

## ***Interactive comment on “The Arctic Traits Database – A repository of arctic benthic invertebrate traits” by Renate Degen and Sarah Faulwetter***

### **Anonymous Referee #2**

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Review essd-2018-97 of The Arctic Traits Database – A repository of arctic benthic invertebrate traits, by Renate Degen & Sarah Faulwetter

This is a comprehensive and impressive Trait compilation that deserves honor and gratitude and a great “thank you” for leading this and compiling this together with other scientists.

This is, as indicated, a great start because .. “Traits can be analyzed across wide geographical ranges and across species pools (Bernhardt-Römermann et al., 2011), they can be used to calculate a variety of functional diversity indices (Schleuter et al., 2010), to estimate functional redundancy, or be used as 30 indicators of ecosystem

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functioning (Bremner et al., 2006). Given the rapid changes we observe in many marine regions of the world, and especially in the Arctic Ocean (Wassmann et al., 2011), the potential to indicate vulnerability to climate change and biodiversity loss, or to estimate climate change effects on ecosystem functions is another inherent advantage of trait-based approaches.

I find the potential of the trait data as being very useful, but this database and the methods and materials is under development and might also need more detailed descriptions.

1. Check the data quality: I find the dataset a good establishment for an ongoing and continues work. Error estimates and sources of errors need to be more clearly expressed when traits-values/categories are missing for, particularly, many Arctic species. Processing of the traiting in the further analyses and presentations need to be elaborated (see notes). 2. Consider article and data set: I find the traiting of species of high quality and this important work is based on much effort. 3. Check the presentation quality: The species information is highly useable for the traits/modules given in the Arctic Trait Database and of high quality. But if a given dataset has species without defined traits, it is more uncertain what to do.

Rating Reviewers are asked to decide how well the respective data sets presented by an article and the article itself meet the following criteria = 2 - 3 Significance  
Uniqueness: The Arctic Traits Database is a unique. It has and will continue to compile traits data that shall be used on a general basis, and allow comparisons areas regions. This has been a huge work and therefore not possible to replicate on a routine basis.  
Usefulness: The traits in the Arctic Traits Database might, or might not be, used in future works depending on how many species are found both in the work that will be implementing the trait data and in the Trait database itself.  
Completeness: The Arctic Trait database is a developing product that will evolve in the same paste as the development of biological data of particularly Arctic species.  
Data quality The available species/taxon trait-data are readily presented and accessible for use. What

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type of analyses and how to deal with missing trait data are not given, and need to be developed by the user.

**Presentation quality** Categorical traits and continuous traits: The categorical traits (e.g. body shape, reproduction, larval development, and more) are well suited to be divided into modalities and to be used in fussy coding. Here obligate traceability of literature information is important, but lacking for, as said in the manuscript, many Arctic species and rocky bottom communities. Please explain how to work with trait based analyses when some (many) Arctic species/taxons cannot be traited due to lack of information. In other words: how large part of a database can lack information, but still be possible to analyze? Is it 5%, 15%, 50%? Or is it so, that the use of the Arctic Trait Database (Degen & Faulwetter) cannot fulfill its purpose before all categorical trait information is in place and with the obligate traceability of literature information? Please explain how the user can work around the problem with categorical trait information that lacks the obligate traceability of literature information.

The continuous traits (e.g. body weight, size, height) are measures that are (or could be) obtained during the field work, and are therefore not be limited to “the obligate traceability of literature information”. You mention in the manuscript that “Arctic species” can be different than their relatives from lower latitudes”. With this, you open for a discussion on species “plasticity” and “adaptation” from area to area. Please explain the difference between a “Trait value” and a “field value” here. If “field values” are to be lumped into broad categories (see table 3: e.g. body size, body weight, zoo-geography – i.e. tolerance of temperatures, and depth range), they might be a tool to compare across areas (if same sampling tool has been used). But if used as a long term monitoring assessment, the “trend” will be “drowning” inside the category, and most likely a catastrophe needs to happen before a signal come forward. With other words, the “early warning signal” will not be available unless the field data are used as detailed as possible. I ask the auditors to mention this in the manuscript in order to make it more clear what the purpose of the traits is. In the arena of “plasticity” and

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“adaptation” from area to area, there might be many different values given by a variety of literature references. You have used a “flagging system” to observe this type of “inconsistency”. Would it be an idea to simply accept that some values are not consistent and therefore need to be obtained as field values, and not be added to the Arctic Trait Database? If not, please explain what to do with such continuously variable with many different literature-based values – do you trust your field data, or do you need to take the “global plasticity” into consideration? If this depends on your scientific question, please explain this carefully, so the reader will understand the differences between and the usefulness of a “trait-value” and a “field-value”. Another point that you might bring forward is “species more or less affected by trawling (see Body size in tab 3)”. What type of Body size value are you referring to here: “the station mean body size of the species” “the area mean body size of a species” or “the obligate traceability of literature information value” These three values might differ a lot. If your answer is that “this depends on your scientific question” – then please explain this carefully to the reader. Please also be aware that a trawl-vulnerable organism (e.g. a sea feather or similar) might be evaluated by its “body-size”. But, is a small (i.e. young) individual of a species “less vulnerable toward effects from trawling” than a full-grown individual of the same species? Is it so that in this type of vulnerability assessment studies a “obligate traceable literature information value” is more correct? Because it is not clear forward when to use field data or when to use “obligate traceable literature information value” it is very important that a pre-evaluation period is made before trait analyses are made.

