A record breaking harmful algal bloom (HAB) composed of the domoic acid (DA) producing diatom *Pseudo-nitzschia australis*, occurred along the U.S. West Coast in the spring/summer of 2015 (FAQ: Harmful Algal Blooms and California Fisheries, 2016). The scientific community suggested that warmer ocean temperatures were the main cause of this HAB, but with little evidence to support the relationship between temperature and the growth of *Pseudo-nitzschia* spp. The research presented here represents the second half of a project to understand the effects of temperature on phytoplankton growth and toxicity, of low and non-toxic phytoplankton strains isolated from the 2015 HAB under a range of temperatures.

**Results**

**Result 1.** At temperatures above 15°C, the non-toxic diatom *Skeletonema costatum* had a lower growth rate than *Chaetoceros decipiens*, *P. fraudulenta*, and all three toxic strains of *Pseudo-nitzschia australis*.

**Result 2.** At temperatures below 6°C, the non-toxic diatom *Chaetoceros decipiens* and all three toxic strains of *P. australis* had no measurable growth.

**Result 3.** At temperatures greater than 10°C, the low-toxic diatom *P. fraudulenta* had greater than or equal growth rates in comparison to the three toxic strains of *P. australis*.

**Toxic results from B. Hansen**

**CONCLUSIONS**

Higher temperatures affect diatom growth rates:

- Above 15°C, the growth rate of *Skeletonema costatum* declined substantially. All other species in this and B. Hansen’s experiment either increased or maintained relatively high growth rates (Result 1).
- Therefore, *S. costatum* may not be competitive with these other diatom species in ocean temperatures above 15°C.

Very low temperatures inhibit diatom growth:

- Below 6°C, *C. decipiens* and all three strains of *P. australis* exhibited no measurable growth (Result 2).
- In areas with ocean temperatures at or below 6°C, oceanographers could expect to find low concentrations of low and/or non-toxic diatom species.

If temperature was the main cause of HABs, *P. fraudulenta* should have dominated the phytoplankton assemblages of the 2015 Bloom:

- Above 10°C, the low-toxic diatom *P. fraudulenta* had equivalent or greater growth rates than all three toxic strains of *P. australis* at the range of temperatures tested (Result 3).
- In hot spots of *P. australis*, *P. fraudulenta* should have been as prevalent using temperature as the only explanation for a HAB.
- Temperature is not enough; other factors contribute to these HABs.

**REFERENCES**


**ACKNOWLEDGEMENTS**

This project has been made possible with support from the National Marine Sanctuary Foundation (www.marinesanctuary.org) and the California State University STEM Teacher Researcher Program. In addition to these contributors, thank you to NOAA Northwest Fisheries Science Center colleagues for diatom isolations and Bridget Hansen for her work on *Pseudo-nitzschia australis*. 