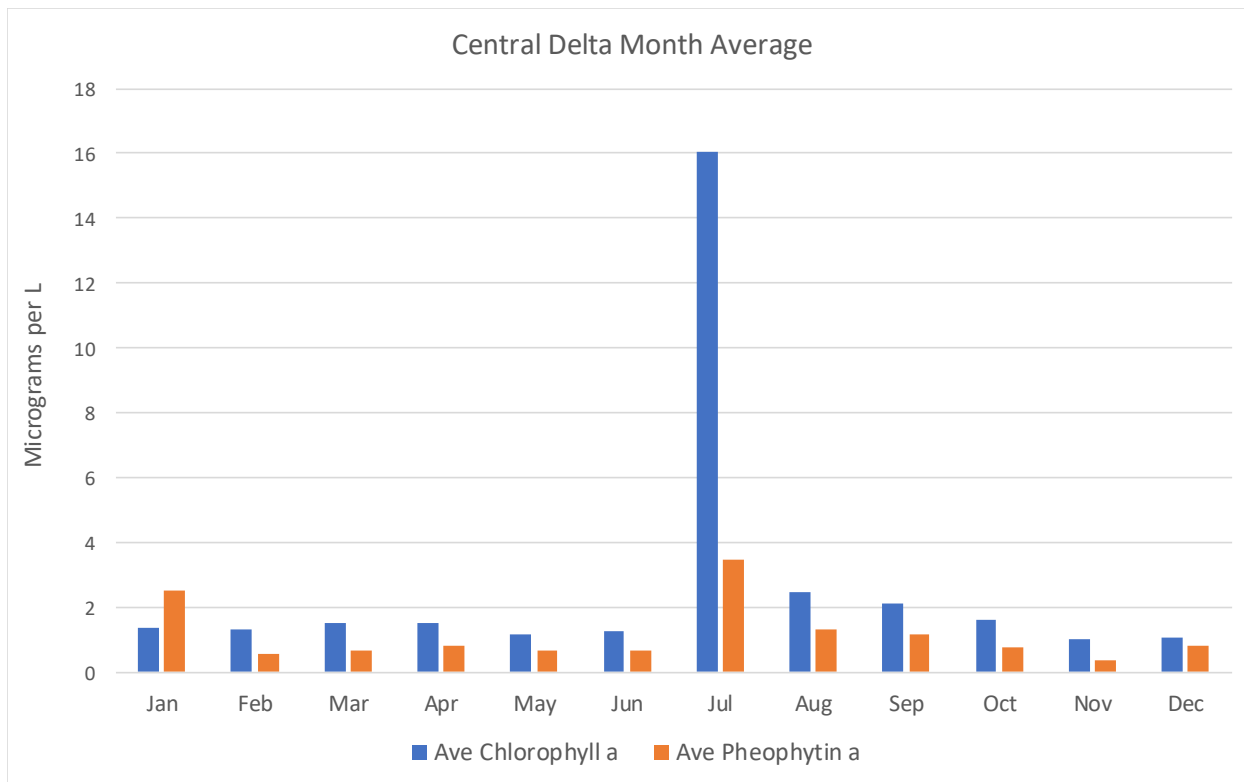


Figure 5. 2017 average monthly chlorophyll *a* and pheophytin *a* in the Central Delta.

