Reply to reviewers:

Reviewer 1: In my first review I made the comment that there needed to be a clearer description of the megafauna at nodule locations. I may not have been clear enough here – what I meant was a summary of the state of knowledge, not a description of the main taxonomic groups present (as was provided in section 1.1). This would include discussion of the very large number of new species (most of which have not been described), the lack of knowledge on distribution of individual species, lack of knowledge of the ecosystem as a whole etc.

A similar point was made by Adrian Glover in his comments "Almost all of the fauna being observed in the images are either undescribed or lack local taxonomic records linked to vouchered specimens. This means it is not possible to identify the animals observed to species level. For this reason, image survey can-not replace actual sampling until such time that we have a reasonably good checklist of known species (verified from samples) from the region where the image survey is taking place."

The authors have still not fully addressed this, adding just 2 sentences in section 4.3 - more could be added in section 1.1. This aspect does have a major bearing on the limitations of the method they are proposing.

Author's Reply: We have chosen to modify section 1.1 substantially to address the reviewers comments and added the following:

Manuscript changes: "In addition to providing a hard substrate for living attachment, nodules also increase the range of hydrodynamic niches available to the local ecosystem fauna (\cite{Mullineaux (1989)}), as well as adding complexity to food fall transport pathways. Recent cruise observations from the DISCOL region showed rapid transport of dead pyrosomes, following a surface bloom, to the seafloor (\cite{Boetius (2015)}). These dead pyrosomes were then hydro-dynamically trapped by benthic currents alongside nodules, providing a local food supply to the nodule community which might otherwise have been transported from the region by the ambient benthic flow conditions. This flow dynamic variability also impacts on the habitat niches available for infauna (across all infauna size classes) below and surrounding the nodules, with their presence influencing local biogeochemical activity and oxygen penetration pathways.

At this crucial time point in research into polymetallic nodules and associated fauna, it is important to highlight also the gaps in current knowledge, and that any management plans developed take these shortfalls into consideration. At time of writing it is clear even from the sparsity of published megafauna papers from nodule regions that these ecosystems are not synonymous with each other. The Peru Basin region of the south Pacific seems to support a generally higher abundance of stalked fauna than the Clarion Clipperton Fracture Zone (CCFZ) nodule domains (\cite{Bluhm, 2001; Vanreusel et al., 2016}). Some large megafauna, such as benthic octopodes have thus far only been observed within these nodule ecosystems in the south Pacific (\cite{Purser et al. 2016}), as have some fish species (\cite{Drazen et al., 2019}) despite the recent increased sampling effort across the CCFZ. Conversely, the abundant sessile sponges recently characterised from the CCFZ, Plenaster craigi, (\cite{Lim et al., 2017}) is not apparent in images or analysed samples collected from south of the equator. Whether these discrepancies are due to oceanographic, nutrient or habitat niche differences is not yet known. It may be considered that the larger nodule sizes found in the Peru Basin region are more suitable as anchors for stalked fauna of sufficient

stability to allow brooding by octopodes for the hypothesised years required by deep sea incirrates (\cite{Purser et al., 2016}).

Another major absence in the scientific data set is sampled voucher specimens from nodule provinces. Opportunistic direct sampling by Remove Operated Vehicle (ROV) has taken place on a limited scale, though the ground-truthing of image and video data collected by ROV and Automated Underwater Vehicle (AUV) to species level is at present, not possible. Though this is an obvious disadvantage over direct sampling of the seafloor by trawl etc. to determine the present fauna mix, this is perhaps to some extent countered by the far larger areas which may be surveyed rapidly by towed and remote camera systems – an important point given the extremely sparse distribution of many fauna individuals of morphospecies in nodule ecosystems (\cite{Bluhm, 2001; Purser et al., 2016; Vanresel et al., 2016; Simon-Lledo et al., 2019c}). These sparse distributions make impact assessments more problematic than for denser fauna categories which have historically been subject to direct impact by the offshore fishery or petrochemical industries, such as coral and sponge reefs, where atolls and accumulations can be directly surveyed prior and post-cruise, either via imaging or direct sampling (\cite{Purser, 2015; Howell et al., 2016; Huvenne et al,. 2016}). Whether future management plans favour a direct or an image-based monitoring approach to megafauna diversity and stock assessment, the requirement to fill these holes in extant voucher specimen collections from these regions is equally prescient."

Reviewer 2 - Comment 1: do not need comma after ecosystems (Line 22)
AC: Done.

R2 – C2: the t in the must should be capitalized- start of sentence (Line 120)
AC: Done.

R2 – C3: there are a number of acronyms that are not 'defined', no impact on paper.
AC: We added the full definition of the acronyms to the text at their first appearance outside the abstract.

R2 – C4: should the word form replace from? (Line 331)
AC: Yes. Has been corrected.

R2 – C5: funny wording, suggested change: values; all but one are above 0.7, which… (Line 323/333)
AC: Done.

R2 – C6: Figure 8- panels 9 and 10 (bottom in each column) have small titles (Spiral Worm and Starfish), but the others have big titles.
R2 - C7: Figure 8 and Figure 9- All Panels have an X-axis with very small font.
AC: We have replaced figures 8 and 9 with new versions that use consistent font settings.