Hidden effects of climate change may threaten eelgrass meadows

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Some research has shown that the effects of changes in the climate may be weak or even non-existent. This makes it easy to conclude that climate change will ultimately have less impact than previous warnings have predicted. But it could also be explained as direct and indirect effects cancelling each other out, as scientists from the University of Gothenburg, Sweden, show in a paper recently published in *PNAS*, the esteemed scientific journal.

To investigate how different climate impacts interact, an experiment was conducted at Kristineberg Marine Research Station.

"We raised the water temperature in miniature ecosystems containing eelgrass meadows, while simultaneously bubbling with carbon-dioxide. This allowed us to simulate a future climate scenario, characterized by both warmer waters and ocean acidification", explains researcher Christian Alsterberg.

Eelgrass meadows grow in shallow coastal waters and are among the most productive ecosystems in the sea. These meadows are now threatened, not only by climate change but also by overfishing and eutrophication.

"By studying eelgrass meadows on a ecosystem level, we were able to observe how plants and animals interact under changing climatic conditions. This also allowed us to measure the indirect effects, meaning the effects of climate change on an animal or a plant mediated through

another organism."

For example, the metabolism of many crustaceans that live in eelgrass meadows increases when the water temperature rises. This in turn means they need to eat more algae and may consequently graze it more efficiently. At the same time, the growth of benthic microalgae on the sediment surface in the eelgrass meadows will be more vigorous.

Using statistical methods that separates direct and indirect effects, the researchers were able to discern how higher water temperature combined with ocean acidification affects not just individual species but also interactions between species in the ecosystem.

The researchers found that the effects are largely determined by the presence or absence of different fauna, primarily small algae-eating crustaceans. The net effect of changes in temperature and ocean acidification on benthic microalgae is non-existent if there are crustaceans in the ecosystem. But in the absence of crustaceans, the amount of benthic algae is largely controlled by positive and negative direct and indirect effects of higher temperatures and acidification.

The results showed that, without small algae-eating crustaceans in the eelgrass meadows, climate change could pose a much greater threat to their survival.

"The experiment also taught us the importance of investigating climate change using several different approaches, in order to fully understand its effects and to predict future impacts", says Christian Alsterberg.

More information: Alsterberg, C. et al. Consumers mediate the effects of experimental ocean acidification and warming on primary producers, *PNAS*. www.pnas.org/content/110/21/8603.full.pdf+html

Provided by University of Gothenburg