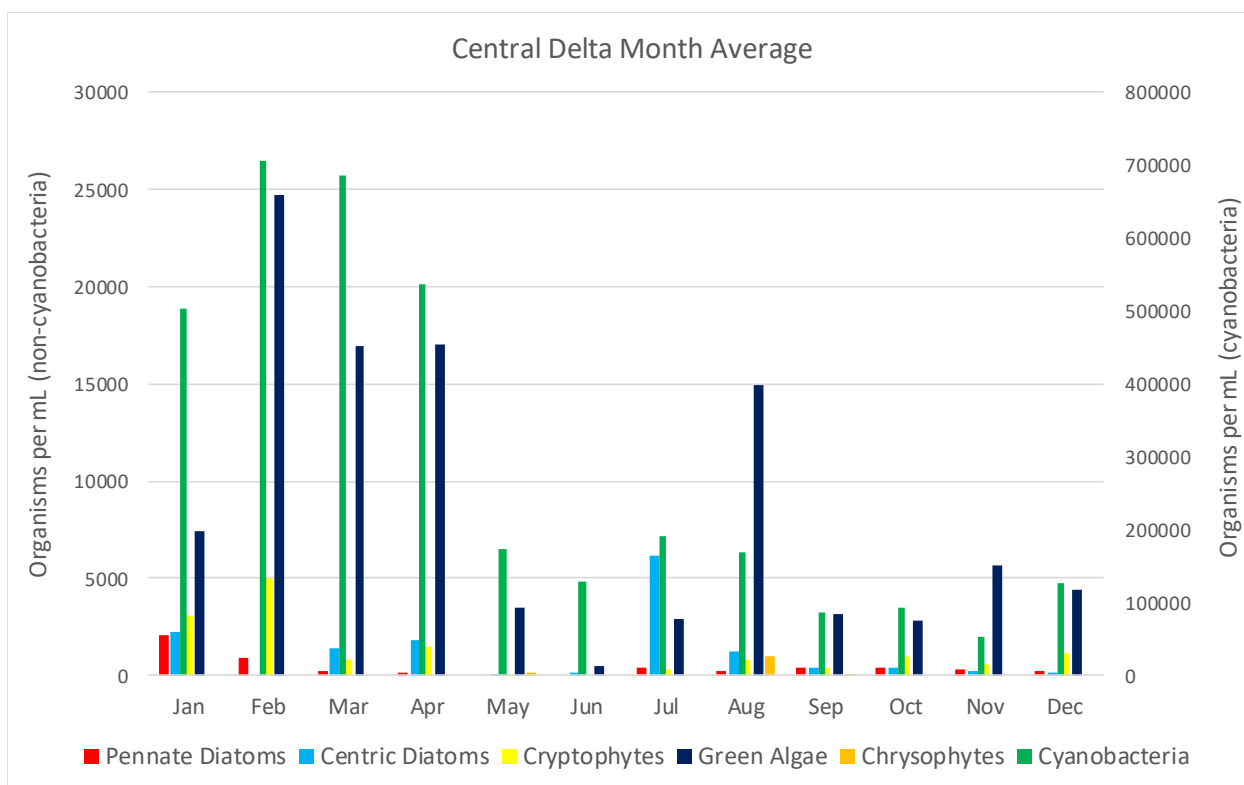


Figure 6. 2017 average monthly phytoplankton composition in the Central Delta.

