**Title tba**

**Key words:** Stability, Biodiversity, Meta-analysis, species contributions, disturbance, variability, variance, species dominance

Authors:

Charlotte Kunze

Maren Striebel

Helmut Hillebrand

Affiliations:

Institute for Chemistry and Biology of the Marine Environment (ICBM), School of Mathematics and Science, Carl von Ossietzky Universität Oldenburg, Ammerländer Heerstraße 114-118, 26129 Oldenburg, Germany

Helmholtz-Institute for Functional Marine Biodiversity at the University of Oldenburg (HIFMB), Oldenburg, Germany.

Alfred-Wegener-Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany.

**Introduction**

**Aim:** Cross-system–cross-organism analyses to determine the importance of species trait distributions for community stability in different realms (i.e. marine and terrestrial).

Does the relative dominance of species explain their responses/ do we find compensatory dynamics?

**Methods**

Details on Meta-Analysis

We extracted species-specific information from a published Meta-Analysis on the effect of pulse perturbations on community stability (Hillebrand and Kunze, 2020). The original meta-analysis was performed in 2018 based on a search at the Web of Science (www.webofknowledge.com/WOS, assessed April 3rd, 2018) using the search term ‘(experiment\* or manipulat\* or mesocosm\* or microcosm\*) AND recover\* AND (disturb\* or perturb\* or pulse) AND (communit\* or composit\* or diversit\* or assembl\*)’. From the 110 publications of the original analysis, we retrieved those experiments which fulfilled the following three selection criteria: 1) The study contained data on genus or species level. 2) The study reported species-specific data for all species in the community, for artificial communities we excluded those studies covering less than 3 species. 3) At least 3 time points were sampled in the experiments.

These criteria led to a database comprising 98 experiments from 30 publications. For each time point we obtained means and standard deviations for the available univariate response variable (abundance, biomass) for control and treatment. Most studies reported abundance and only ~1/3 reported biomass values. Response traits were then calculated for each community using species relative and absolute contributions to stability. As we did not have monospecific information like for the model simulations, we only calculated the realized response traits here.

To test for the effects of response diversity on community stability, we performed an unweighted meta-analysis with community instability as response variable, mean response as moderator, and experiment and study ID as random factors. Other response traits, i.e. response diversity and variance, as well as variables that had an effect on community stability metrics in the previous meta-analysis, were introduced as additional moderators, i.e. duration, system, open, organisms, but were removed following the model reduction according to Viechtbauer *et al.* (2010).

**Results**

A graph of different colored dots

Description automatically generatedMeasuring species contributions for the cross-organism-cross-systems meta-analysis on pulse disturbances (Fig. SX), allowed mapping species response traits in each community following pulse perturbations. Most species showed both, negative absolute and relative stability contributions (46.6 %, Sector III), indicating that species were negatively affected by pulse perturbations. In total, 25.8% showed positive contributions to stability (Sector I), and 21.5% of species showed a negative absolute but positive relative contribution (Sector II), which characterizes species that suffer from the perturbation but less than other species. Only rarely, in 6.13 % of the cases, we encounter the case, where species show positive absolute contribution to stability but negative relative contribution to stability (Sector IV) as this would suggest that species decrease in proportion although increasing in absolute biomass.

**Fig SX:** Absolute and relative net contributions of individual species or taxa to functional stability. Each point is one species, different colors indicate different systems (freshwater, marine and terrestrial).

A comparison of a graph

Description automatically generated with medium confidence

**Discussion**

*Main results of Meta-Analysis*

* Species contributions analysis: Proof of concept that species contributions can be assessed cross-organism-cross-system and **most species** indeed fall into three out of the 4 sectors.
  + Discuss why do we find species in sector 4? Because of the means??
  + Feasibility domain