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Interactive comment on "Reviews and syntheses: Processes and functional genes involved in nitrogen cycling in marine environments" *by* Ramiro Ramos and Silvia Pajares

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We would like to thank the Reviewer for the review and the valuable suggestions, which will help us to substantially improve our manuscript. We address each of your points raised (between quotation marks) below.

1. "The manuscript summarizes the very relevant topic of marine N cycling, addressing all major N cycling processes. Due to the existence of excellent reviews in this field (e.g. Voss et al 2013, Zehr and Kudela 2011, Lam and Kuypers 2011, Devol 2015), composing a review paper on this topic is a challenging task. In its current state, the manuscript does not represent a substantial contribution to the N cycle community. However, the

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authors mention a number of important aspects which could be elaborated further in order to focus more on new findings and ideas rather than repeating aspects that have already been reviewed. These aspects could potentially include (among others): more emphasis on anthropogenic effects on the N cycle (and potentially connections with C cycle), budgets of N loss processes and factors favoring N-loss (e.g. denitrification vs. DNRA) and the production and consumption of climate-relevant gases such as N2O."

We share your opinion that writing a review paper on this topic is a very challenging task given the many great contributions made by other authors in recent years. However, the review papers you mention cover aspects of marine N cycling that differ from the main aim of our manuscript. For instance, Voss et al. (2013) only covered some of the major N processes (i.e. N2 fixation, anammox, and denitrification) in surface waters, OMZs and coastal environments with an anthropogenic perspective without delving into the participant microbial communities. In a similar way, Zehr and Kudela (2011) did an excellent review of the current understanding of marine N cycling, focusing in budgets and connections with the cycling of other nutrients and mentioning N assimilation, N2 fixation, nitrification, anammox, and denitrification without delving into the ecology and distribution of the microorganisms involved. Other recently published papers have covered the N cycling only in specific marine environments. For example, the review by Lam and Kuypers (2011) covered the major N cycling processes in OMZ or the review by Devol et al. (2015) focused on N2-producing processes occurring in marine sediments, such as anammox and denitrification. In our review we try to go further, summarizing the current knowledge on the N processes studied so far in many marine environments and including new findings and processes that previous reviews have not addressed, such as the recent findings of N-DAMO in OMZs and anoxic estuarine sediments, as well as the distribution of microorganisms involved in the N cycling in marine environments and the factors affecting it. Thus, we consider that with the proper modifications our review paper could represent a good contribution to the scientific community working in this field. We also agree that the manuscript can be improved and in the new revised document we will emphasize more on anthropogenic

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effects on the N cycle and will include all the suggested recommendations.

2. “While the abstract provides a complete and concise summary of the topic, the overall representation of different aspects of the N cycle is not well-structured. Each N process is divided into sub-sections on factors affecting a specific process and on the distribution of organisms carrying out this process in the environment. However, as factors such as temperature, salinity, depth and oxygen concentrations define different environments, these two sections are highly repetitive and can be shortened and structured in a more concise way.”

We think that the division into sub-sections for each N process reflects well what we try to show in our manuscript; however, we will revise it and try to restructure the information in order to make it more concise and less repetitive.

3. “In addition, some N process sections introduce other N processes (e.g. ANRA in the DNRA section). This issue could be overcome by a more detailed general introduction, which is at the moment rather short. A broader division into oxic vs anoxic, or nitrogen fixation/assimilation vs N loss processes could also help to guide the reader better through the different processes.”

We appreciate a lot the Reviewer’s suggestions. We agree that we can improve the general introduction giving more detail information, so we will further work on it and we will also divide the presentation of the nitrogen processes as the Reviewer recommends.

4. “In addition, some aspects on nitrifying microorganisms are not well represented in the manuscript. AOA are the dominant ammonia oxidizers in most parts of the global ocean, which does not become clear in the manuscript. Also, some statements regarding nitrifiers are too general e.g. it is not entirely clear why nitrifiers are mostly absent in surface waters and there are more potential explanations than UV light (specifically in the case of AOA). The whole process of nitrite oxidation is only mentioned in two sentences and the diversity and distribution of nitrite oxidizers is missing. While the

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recently discovered ‘comammox’ is a very interesting process and of great important for the N cycle community, thus far there is no evidence of the existence of this process in the marine environment. Hence, a whole section on comammox in a review paper on marine N cycling is not necessary.”

We thank again the Reviewer for the good recommendations. We will improve this section by expanding the information related to AOA, AOB and NOB communities; nevertheless, we cannot delve into the subject too much since our manuscript is intended to be a general review of the microbial communities involved in each of the different nitrogen processes studied in different marine environments. We agree with the Reviewer that there is no evidence of the existence of comammox in the ocean; then, we will remove the comammox section in the revised manuscript.

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