March 13th, 2022

Dr. Michael Boufadel, Dr. Francois Galgani, Dr. Gui-Peng Yang

Co-Editors-in-Chief

Marine Pollution Bulletin

We are pleased to resubmit our manuscript, “Initial estuarine response to inorganic nutrient inputs from a legacy mining facility to Tampa Bay, Florida” to be considered as an original research article in Marine Pollution Bulletin. Once again, we thank the reviewers for providing helpful comments on the revised draft. Our response to these final comments is provided below. In short, we have revised the manuscript title, further simplified the graphical abstract, and provided additional clarification regarding the modelling components of this work. We are confident that these changes have further improved the draft, making it suitable for publication.

Sincerely,



Dr. Marcus W. Beck

Program Scientist

Tampa Bay Estuary Program

We sincerely thank the reviewers again for providing comments on our manuscript. As before, we provide a point-by-point response to these comments below.

## Reviewer 1

This revised version is significantly improved compared to the first submission. However, there are still some issues that need addressing. It remains an overall descriptive study with little or no mechanistic understanding of why the bloom happened- but perhaps that is OK. The writing is better.

* **Response**: Thank you for your comments and we are pleased to hear that the draft has improved. We have addressed the remaining concerns below.

Title- no one other than local people will know what a Piney Point is. Needs revision to something along the lines of: Initial estuarine response to a spill of phosphate mining waste: time course of a red tide following the Piney Point spill in Tampa Bay, USA

* **Response**: Agreed, the title has been changed to “Initial estuarine response to inorganic nutrient inputs from a legacy mining facility to Tampa Bay, Florida.” However, we have added “Piney Point” to the key words to assist with article indexing.

The graphics abstract needs a lot of work. It has far too many words and too much detail. Such an abstract is intended as a tease, not as a way to condense every detail of the paper. The little blurred icons are not helpful- I can’t even tell what some of the blobs are supposed to represent. No one needs dates and every detail for this presentation. It should not be a miniaturized poster. Simplify, simplify. Key points: the spill and the bloom followed.

* **Response**: The graphical abstract has again been revised for simplicity. We have enlarged the icons, removed unnecessary icons, and simplified the text.

Figure 8d looks like K brevis occurred on only 1 day or 2– odd.

* **Response**: Each point on the x-axis is one week. However, the upper limit of the y-axis was truncated to better emphasize the date ranges within which *K. brevis* was observed. This is also noted in the figure caption.

The paper lays out a lot of background and will be helpful to follow up papers.

## Reviewer 2

This is a nice paper that addresses the effects of a high visibility/publicity wastewater spill on an iconic estuary (Tampa bay). Most of my comments were addressed, but there are still a few issues that need additional attention.

* **Response**: Thank you again for your comments. We have made efforts to address your final concerns as noted below.

