Assessing the ecological effects of management zoning on inshore reefs of the Great Barrier Reef Marine Park

Research questions
- How have populations of targeted fish species responded to protection on no-take marine reserve (NTR, green zone) reefs?
- Has the establishment of NTRs affected fish populations on reefs that remained open to fishing?
- To what extent can disturbance events (cyclones, floods, coral bleaching) impact on the accrued benefits of NTRs?
- Does coral health and the prevalence of coral diseases vary among NTR and fished reefs?
- How much illegal fishing (non-compliance) is occurring in NTRs?

Approach
- Underwater surveys were used to assess fish and coral communities at 100 coral reef monitoring sites in the Palm, Whitsunday and Keppel Islands between 1999 and 2014.
- Half of the monitoring sites were located on NTR reefs and half were on reefs that are open to fishing.
- Pre-zoning (1980s) coral trout survey data provided a valuable baseline for assessing population changes on NTR and fished reefs.
- Coral community health and the prevalence of coral diseases was assessed at all monitoring sites in 2012.
- Derelict (lost and discarded) fishing lines were removed from a subset of the monitoring sites in the Palm Islands.
- The re-accumulation of fishing lines was monitored over two years to estimate NTR non-compliance levels.

Consistent increases in coral trout biomass on no-take reserve reefs

Palm Islands

Whitsunday Islands
Reef condition remained stable throughout the monitoring period. Biomass was consistently higher on reefs within old (1987) and new (2004) NTRs than on fished reefs. Biomass was relatively stable on fished reefs between the early 1980s and 2014. Biomass ratio NTR: Fished (2014) = 5 : 1

Keppel Islands
Reefs were impacted by coral bleaching in 2006 and by flood plumes in 2011 and 2013. Biomass was consistently higher on NTR reefs than on fished reefs through to 2011. Severe reef degradation post-2011 led to biomass declines at impacted NTR sites. Biomass ratio NTR: Fished (2013) = 1.5 : 1
Decreased prevalence of coral diseases on reefs within no-take reserves

- The mean prevalence of coral diseases was 4-fold lower on NTR reefs than on reefs that are open to fishing in the Whitsunday Islands during 2012.
- Disease lesions were recorded on a significantly higher proportion of injured corals compared to non-injured corals.
- Damage to corals through entanglement with fishing gear may increase susceptibility to disease infection, but further research is required to verify the factors driving the observed patterns.

Fishing line re-accumulation reveals illegal fishing in no-take reserves

- Derelict fishing lines were surveyed at five NTR sites and at five non-NTR sites in the Palm Islands.
- All fishing lines were removed from the ten monitoring sites following the completion of the surveys (Fig. A).
- Fishing lines were re-surveyed 2.5 years after the sites were cleaned.
- Lines re-accumulated on NTR reefs at one-third (32.4%) of the rate recorded on non-NTR reefs (Fig. B).
- It was evident that a substantial amount of illegal fishing occurred in the NTRs during the study period.

Summary of key findings

- Coral trout were consistently more abundant and larger on NTR reefs than on reefs that were open to fishing.
- Coral trout biomass has been relatively stable since the 1980s on reefs that remained open to fishing.
- The combined effects of NTRs and direct fishery management actions have increased coral trout population sizes on inshore GBR reefs since the 1980s.
- Climatic disturbance events such as cyclones, coral bleaching and flood plumes can degrade reefs, reduce biodiversity and productivity, and impact populations of key fishery-targeted species such as coral trout on both NTR and fished reefs.
- The mean prevalence of coral diseases was significantly lower on NTR reefs than on fished reefs in the Whitsunday Islands.
- NTR non-compliance may limit the biodiversity conservation and fishery benefits of the GBR Marine Park zoning plan.

Publications


Further information

WEB: http://eatlas.org.au/nerp-te/gbr-jcu-inshore-zoning-effects-mpa-8-2 EMAIL: Dr. David Williamson (JCU): david.williamson@jcu.edu.au