

Author response Feb 2 2021.

We have fully addressed all review comments, questions, and suggestions along the lines of our specific responses to reviewers 1 and 2 submitted in December 2020. We appreciate the efforts of both reviewers and their efforts have improved the paper. In responding to reviewers, we have included a new discussion of errors in Sect. 2.2.4, moved one section from results (formerly Sect. 3.5) to methods (as Sect. 2.4). Throughout the manuscript we have addressed review comments or clarified discussion as requested. The reviewers requested simplification of figures 15 and 16. We have done this. The reviewers requested additional figures (SEM and satellite imagery are added to the Appendix figures), and tables (Tables 2 (euphotic zone properties) and 4 (Martin fits to sediment trap data) are new additions to the paper. Table A1-1 provides tabulations of aggregate and fecal pellet counts from Methods 2 and 3 as requested by reviewer 1. To compensate, for additional discussion and clarification of results, we have gone through the manuscript to focus the writing. In the end, the line count for the body of the manuscript between new and the Sept 30 2020 version has increased by 13 lines. The major findings of the study remain substantially sustained. We hope you find the revised manuscript suitable for acceptance for publication.

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Specific actions follow.

R1 - P3 L72 done
R1 – P5 L124/L128 changed wording
R2 – P5 L126 changed discussion of the size of the shark
R2 – P5 L141 add Bourne et al. ref.
R1 – P5 L147 – add regression stats of calibration slope
R2 – Sec 2.2.2 – clarified
R2 – L154-155 – moved to discussion
R1 – P6 L151 – done as stated.
R2 – L166 – removed
R1 – L165 – pixel size stated (13 um)
R2 – eliminate / condense lines 169-227. This methodology is central to the paper and thus must be retained.
R1 - L213 Requested tabulated data (pellet vs aggregates M2 vs M3). Now Appendix Table 1.1
R1 - L235/L245 typos fixed
R2 - L246 – UPV data were non-living – stated.
R1 – L263 – add units. Done
R1 – Simplify Section 3.1. Create Table to aid writing. Done – new table 2. Sec 3.1 simplified.
R1 – CFE trajectories do match ADCP data – added fer to Fig. 9
R1 – L293 – modified shark discussion
R1 – 312 grammar – fixed

R1 L317 – mixed
R1 L324 – CFEs are Lagrangian as shown in Fig 9.
R1 L336 – typo – fixed
R2 L357-363 – particle descriptions now refer to Figs. 6 and 14. Captions of 6 and 14 modified.
R2 L360 – text clarified
R1 L364 – separated plots for each deployment; Fig 15 was extensively redone.
R1 L365 – typos
R1 L365 and R2 L366-369 Fit methodology. We have clarified the fits. We understand the Log bias effect, but curves fit to individual dives and pooled data yield curves with very similar trends. Our new Fig 16 has examples.

We provide dive averaged ATN fluxes and NO fluxes in 30-100, 100-200, 200-400, 400-1000, >1000 μm and total flux categories along with estimated errors in Supplemental materials so that readers can reanalyze our results.

R1 L373. Fig 16. Simplify. We have greatly simplified data in both Fig 15 and 16.
R1 L378 significance – we have analyzed counting errors and they do not impact interpretation.

R1 and R2 L 380 requested SEM imagery – now as Appendix figure. Discussed significance.

R2 L388-389; 569 sinking speeds now are backed by literature based estimates.
Added discussion.

R1 L400 – significance of slopes discussed.
R1 L402 – flx increase at L2 far exceeds errors. (see Fig A1-5).
R1 L406 – fast method – fixed
R1 L415 – typo fixed
R1 L418 – fixed unit issues
R2 L423-433 – Move to methods – moved

Fig 12 becomes Fig 10, Fig 10 -> 11, Fig 11->12

We added reference to archived original data and provided averaged NO₃ results as a supplement

R1 L428 – typo fixed
R2 L444. CFEs Lagrangian? – Figure 9 confirms this fact.
R1 L446 – binning of SSH and CHL determined by satellite product.
R1 L455 – clarified Siegel discussion and simplified Fig 17
R1 L472 – Provided figure A1-7: CZCS imagery from June 1984 near VERTEX station
R2 L485-489 – we clarified reference.
R1 L496; R2 L493-499 – Provide significance of results. Table 4 has fitted results. Significance discussed.
R1 L501 discussion clarified
R1 L509 uncertainties discussed
R1 L517 we think we have clarified results
R1 L519 we discuss uncertainties in new Methods section
R1 L521 Fig 18 caption and discussion is clarified
R2 L521-524 – references added as requested.

R1 L536 Fig 5. Flux trends are relatively small. While 500 decreases, 250 increases

R2 L552-554 – Reference added

R1 L574. Larvacean house production rate – referenced

R1 L607. Uncertainties discussed. L2 results are robust

R1 Requests error discussion. Inserted new section 2.2.4. Added Appendix Fig A1-5 illustrating errors. We conclude that counting errors are not significant drivers of the observed variability in flux observations. We contrast L3 and L2 results. It was a useful exercise.

R1 L625. Typo – fixed

R2 L625-627 – references in the paragraph.

R1 L677. Clarified discussion of olive pellets

R1 L683. Trends of flux by different size classes are not influenced by the count probability

R2 689-690 – clarified remarks

R2 691 – reference P in particles. Done

R1 L698. Clarified discussion

R1 L713 typo fixed