

Postcards from the Bay

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Introduction

Phytoplankton play a crucial role in the world's oceans, providing oxygen, a food source, and a carbon sink. As microscopic heterotrophic organisms, they form the base of most marine food chains and produce up to 80% of the world's oxygen through photosynthesis. In our comparison of phytoplankton communities from three sites around the Monterey Bay – the North and South Santa Cruz Harbor, the Santa Cruz Wharf, and the Monterey Wharf – we hoped to determine if similar factors affected the individual genera populations at each site. To accomplish this, we studied four of the most populous phytoplankton genera: two diatom genera (*Chaetoceros spp.* and *Pseudo-nitzschia spp.*) and two dinoflagellate genera (*Prorocentrum spp.* and *Ceratium spp.*). We were able to compare the relative abundance of the genera based on the percentage of each in the overall composition of our samples. Comparisons like this have been done before, but never across the Monterey Bay Marine Sanctuary. We believe that the populations from the Monterey and Santa Cruz Wharf sites should have similar fluctuations in phytoplankton species and relative abundance.

Materials and Methods

- Phytoplankton net, rope, and cod
- Secchi disk
- Thermometers
- Tide books
- Salinity refractometer
- Collection bottles

Recording Abiotic Conditions:

1. Record time, tides, and any other relevant subjective observations (i.e., foggy, windy, etc.).
2. Fill pail with ocean water and record temperature in degrees Celsius.
3. Record turbidity in feet using Secchi disk and salinity in parts per thousand using salinity refractometer.

Collecting Phytoplankton:

1. Fill cod end of net with ocean water and attach to bottom of net.
2. Submerge net slowly in the water to the pre-determined number of feet (14 feet in south harbor, 7 feet in north harbor).
3. Slowly pull net back up. Repeat five more times in the south harbor and eleven more in the north harbor to obtain a sufficient amount of phytoplankton.
4. After the last pull, remove cod end from the net and pour the remainder of the sample into a separate bottle for later analysis.

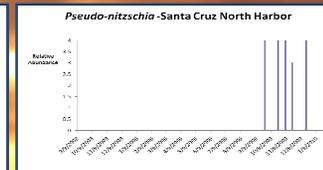
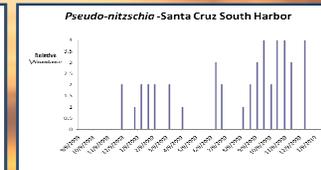
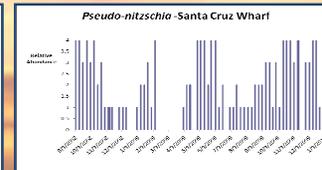
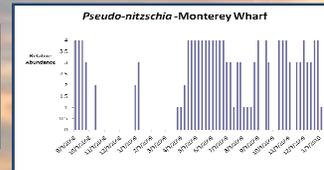
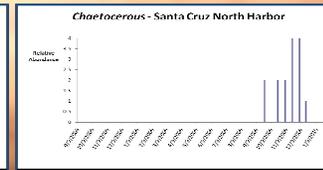
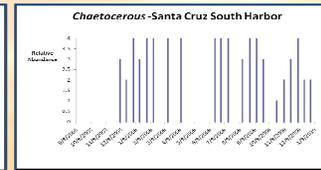
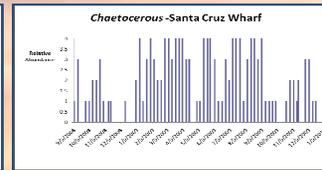
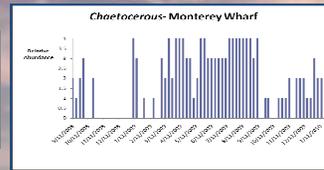
Testing:

1. Set up compound microscope.
2. Prepare microscope slide with 2 drops of preserved sample.
3. Starting with top left corner, move slide across light, left to right, at 40x magnification.
4. Examine any possible phytoplankton by shifting to 100x magnification.
5. Identify any phytoplankton found and record the total cell count of all genera.
6. Obtain percentage of each phytoplankton genera in sample and convert to relative abundance.

