

## Response to Reviewer #2

Thank you for reviewing our manuscript and for providing supportive comments. We appreciate the effort you made to improve this manuscript and are grateful for your insightful comments. The discussion below responds directly to the specific comments made by Reviewer #2. The reviewer's comments are in bold and italicized. The authors' comments are in normal font.

***One area where the manuscript could be improved would be to compare/contrast the study system with other well-studied west coast systems to demonstrate that the Pacific is the dominant nutrient source term in most cases.***

We will add a few sentences in the introduction to discuss other west coast systems that have been studied. The newly added text will be added starting on page 7137, at the beginning of line 18 as a new paragraph.

The new text will be:

“In a global context, N budgets for coastal systems have been well-studied, particularly on the east coast of North America (Nixon et al., 1995; Boynton et al., 1995; Castro et al., 2003; Schaeffer et al. 2007) To date, N budgets have been constructed for only 6 locations on the west coast of North America, including Tomales Bay (Smith and Hollibaugh, 1997), Elkhorn Slough (Caffrey et al., 2003; Chapin et al., 2004), Yaquina Bay (Kaldy, 2006), the Gulf of California (Sanchez-Carrillo et al., 2009), San Francisco Bay (Smith and Hollibaugh, 2006), and the Salish Sea (includes Juan de Fuca Strait, Strait of Georgia, and Puget Sound; Mackas and Harrison, 2007). Only 2 (of the 6) study locations, San Francisco Bay and the Salish Sea, are sites likely to be affected by elevated N loadings due to human activity. As such, neither of the remaining 4 locations are suitable proxies to compare and evaluate the influence of human-derived N on the west coast of North America. Further, it is difficult to compare the influence of human-derived N between San Francisco Bay and the Salish Sea since their basin shape (e.g. depth, length) and exchange rates with the open ocean are very different (Mackas and Harrison, 1997; Smith and Hollibaugh, 2006). Nonetheless, the Pacific Ocean appears to be the dominant source of dissolved N for coastal systems on the west coast of North America; based on the available data presented in the aforementioned studies. In general, the available data suggest that eutrophication, due to increases in N loading from human activities, is unlikely to occur on the west coast of North America.”

***An identified shortcoming is the lack of a description in the methods for how the uncertainties (standard deviations) were calculated for each budget term. This is important because many of the budget terms, especially the big terms that dominate the budget like the ocean exchanges, have standard deviations that make the budget terms not statistically different from zero. This is a typical problem for many budgeting exercises, and the authors should make the effort to describe how they calculated uncertainties and point to which of the measurements or calculations contribute most to this uncertainty.***

Thank you for recognizing that a section was not added to describe how the uncertainties were propagated. A description of how the uncertainties were propagated will now be included in the methods under a new section: “2.12 Calculation of Propagated Uncertainty” (page 7146 line 14). The following description of section 2.12 will be added to the text:

“The uncertainties (standard deviations) for budget terms determined from a calculation, such as the advective transport of DIN into and out of the SoG, were determined by propagating their uncertainties. Uncertainties were propagated onto the final calculated results using a linear approximation (a first order Taylor series expansion). This is the standard method for propagating uncertainties through a function onto a derived quantity (e.g., Bevington and Robinson 2003; JCGM 2008).”

The following citations will be added:

Bevington, P.R. and Robinson, D.K.: Data reduction and error analysis for the physical sciences, 3rd ed. McGraw-Hill, New York, 2003.

Boynton, W.R., Garber, J.H., Summers, R., Kemp, W.M.: Inputs, transformations, and transport of nitrogen and phosphorus in Chesapeake bay and selected tributaries, *Estuaries*, 18, 285-314, 1995.

Caffrey, J. M., Harrington, N., Solem, I., and Ward, B. B.: Biogeochemical processes in a small California estuary. 2. Nitrification activity, community structure and role in nitrogen budgets, *Marine Ecology Progress Series*, 248, 27-40, 2003.

Castro, M.S., Driscoll, C.T., Jordan, T.E., Reay, W.G., and Boynton, W.R.: Sources of nitrogen to estuaries in the United States, *Estuaries*, 26, 803-814, 2003.

Chapin, T. P., Caffrey, J. M., Jannasch, H. W., Coletti, L. J., Haskins, J. C., and Johnson, K. S.: Nitrate sources and sinks in elkhorn slough, California: Results from long-term continuous in situ nitrate analyzers, *Estuaries*, 27, 882-894, 2004.

JCGM 100: Evaluation of measurement data — Guide to the expression of uncertainty in measurement 120, 2008.

Kaldy, J. E.: Carbon, nitrogen, phosphorus and heavy metal budgets: How large is the eelgrass (*zostera marina* l.) sink in a temperate estuary?, *Marine Pollution Bulletin*, 52, 342-353, 2006.

Nixon, S.W., Granger, S.L., and Nowicki, B.L.: An assessment of the annual mass balance of carbon nitrogen and phosphorus in Narragansett Bay, *Biogeochemistry*, 31, 15-61, 1995.

Sanchez-Carrillo, S., Sanchez-Andres, R., Alatorre, L. C., Angeler, D. G., Alvarez-Cobelas, M., and Arreola-Lizarraga, J. A.: Nutrient fluxes in a semi-arid microtidal mangrove wetland in the gulf of California, *Estuarine Coastal and Shelf Science*, 82, 654-662, 2009.

Schaefer, S.C. and Alber, M.: Temperature controls a latitudinal gradient in the proportion of watershed nitrogen exported to coastal systems, *Biogeochemistry*, 85, 333-346, 2007.

Smith, S.V. and Hollibaugh, J.T.: Annual cycle and interannual variability of ecosystem metabolism in a temperate climate embayment, *Ecological Monographs*, 67, 509-533, 1997.

Smith, S. V., and Hollibaugh, J. T.: Water, salt, and nutrient exchanges in san francisco bay, *Limnology and Oceanography*, 51, 504-517, 2006.