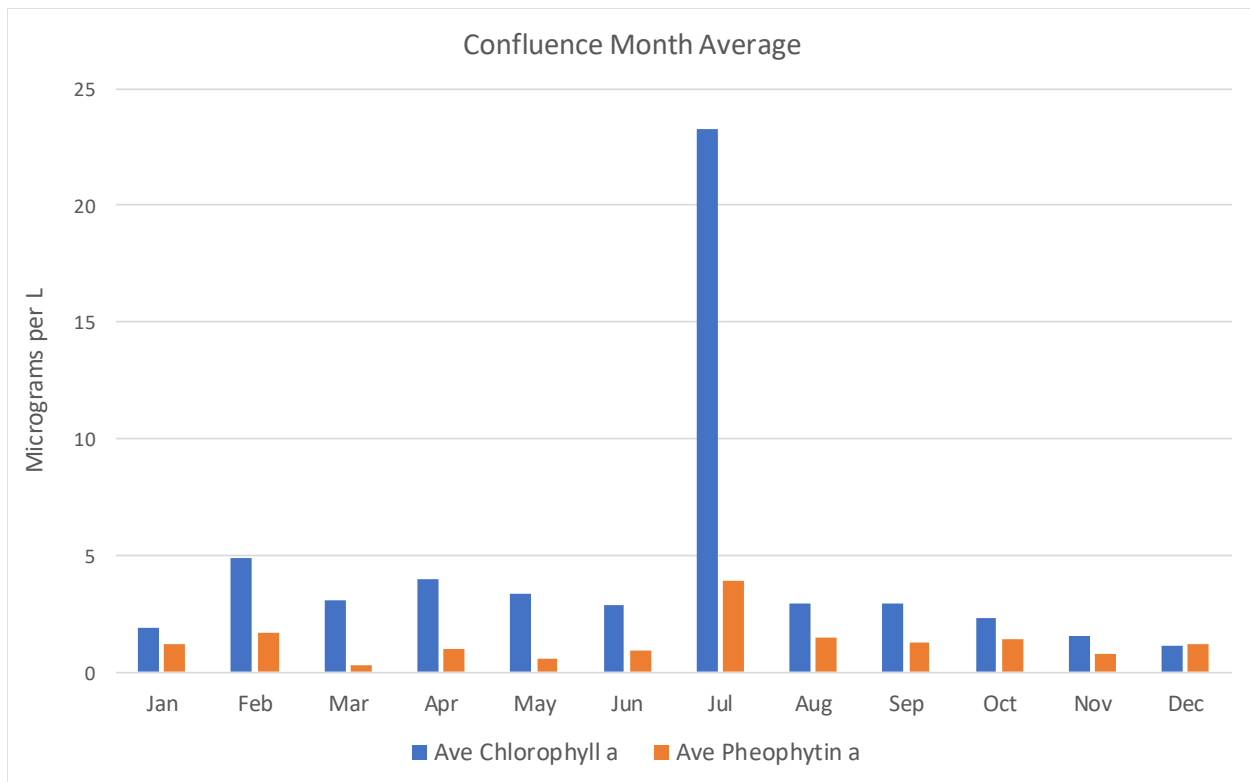


Figure 7. 2017 average monthly chlorophyll *a* and pheophytin *a* in the Confluence.

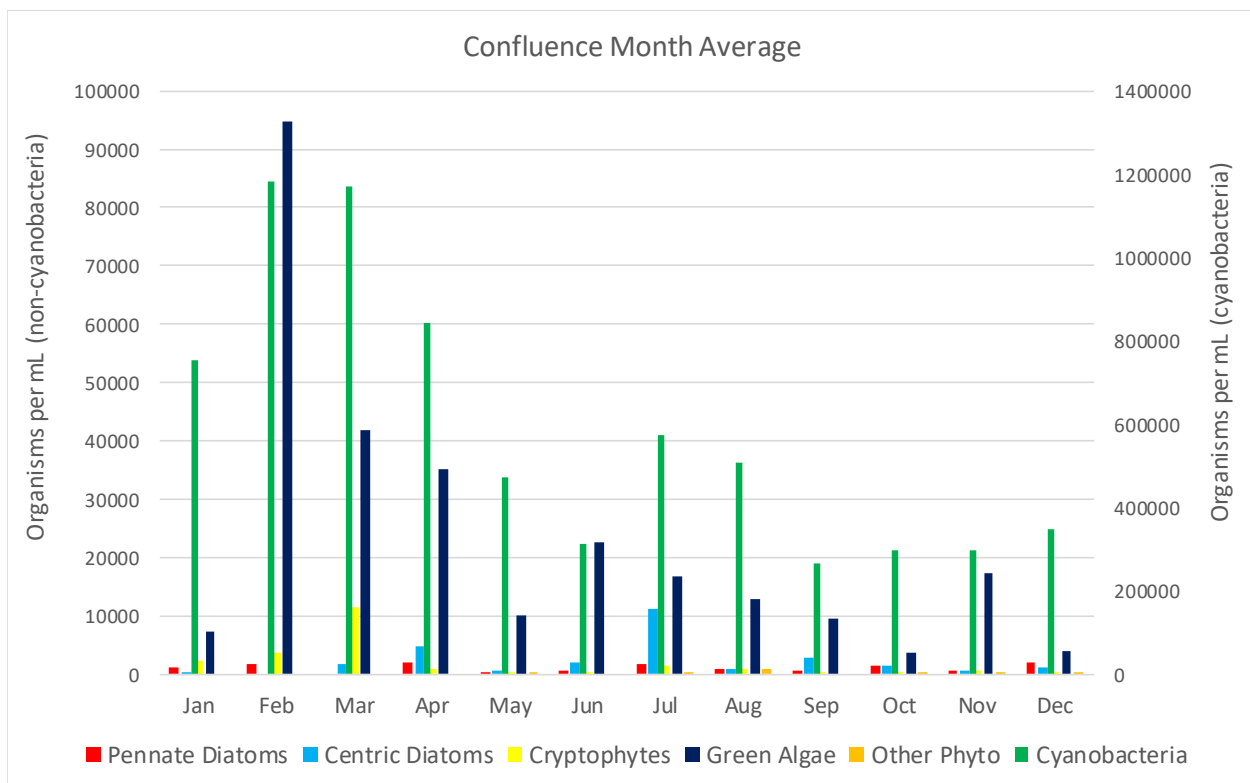


Figure 8. 2017 average monthly phytoplankton composition in the Confluence.

