Interactive Discussion Comment on the Biogeosciences discussion paper: *The vertical distribution of buoyant plastics at sea* by J. Reisser et al. (bgd-11-16207-2014)

Referee: Anika Ballent

Overall / General Comments:

This paper is scientifically significant (rated: excellent) due to the novelty of using a multi-level trawl to quantitatively address the lack of understanding about the vertical distribution of microplastics within the surface layer of the world's oceans. The authors' thorough investigation of the effect of sea-state on surface plastic estimations has important implications for improving estimations and models of total surface plastic loads in the oceans.

The scientific quality (rated: good) could be improved by addressing a couple instances of overgeneralization within the text and clarifying statements which are ambiguous as to where the information was take from (see below). In text citations could be used more specifically. For example, there are several cases where a citation is listed at the end of the sentence, although it only refers to a part of the previous statement. These instances could be improved by instead writting "Author et al., year suggested/reported/etc. that …". Otherwise, the experiments and calculations are clearly traceable allowing for reproduction of the work presented here in future studies.

The paper's presentation quality is excellent. Overall, the paper is clearly written and flows well. It is well structured and demonstrates appropriate use of the English language. Tables and figures are supportive in presenting the results. In my opinion, pronouns "It, them, they, etc" were used too often, especially within the methods section, however this simply an aspect of writing style. Although the pronouns are used correctly, this style may increase the chance for readers to misunderstand the methods. The abstract is concise and complete and the title is representative of the paper, but it could be clarified with a subtitle, for example, "The vertical distribution of buoyant plastics at sea: a case study in the North Atlantic Ocean."

Specific Issues/Concerns:

In the introduction, on page 16209, line 9, "mostly fragments of packaging and fishing line" is only supported by Reisser et al., 2013 for the waters surrounding Australia. I would suggest finding additional support for this statement, e.g. Hidalgo-Ruz et al., 2012, or clarify the statement by making it less generalized.

The methods and assumptions are valid and clearly outlined, but in several cases it was necessary to read the figure captions to fully comprehend some points. I would suggest to include the information that is in the figure captions within the text as well so as to minimize confusion when reading. For example, it is not clear whether or not each of the four sampling stations were sampled at each of the 3 sea-states until one reads Figure 3. Also, in the methods section, it is not clear whether the Kukulka model is specifically for the prediction of **numerical** or mass concentration.

In the discussion section, I suggest to discuss the implications of not including any thin filaments from samples in analysis. Additionally, on page 16215, lines 11-20, other studies concerning estimation of total surface plastic amounts are mentioned. I would suggest also mentioning of the most recent publication by Eriksen et al. 2014 (Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea) which aims to extrapolate and estimate total global plastic amounts. On page 16215, line 25, the citation of Ballent et al, 2013 is inaccurate; it was not specifically a turbulence assay but rather and examination of the effects of subsurface velocity and shear stress on subsurface transport of plastics using a model. I would change "As shown here, in a previous turbulence assay (Ballent et al. 2013)…surface." to "As shown here and in two modelling studies, vertical mixing affects the subsurface transport of plastics and the size distribution of plastics floating at the surface." On page 16216, the statement in lines 15-17 is underdeveloped and does not satisfactorily support the previous statement. How do/may the study results affect this observation? In general, the discussion could go into more depth regarding potential effects of the results on estimates of plastics concentration, total amounts, models, subsurface transport, and effects on biota.

Technical Corrections: (mostly suggestions)

Page 16208

Line 5: change "subsurface" to "in situ"

Line 6: "12 sites" is misleading. Change to 4 sites or 12 samples?

Line 7: Sentence beginning with "By using…" sounds like the physical properties were measured using the trawl. I suggest rewording this sentence.

Line 9: Change "but" to "and"

Line 21: Change "on" to "via"

Page 16209

Line 3: I don't think the word "Each" can be used as it is too much of an extrapolation and is thus unscientific.

