Loss of species makes nature more sensitive to climate change

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High biodiversity acts as an insurance policy for nature and society alike as it increases the likelihood that at least some species will be sufficiently resilient to sustain important functions such as water purification and crop pollination in a changing environment.

"It's the same principle as an investment portfolio – you'd be mad to put all your eggs in one basket," says researcher Johan Eklöf.

Experiments with eelgrass meadows in shallow inlets on the west coast of Sweden are now showing that climate change can exacerbate the negative effects of losing sensitive species, and that the insurance effect of biodiversity may be weaker than what we typically assume.

Eelgrass meadows in shallow inlets are important nursery habitats for cod, for example. Since the early 1980s the prevalence of eelgrass has fallen dramatically along the Bohuslän coast.

This is thought to be due partly to eutrophication, which favours mats of filamentous "nuisance" algae which shade and suffocate the eelgrass, and partly to the loss of cod, which has resulted in a huge increase in numbers of smaller predatory fish. These predatory fish, in turn, reduce numbers of Grammarus locusta, herbivorous crustaceans which are effective grazers that normally control the filamentous algae.

This type of cascade effect has become increasingly common both onshore and off as many types of predator have been wiped out by

hunting or fishing. Worryingly, theory and observations would indicate that these effects could magnify the effects of global warming, which favours heat-tolerant but grazing-sensitive plants such as filamentous algae.

At the Sven Lovén Centre for Marine Sciences' Kristineberg research station on Gullmarsfjorden, researchers from the University of Gothenburg's Department of Biology and Environmental Sciences have developed miniature ecosystems in outdoor aquariums and have been investigating how future ocean warming and ocean acidification could affect the balance between eelgrass and filamentous algae.

The effects were unexpectedly clear and unambiguous: it was the diversity of algal herbivores that determined the extent to which the ecosystem was affected by warming and acidification.

"High diversity meant that neither warming nor acidification had any real effect as the algae were eaten before they managed to grow and shade the eelgrass," says researcher and biologist Johan Eklöf, who headed up the study. "But when we simultaneously simulated the effects of fishing and removed the effective but vulnerable herbivor Grammarus locusta, the algae took over the ecosystem – especially in the warmer conditions."

The researchers believe that we should be concerned about the results.

"Most management is based on the assumption that we afford to lose the most sensitive species because other, more resilient species will take their place," says Johan Eklöf. "But this may not be the case with future climate changes, as it can reduce the net efficiency of the resilient species – without directly affecting them."

However, the researchers are also careful to point out that there is still

hope if society does decide to take action.

"If we protect the local biodiversity we still have, and restore the diversity we've lost, by for example protecting predatory fish stocks in coastal areas and reducing nutrient loading, then we'll probably be able to increase the ecosystems' resilience to climate change."

Provided by University of Gothenburg