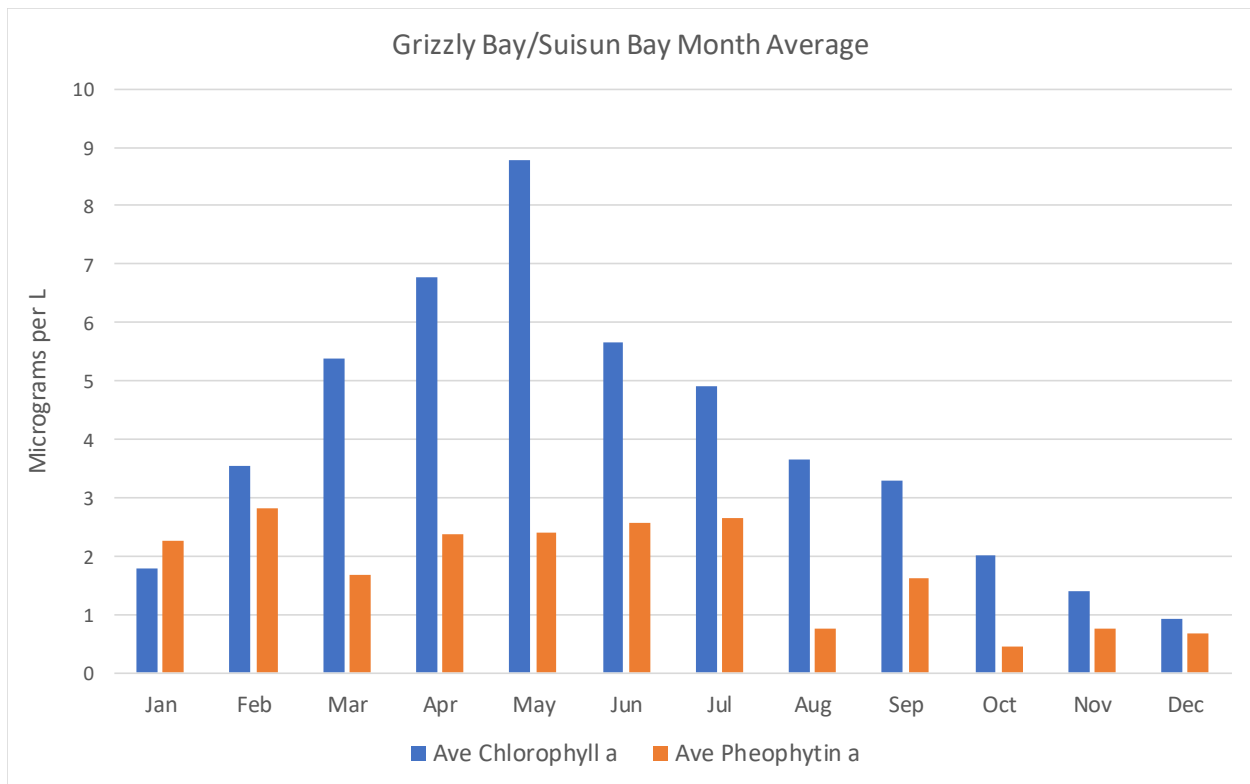


Figure 9. 2017 average monthly chlorophyll *a* and pheophytin *a* in Grizzly Bay/Suisun Bay.

