

Marine biodiversity loss due to warming and predation: study

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The biodiversity loss caused by climate change will result from a combination of rising temperatures and predation – and may be more severe than currently predicted, according to a study by University of British Columbia zoologist Christopher Harley.

The study, published in the current issue of the journal *Science*, examined the response of rocky shore barnacles and mussels to the combined effects of warming and [predation](#) by sea stars.

Harley surveyed the upper and lower temperature limits of barnacles and mussels from the cool west coast of Vancouver Island to the warm shores of the San Juan Islands, where water temperature rose from the relatively cool of the 1950s to the much warmer years of 2009 and 2010.

"Rocky intertidal communities are ideal test-beds for studying the effects of climatic warming," says Christopher Harley, an associate professor of zoology at UBC and author of the study. "Many intertidal organisms, like mussels, already live very close to their thermal tolerance limits, so the impacts can be easily studied."

At cooler sites, mussels and rocky shore barnacles were able to live high on the shore, well beyond the range of their predators. However, as temperatures rose, barnacles and mussels were forced to live at lower shore levels, placing them at the same level as predatory sea stars.

Daily high temperatures during the summer months have increased by

almost 3.5 degrees Celsius in the last 60 years, causing the upper limits of barnacle and mussels habitats to retreat by 50 centimeters down the shore. However, the effects of predators, and therefore the position of the lower limit, have remained constant.

"That loss represents 51 per cent of the mussel bed. Some mussels have even gone extinct locally at three of the sites I surveyed," says Harley.

Meanwhile, when pressure from sea star predation was reduced using exclusion cages, the prey species were able to occupy hotter sites where they don't normally occur, and species richness at the sites more than doubled.

"A mussel bed is kind of like an apartment complex – it provides critical habitat for a lot of little plants and animals," says Harley. "The [mussels](#) make the habitat cooler and wetter, providing an environment for crabs and other small crustaceans, snails, worms and seaweed."

These findings provide a comprehensive look at the effects of warming and predation, while many previous studies on how species ranges will change due to warming assume that species will simply shift to stay in their current [temperature](#) range.

Harley says the findings show that the combined effects of warming and predation could lead to more widespread extinction than are currently predicted, as animals or plants are unable to shift their habitat ranges.

"Warming is not just having direct effects on individual species," says Harley. "This study shows that [climate change](#) can also alter interactions between species, and produce unexpected changes in where [species](#) can live, their community structure, and their diversity."

Provided by University of British Columbia

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