Global Synthesis of the Response of Marine Taxa to Ocean Acidification

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Background
Anthropogenic carbon dioxide (CO₂) emissions cause the partial pressure of CO₂ ($P_{CO_2}$) to rise in the atmosphere and the oceans, resulting in shifts in ocean chemistry including its acidification. Climate-related ocean acidification may affect marine species and ecosystems in different ways, adding to the impacts of ocean warming and deoxygenation.

Meta-Analysis of Published Studies
A meta-analysis of the impacts of ocean acidification on marine species was carried out in the framework of the German research network BIOACID (Biological Impacts of Ocean Acidification).

The study elucidates the sensitivity of almost 500 different species from more than 650 published studies. The assessment of a species’ response at different $P_{CO_2}$ levels compared to a control considered the absence or presence and the direction (positive, negative) of an effect on fitness and performance capacity. The data were analyzed to identify potential consequences for species’ spatial distribution, life stage, specific characteristics and functional traits.

Responses of Marine Taxa

Conclusions
> The percentage of negatively affected species clearly increases with increasing $P_{CO_2}$ in all animal taxa, but sensitivity differs between taxonomic groups.
> Calcifying groups, in particular some macroalgae, molluscs (gastropods and bivalves) and echinoderms (e.g. sea urchins) but also corals, are particularly sensitive to ocean acidification.
> Non-calcifying macroalgae and some microalgae may benefit from increasing $P_{CO_2}$.
> Larvae are the most vulnerable life stage among animal taxa.
> Tropical species seem to be more sensitive than species from temperate regions.