Acknowledgments

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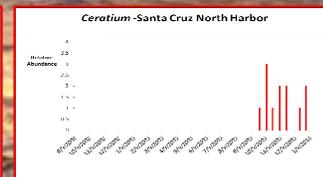
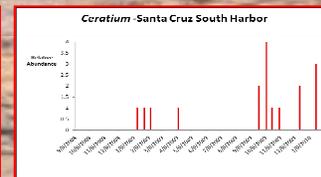
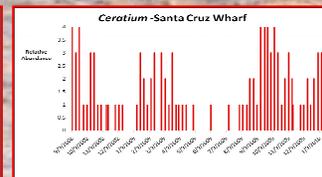
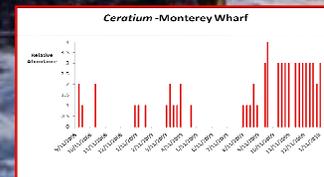
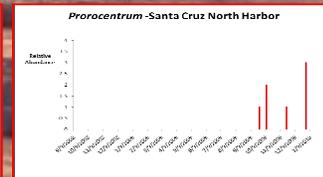
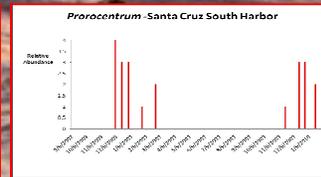
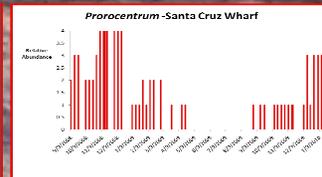
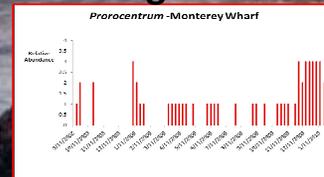
Diatoms



Key

- 0 = not present
- 1 = 0-1% of overall genera present in sample (rare)
- 2 = 1-10% of overall genera present in sample (present)
- 3 = 10-50% of overall genera present in sample (common)
- 4 = >50% of overall genera present in sample (abundant)

Dinoflagellates



Results

Our comparison of phytoplankton communities through four genera was successful. The four communities measured all displayed fairly similar trends in genera relative abundance. Diatoms (*Chaetoceros spp.* and *Pseudo-nitzschia spp.*) were almost always highly abundant in both the Monterey and Santa Cruz sites, which contradicts the commonly held theory that diatoms are prevalent in the spring and dinoflagellates dominate in the late summer and fall. Dinoflagellates (*Prorocentrum spp.* and *Ceratium spp.*) were more abundant in the fall, but the presence of diatoms was not diminished.

By examining our graphs, we determined that the phytoplankton genera follow corresponding population trends between the four sites. For example, when the Monterey Wharf experienced a period of high relative abundance for *Chaetoceros spp.* (such as in March 2009), the three other sites showed a similar increase in abundance. This pattern held true for *Pseudo-nitzschia spp.*, the other diatom genera, and *Prorocentrum spp.* and *Ceratium spp.*, the two dinoflagellate genera. We also determined that the dinoflagellate genera have a lower relative abundance than the diatoms because their populations rarely exceeded a value of 3 on the relative abundance scale.

Conclusion

We believed that phytoplankton populations around the Santa Cruz Wharf and Monterey Wharf would have similar fluctuations in the relative abundance of phytoplankton genera. Our results showed that phytoplankton populations from all four sites – the North and South Santa Cruz Harbor, the Santa Cruz Wharf, and the Monterey Wharf – displayed similar fluctuations in genera abundance. This seems to indicate that phytoplankton communities in the Sanctuary are influenced more by broad factors than by local ones. Such broad factors could include changes in season, upwelling, or natural phenomena. The factors affected the populations at the Harbor and wharves equally, even though the harbor is enclosed by jetties and has limited access to the open ocean. From our results, scientists comparing populations from different communities can now do so with the expectation that the results will be similar. Divergent results could indicate that a local event is affecting one of the populations, typically impacting other parts of the ecosystem. If, for instance, a bloom (a rapid accumulation of phytoplankton in a community) occurs, it is reasonable to assume that blooms will also appear at other Monterey Bay sites. Scientists monitor these blooms because those of certain toxin-producing genera can be detrimental to marine and human health. The next logical expansion of this study would compare data from communities along the entire California coast, determining if the same broad factors affect these populations.