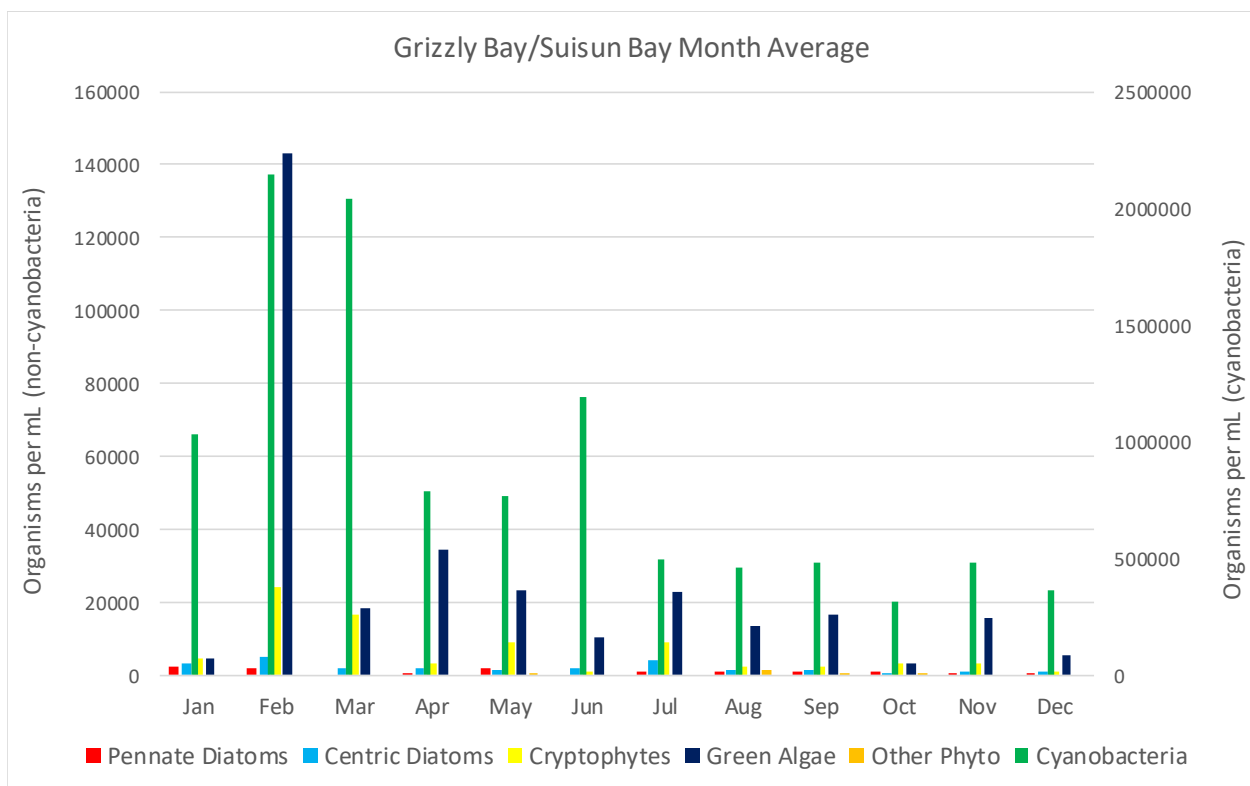


Figure 10. 2017 average monthly phytoplankton composition in Grizzly Bay/Suisun Bay.