Line 5: Carpenter and Smith, 1972 mentions plastics being smaller than .5 cm but doesn't seem to define microplastics as such. I would remove this citation and find a review-type study to support the statement, e.g. Hidalgo-Ruz et al., 2012 (see Review of Methods section) and Arthur et al., 2009 (Proceedings of the International Research Workshop on the Occurrence, Effects and Fate of Microplastic Marine Debris. Sept 9-11, 2008. Arthur, C., Baker, J., Bamford, H., Eds.; NOAA Technical Memorandum NOS-OR&R-30, 2009).

Line 10: Again, to extrapolate results from the North Pacific to the entire world's oceans is not valid in my opinion. I would suggest to instead change "mostly" in Line 9 to "commonly". Moret-Ferguson et al. only studied the North Atlantic. Either make the sentence more specific (i.e. Plastic in the North Atlantic are mostly...) or add more references to include studies done in the other gyres).

Line 13: “It is predicted..” It is not clear whose prediction this is. Is this the guiding hypothesis of this study?

Line 15: “…,where only a few low-resolution measurements exist (Lattin et al…)” I would suggest moving this to the beginning on the sentence; e.g. “As suggested by a few low-resolution measurements (Lattin…), it is predicted in this study that…”

Line 20: change “at” to “in”

Line 23: change “at” to “in”

Line 24: change “decays” to “decay rates”

Page 16210

Line 3: Insert “from 4 sampling locations” after “12 multi-level net tows”

Line 6: Change “type of equipment” to “collection device”

Line 8: Change “onto each other by an” to “vertically and secured within an”

Line 10: Insert “completely” between “net above”

Line 13: Change “while the net system was towed” to “of each sampling period”

Line 15: Change “for” to “during”

Page 16211

Line 2: Two other recent studies could be cited: Mathalon and Hill, 2014, Microplastic fibers in the intertidal ecosystem surrounding Halifax Harbor, Nova Scotia and Dekiff et al., 2014, Occurrence and spatial distribution of microplastics in sediments from Norderney.

Line 9: Change “at:” to “at depths of” and remove “deep” from end of sentence.

Line 17: Include units after $w_b = 0.0053$ (m s^{-1})

Line 21: Missing reference for Pugh (1987)

Page 16213

Line 2: Insert “Depth” before “Profiles”

Line 16: Explain that the three numerical ranges refer to the ranges of frictional velocity typical for each sea-state. This is explained in one of the figure captions but would be helpful to have in text too.

Line 20: Change “plastics” to “plastic pieces”

Page 16214

Line 6: Change “deeper” to “greater”

Line 8: Word “proportion” is ambiguous. Is it referring to the fractional amount or the length of plastic pieces? Also, change “underwater” to “submerged below 0.5 m”?

Line 21: “is due to the fact” is too absolute in my opinion. Would change to “can be explained by our observation”

Page 16215

Line 1: Insert “as determined in our study” after “surface layer”

Line 3: Change “underwater (>0.5 m deep)” to “submerged > 0.5 m below the water surface”

Line 10: “lighter” is ambiguous, change to “less dense” or “smaller”

Line 23: Change “then” to “better”

Line 27-29: Reword this sentence: “We observed...sizes” to “We observed the proportions of plastics mixed into deeper waters to increase towards smaller size even under low wind speed (1 knot) conditions.”

Page 16216

Line 7: Insert “further” before “quantify”

Line 29: Capitalize Eric

Page 16217

Line 3: Change “receives” to “received”?

Page 16219

Line 5: cannot find the data set using Information given for figshare (Reisser et al., 2014b). Data sets from Reisser et al, 2014a (Millimeter sized marine plastics: a new pelagic habitat for microorganisms and invertebrates) were found but not data sets from this paper.

Page 16220

Figure 1 caption should include a note about the trawl depiction.

Add “and solid grey line” to (grey dots)

Page 16223

Include corresponding Beaufort values with 1 knot and 15 knot wind speeds in captions

Page 16224

Change “x” to “versus”

Change “boxplot of rise velocity at different depth intervals” to “boxplot of rise velocity for plastics collected at different depth intervals”

Note to the authors:

Please be aware that this is my first referee assignment and that I am currently pursuing my Master’s degree. I have given my best effort in analyzing this discussion paper, but am not yet fully accustomed to the peer-review process, so please pardon any atypical comments.