

Interactive comment on “Can whales mix the ocean?” by T. J. Lavery et al.

Anonymous Referee #3

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This is an interesting and thought provoking paper, but I have some concerns about the calculations and the presentation. On the presentation, the authors present a very nice review of the biomixing literature. While they do a good job presenting counter arguments, the main thrust is that biomixing could account for a globally significant amount of mixing, potentially on the order of 1TW. This flies in the face of their main conclusion that sperm whales make a modest contribution to the diffusion of nutrients into the euphotic zone off Hawaii. If the contribution is modest, how can it be globally significant? I realize that the authors never claim that whale biomixing is globally significant, but the tone of the introduction certainly leads the reader in that direction. I would prefer that the introduction and abstract tone down the global significance talk and focus more on the importance of nutrient transport. My second point concerns the calculations, specifically, equation 2. This equation essentially says that the whale creates a volume of turbulent wake roughly proportional to its body volume. I am not

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familiar with the literature on turbulence behind swimming animals, but I'm skeptical that the volume is really this large. Whales have evolved to be very efficient swimmers, and this means minimizing turbulence. I could imagine some vortices coming off of the edge of the fluke, but I would guess that these comprise only a small portion of the volume envisioned in equation 2. My impression is that Equation 2 describes the volume in which whale induced turbulence could occur, but I think the real volume of turbulent water is smaller. I would like to see the authors slow down in this section and spend some more time on the details of this part of the calculation (for example, summarizing some of the literature cited). This could easily be done at the expense of some of the introductory text. A diagram would also be very helpful.

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