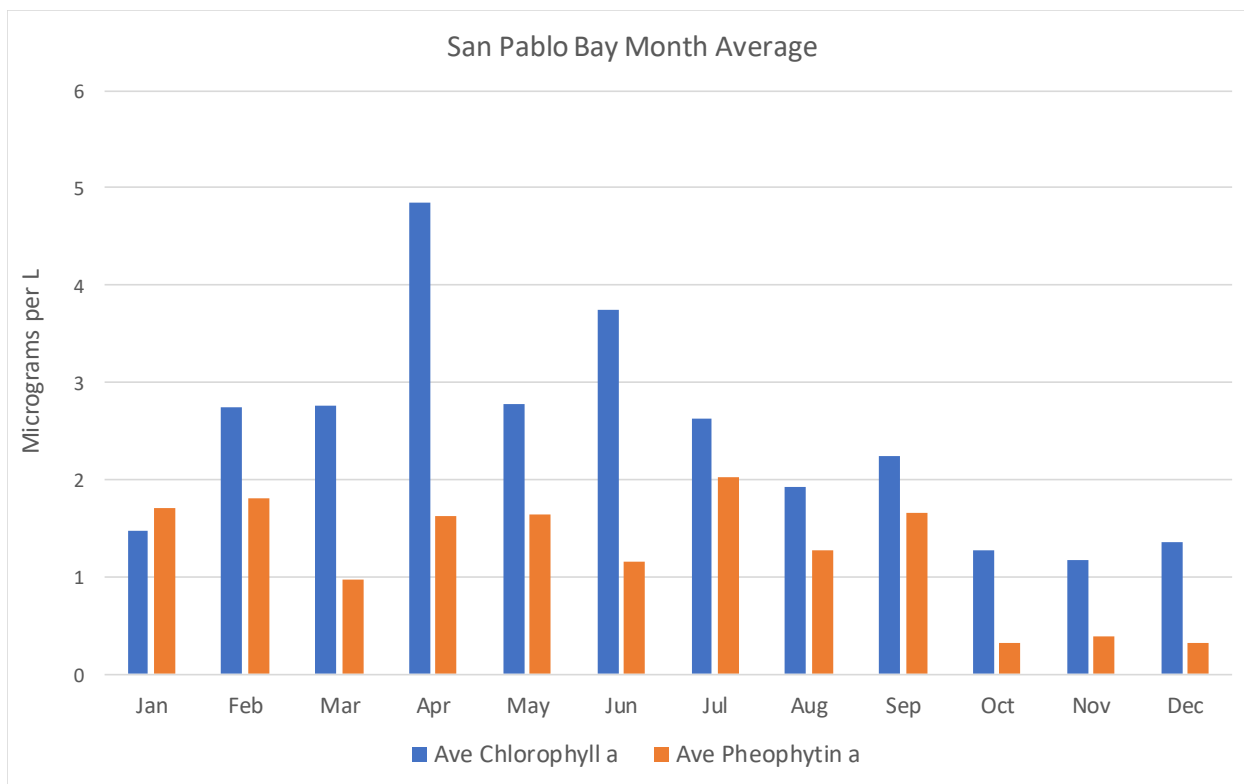


Figure 11. 2017 average monthly chlorophyll *a* and pheophytin *a* in San Pablo Bay.

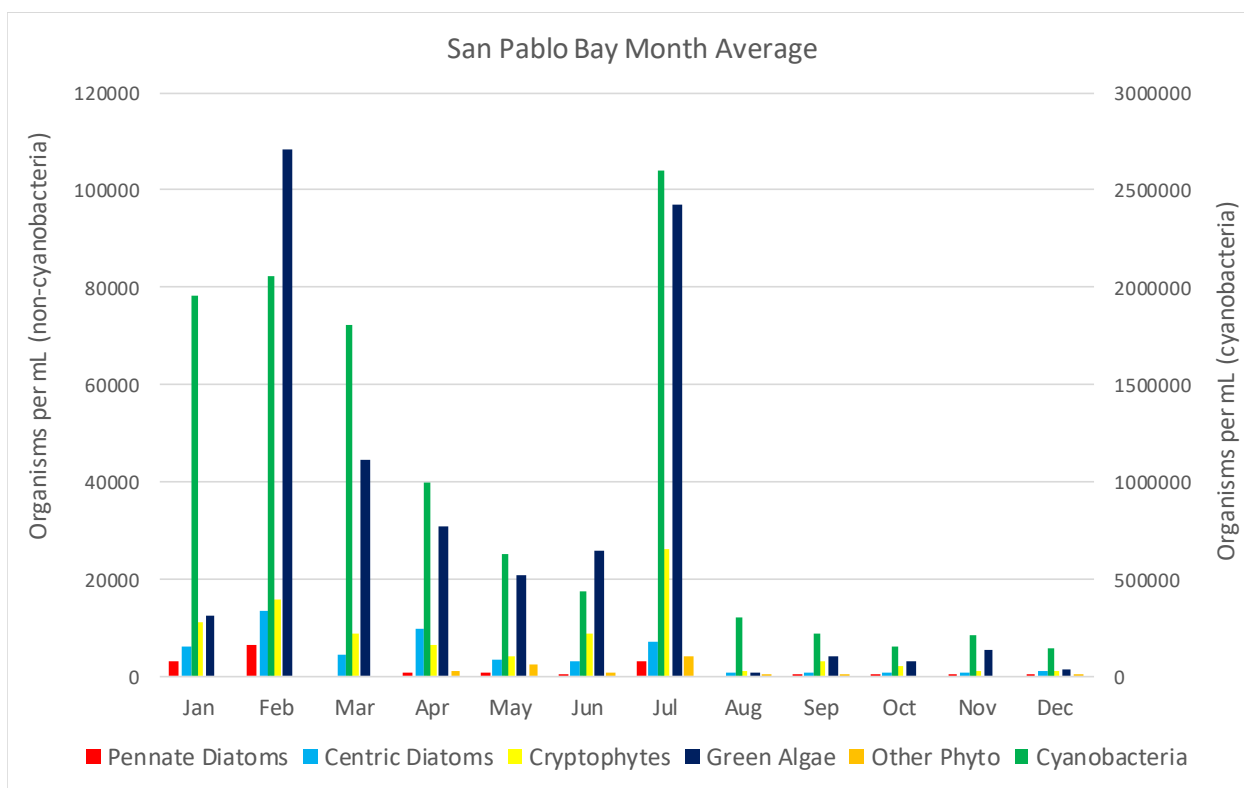


Figure 12. 2017 average monthly phytoplankton composition in San Pablo Bay.