Degraded coral reefs will threaten the livelihoods of fishermen

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When a reef has a healthy structure, vulnerable prey species of fish have plenty of places to hide from their predators.

If coral reef health continues to decline, reefs of the future may not be able to support the food demands and livelihoods of millions of people living in the coastal tropics, according to new research from the Universities of Exeter and Queensland.

The findings, to be reported in the journal *Current Biology* on 5 May, are based on a study of Caribbean coral reefs and their ability to support reef fisheries.

"Corals are the building blocks of coral reefs. They create an amazingly complex habitat with lots of holes, cracks and crevices that serve as hiding places and homes for a huge abundance and diversity of organisms," said Dr Alice Rogers of the University of Exeter and University of Queensland. "Due to stressors like disease, overfishing, and coastal development, corals are dying and as they do, coral reefs are becoming flatter. We wanted to know how this flattening of the reef would change interactions between reef organisms and affect the abundance and productivity of reef fish."

The research team studied coral reefs in one of the best protected marine parks in the Caribbean – the Exuma Cays Land and Sea Park in the Bahamas. "Working in the Park allowed us to study reef fish in areas of naturally high and low reef complexity, but without worrying about factoring in how many fish were absent because of fishing," Dr Rogers explained. "We found that the structure of fish assemblages from these contrasting habitats were really different. There weren't just fewer fish where the structure was flat, but there was also a difference in fish size. The complex habitat had a lot more small to medium-bodied individuals."

Combining expertise from fisheries science and coral reef ecology, the researchers developed food web models for the two habitat types. Dr Rogers explains, "When a reef has a healthy structure, vulnerable prey organisms including juvenile and small-bodied species of fish have plenty of places to hide from their predators. When the habitat is degraded, this isn't the case. We captured this in our models and discovered that this change in vulnerability really affected the dynamics of the whole community. Our models were able to predict the same patterns and differences that we'd observed in the field."

Using this new tool, the team were able to ask how a decline in coral reef habitat structure would affect the productivity of reef fisheries. They found that a complete loss of complexity resulted in more than a three-fold reduction in the availability of large-bodied reef fish. "That means three-times less potential catch for a fishery. That's going to have a huge impact on food security and peoples' livelihoods," says report co-author Julia Blanchard of the University of Sheffield.

Dr Rogers and her colleagues stress the importance of managing coral reef fisheries into the future. "Fortunately, much of the loss of reef habitat structure can be averted if we take significant steps to manage our ecosystems and climate," says Professor Peter Mumby of the Universities of

Exeter and Queensland. "We know that practical steps to manage reefs, such as refraining from the harvest of parrotfish – which eat algae and help corals grow – and taking care not to let fertilizers and sediments run into rivers, can all make a significant different to reef health. Such management is vital in order to help fishers maintain a sustainable and productive livelihood."

Provided by University of Exeter

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