

Progress Report SP 2009-003

Interactive effects of fishing and climate change on coral reef fish populations

Marine Science

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Project status as of July 11, 2016, 4:02 p.m.

Approved and active

Document endorsements and approvals as of July 11, 2016, 4:02 p.m.

Project Team	granted
Program Leader	granted
Directorate	granted

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Context

Climate change and over-fishing are widely regarded as the major threats facing coral reef communities world-wide. Typically fishing has a 'top-down' effect on communities, through the removal of large predators, whilst climate change causes degradation of habitat, which affects fish that recruit, feed and shelter within corals. The independent impacts of these threats are well-studied; however, the interactive effects between fishing and climate change are yet to be examined. This interaction may be particularly important on reefs off the mid-western Western Australian coastline where per-capita boat ownership and recreational fishing pressure is extremely high.

Two critical processes that determine the community structure of coral reef fish are recruitment and early post-settlement predation. It is hypothesised that the degradation of coral-associated habitat due to climate change will cause a decline in recruit numbers. Conversely, fishing will reduce abundance of large predators and increase numbers of smaller habitat-associated predators, thereby increasing post-settlement predation. Examining how changes in habitat and predators interact and influence post-settlement survival of fish will be critical to understanding the impacts on biodiversity of fish communities and fish populations.

Aims

- Determine how habitat degradation instigated by climate change and changes in predation instigated by fishing pressures affect the composition of the predator community on Western Australian coral reefs.
- Assess diet of predatory species targeted by fishers.
- Identify microhabitats preferentially used by juvenile fish.
- Assess how variation in fishing pressure and habitat complexity/composition influence predation rates on juveniles.

Progress

- A paper reviewing recent research on the effects of climate change on fish and corals has been published in the journal *Diversity*.
- A paper identifying *Pocillopora* corals as important habitat for predatory hawkfishes has been published in the journal *PloS One*.
- A manuscript linking the extent of coral habitat at the time of juvenile recruitment with the abundance of adult fish has been submitted for publication in the journal *Proceedings of the Royal Society B*. This work was also presented at the International Coral Reef Symposium in Hawaii.

Management implications

- Environmental disturbances associated with climate change pose a major threat to the long term conservation of coral reefs in Western Australia's marine parks and reserves. Understanding which environmental factors promote recovery on coral reefs allows managers to identify which reefs are more likely to persist over time.
- This research project has identified two metrics, depth and structural complexity, which can be easily measured over large spatial scales to locate reefs resilient to disturbances like coral bleaching. This information will help conservation planners determine which areas are most appropriate for protection when designing marine reserves.

Future directions

- The influence of range shifts of tropical fish into temperate waters will be examined.