1. The authors didn’t address my question of how the plume model was verified, other than to point to a couple of papers. I read those papers and don’t fully understand them as I am not a physical oceanographer, but as far as I could tell, neither paper clearly stated how verification was made using field observations. Given that this paper is likely to be read mostly by water quality experts and not physical oceanographers, I feel strongly that the authors need to include a brief (plain language… not physical oceanographer-speak) description of modeled plume verification, especially considering that the field sampling and interpretation of results is so strongly dependent on accurate quantification of plume evolution.
   * **Response**: The Tampa Bay Coastal Ocean Model was previously tested for sea level and velocity field veracity under extreme conditions, e.g., Hurricane Irma ([Chen et al., 2018](#ref-Chen18)) and under more regular variations in tide, wind and river forcing by [Zhu et al.](#ref-Zhu15) ([2015](#ref-Zhu15)) and [Chen et al.](#ref-Chen19) ([2019](#ref-Chen19)). Model results closely followed observations over the time scale associated with tides, wind forcing and the longer term averaged net estuarine circulation. It was with this backdrop that we felt justified in adding a tracer component to examine how the Piney Point effluent would spread throughout Tampa Bay. Two additional tests were then performed. The first was to demonstrate that the model faithfully conserved the amount of tracer. Thus, we plotted what was known to be released and compared this with the integrated amount of tracer within the Tampa Bay Coastal Ocean model simulation. Both were identical. Next, we compared patterns of modeled tracer distribution with ocean color observations by satellite remote sensing. Again, the agreements were very good. In essence, if a model is known to faithfully reproduce the three-dimensional circulation features, then it should perform similarly in tracking a passive scalar because the scalar is transported and spread by the circulation. A dedicated paper of the modeling work (including model/data comparisons) is still in preparation. More details will be reported in that paper. Preliminary results were reported at a recent conference (see Weisberg 2022, [BASIS7](https://tbep.org/estuary/basis/basis7/)).
2. The authors speculate that nutrients were likely a driver of the abnormally high K. brevis abundances during the study. Is there any way to determine if the abundances observed in Tampa Bay were a result of growth vs. a physical concentration mechanism? This seems like it would be a good first step for giving the reader some confidence that nutrients from Piney Point played a role. For example, if you know the initial abundance coming into Tampa Bay via the inlet, can the plume model be used to estimate transit time to whatever location/time point maximum abundances were observed, and from that, can you use known growth rates to determine if those abundances are logical based on growth alone vs physical concentration?
   * **Response**: These are all valid points when considering the potential mechanisms driving the observed red tide in 2021. However, without additional data on timing and locations of cell concentrations and substantial modelling efforts, we cannot fully address this question. We do note in several locations in the discussion that the bloom did originate in the Gulf of Mexico, yet the availability of nutrients from Piney Point very likely increased the severity of the bloom in July. We provide some additional citations in the discussion to make this point more clearly ([Medina et al., 2022](#ref-Medina22), [2020](#ref-Medina20)).
3. The authors argue in several locations that elevated salinities are conducive to K. brevis growth. Need references to support this.
   * **Response**: We have added citations to the discussion, second to last paragraph: “Severe *K. brevis* blooms are rarer in estuaries because high abundances are most common at higher salinities typical of coastal or oceanic waters ([Steidinger et al., 1998](#ref-Steidinger98); [Villac et al., 2020](#ref-Villac20)).”
4. The discussion is awkwardly laid out, e.g., the first paragraph of “Additional interpretation of impacts” would seemingly belong in the previous section on “Nutrient cycling.”
   * **Response**: This paragraph was moved to the preceding section.
5. In the discussion section on seagrass impacts, there is a sentence that is confusing and possibly contradictory: “The results observed in 2021 suggested water quality conditions were not supportive of seagrass growth, although changes were not observed and the conditions likely did not persist long enough to impact seagrasses.”
   * **Response**: This sentence was revised as “Water quality results in 2021 suggested that conditions may have been light-limiting for seagrass growth (e.g., high chlorophyll concentrations, low secchi observations), although the conditions likely did not persist long enough to impact seagrasses.”

# References

Chen, J., Weisberg, R.H., Liu, Y., Zheng, L., 2018. The Tampa Bay Coastal Ocean Model performance for Hurricane Irma. Marine Technology Society Journal 52, 33–42. <https://doi.org/10.4031/MTSJ.52.3.6>

Chen, J., Weisberg, R.H., Liu, Y., Zheng, L., Zhu, J., 2019. On the momentum balance of tampa bay. Journal of Geophysical Research: Oceans 124, 4492–4510. <https://doi.org/10.1029/2018JC014890>

Medina, M., Huffaker, R., Jawitz, J.W., Muñoz-Carpena, R., 2020. Seasonal dynamics of terrestrially sourced nitrogen influenced Karenia brevis blooms off Florida’s southern Gulf Coast. Harmful Algae 98, 101900. <https://doi.org/10.1016/j.hal.2020.101900>

Medina, M., Kaplan, D., Milbrandt, E.C., Tomasko, D., Huffaker, R., Angelini, C., 2022. Nitrogen-enriched discharges from a highly managed watershed intensify red tide (*Karenia brevis*) blooms in southwest Florida). Science of the Total Environment 154149. <https://doi.org/10.1016/j.scitotenv.2022.154149>

Steidinger, K.A., Vargo, G.A., Tester, P.A., Tomas, C.R., 1998. Bloom dynamics and physiology of *Gymnodium breve* with emphasis on the Gulf of Mexico, in: Anderson, D.M., Cembella, A.D., Hallegraeff, G. (Eds.), Physiological Ecology of Harmful Algal Blooms. Springer-Verlag, Berlin, Heidelberg, pp. 133–151.

Villac, M.C., Hoeglund, A., Tilney, C., Garrett, M., Lopez, C., Hubbard, K.A., Steidinger, K.A., 2020. Ecophysiology and bloom dynamics of *Karenia* with emphasis on *Karenia brevis* in Florida waters, in: Rao, D.V.S. (Ed.), Dinoflagellates: Classification, Evolution, Physiology and Ecological Significance. Nova Science Publishers, New York, pp. 261–301.

Zhu, J., Weisberg, R.H., Zheng, L., Han, S., 2015. On the flushing of Tampa Bay. Estuaries and Coasts 38, 118–131. <https://doi.org/10.1007/s12237-014-9793-6>