**The use of the data and the visual outcome** As written in the Introduction: Traits can be analyzed across wide geographical ranges and across species pools (Bernhardt-Römermann et al., 2011), they can be used to calculate a variety of functional diversity indices (Schleuter et al., 2010), to estimate functional redundancy, or be used as indicators of ecosystem functioning (Bremner et al., 2006). Given the rapid changes we observe in many marine regions of the world, and especially in the Arctic Ocean (Wassmann et al., 2011), the potential to indicate vulnerability to climate change and biodiversity loss, or to estimate climate change effects on ecosystem functions is another

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inherent advantage of trait-based approaches. There is an issue of “not all species (particularly Arctic species) being traited” due to the lack of “obligate traceable literature information” on morphological, life history, behavioral traits information. I therefore wonder what type of method need to be used to calculate and finally obtain a result that can be, for example, depicted on a map. Again, I expect that the answer will be that this “depends on the scientific question that is been asked”. But could you please explain how to move from an incomplete species-traits database to the most appropriate method, and further to the presentation (be it a map or a figure) that identify the results but also the flaws?

General comments: 1) Line 39: what is a species “trait” – please define very clearly. 2) As clearly stated by the auditors – few (if any) literature proved traits are available for all species – what do you do with a field analyses when you have “missing trait data” because of lacking literature evidence? 3) Even if one or more literature references are available for a species Trait – how can we be sure that its correct? –the wording in line 13 “- obligate traceability of information (every entry is linked to at least one source)” seems overemphasized (see also line 157-158). When a literature based trait is not possible to find for a species, and when a specific trait (for example “size”) can vary from one geographic area to another, a “obligate literature traceability” can be misleading information. 4) Line 86-88: traits used in previous studies and databases should be favored to enable comparisons across studies (Degen et al. 2018), and 3) the traits should be usable across a wide geographical area (Bremner et al. 2006). Characteristics such as “body weight”, “size”, “morphology”, “temperature preference”, and “depth range”, are area depended and subjected to adaptivity/plasticity for existing environment. Do to the “line 13 - obligate traceability of information (every entry is linked to at least one source)” meaning that your species need to be pre-defined with a trait, please explain why changes in “field-based traits” such as “size” cannot be used. 1) Field based characteristics are very important “traits” in monitoring to detect “early warning signals” (see also line 70). These type of field based traits cannot be useful if lumped into large modalities as for example S1-S5 and W1-W5 because a

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“catastrophe” need to happen before a species will fall from one modality to another. And if literature based evidence shall be given for a trait, such as “size” – how can we detect a change in an area? Please explain why “field-based traits” are not coming into consideration in your choice of traits (line 85-88)? 2) Line 85-88 – says that chosen traits shall be available and applicable to all benthic taxa . . . but still . . . as also stated in the manuscript – not all species (particularly not the Arctic species) can be traited due to the lack of literature based evidence – so what do you do when you will like to apply traits to a dataset? Does this means that the trait database cannot be used because of this lack of literature based trait evidence? Please explain how to cope with this. 3) Traits must be selected in accordance to the scientific question. If a comparison to other areas are important not only same trait and modality has to be used, but also the same type of analyses. Please describe the steps from the fuzzy coding, the analyses and the mapping that can be applied to “all” in order to compare across regions.

Line 115-148: You divide your traits into “indicators of ecosystem functions (effect traits)” and “changes in the environment (response traits)”. But it is unclear how you use these two categories in table 3. Can you please mention them specifically here? Please make it clear in Table 3 if Body Size, Body Weight, Zoogeography, Depth Range are “Field-based Traits” or if they have to be “obligate traceability of information (every entry is linked to at least one source)”. Table 3: Please define the “Zoogeography” Trait. What is an Arctic, a Arctic-boreal, and a boreal species defined as. . . what temperature ranges? If lines 149-154 is true, please add them up front in the paper so it is clear that a “trait” have to be both “field-based” and “literature-based” in order to be able to apply a traitbased analyses on all, and not only on a subset of species. Chap 4.2 – it is also obvious that the trait database most efficiently covers macrofaunal species as Annelida, Arthropoda, Mollusca .. It might be written up front in the manuscript that mega-fauna, such as Echinodermata, Sponges are “under development” and therefore not fully operative due to many missing literature based-traits. Line 188: I agree that “Body weight” can be removed from the database because this trait is plastic and variable within and between areas, i.e. not a global constant, and will not be covered

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efficiently by 1 or 2 literature based references.

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