

Review of manuscript bg-2020-17: "Persistent effects of sand extraction on habitats and associated benthic communities in the German Bight"

General comments:

This paper investigates the recovery of benthic invertebrate fauna following dredging for beach replenishment in the German Bight. The underlying premise of this work is that eventually the habitat condition will return to pre-dredging condition, and this will allow the re-establishment of pre-dredging benthic fauna, which is found in nearby undisturbed areas. The author suggests that any benthic assemblage that differs from the unimpacted zones is a successional stage.

This premise has 2 flaws:

1. The author states that the sands being dredged are Pleistocene in age, and that the existing hydraulics of the system and sediment supply limits deposition to very fine sand and mud at very low rates of deposition. This information highlights that the hydraulics and sediment supply of the area has fundamentally changed since the sands were deposited in the Pleistocene, so it is difficult to understand how the author expects these conditions to be restored, even over many decades/centuries/millenia. In effect, Pleistocene marine conditions and sediment supply would need to be re-established for the pre-mining conditions to be re-established. What these changes do highlight is that the dredging is an unsustainable mining activity – e.g. the material being extracted will not be replenished, so the dredging is resulting in a permanent change in habitat conditions. The implications of this permanent change should be the focus of the paper.
2. The benthic assemblages present at the mined sites are not a successional stage that will ultimately lead back to the pre-mining assemblage. If the muds are not replaced by sand (which is highly unlikely given the quiescent hydraulics and limited sediment supply), then the mud loving assemblage will remain in perpetuity. The paper suggests that there is a successional order of benthic infauna, while at the same time saying the infauna reflects the sediment characteristics. Mud is not a successional stage to sand. The change in benthos due to the change in sediment, and why this matters, should be the focus of the discussion, not that it is an intermediate step leading back to the original assemblage.

This work should be re-framed to highlight the permanent changes that are occurring to the sediments, how the infauna has changed due to these impacts, and what are the implications of these changes. The author states that the sandy benthos is wide-spread and the mining is not a threat to the prevailing species – so the question is what are the implications, if any, of the conversion of sandy habitat to muddy habitat and the loss of sessile habitat? Discussing how these changes might affect other trophic levels or food webs, such as through the uptake of PAHs or other contaminants from the mud, would be more relevant than focussing on the (lack of) re-establishment of the original fauna. It would also provide more context for the comment about monitoring PAH's which is otherwise unrelated to anything discussed in the paper.

The introduction and presentation of the scientific question should be revised and strengthened, and the aim of the investigation should be clearly stated earlier in the paper. It would also be useful to provide more discussion about why deeper extraction pits might have a different recolonization trajectory as compared to shallower disturbances. Providing some hypothetical examples of how deeper disturbance could have different impacts as compared to shallow extraction would provide more context for the results. The paper would benefit from additional, and more recent references.

Other comments:

1. First sentence in abstract is very ambiguous – what local population is being referred to? What is sea-level rise demanding?
2. This paper discusses regeneration whereas it might be more applicable to use re-establishment.
3. Line 29 – has reached a high level? Examples of the growth in extraction rates would be useful if it is considered that ongoing sand mining will pose a threat.
4. Line 36 – activities have led
5. Line 54 - sonars allow the analysis of backscatter intensity – how? This needs more explanation.
6. Line 59 – poor English
7. Line 64 introduces aim of paper – should be presented much earlier
8. Line 67 -will be used? Have been used.
9. 53 grab samples for 55 x 5 km transects are not a lot of samples. A more detailed description of the sampling strategy should be presented to demonstrate the samples are representative of the different areas.
10. Line 99 - area was collected
11. Some justification should be provided that all of the past mining pits are still visible. Were the locations compared to maps? How would you know if a pit was no longer visible?
12. Benthos -line 159 – what is class 1 lower than? Class 0?
13. Polychaete profited? Polychaete exploited suitable environment.