Technical Information Sheet #3

>> Representative Areas Program background and history

[Published - 2002]

The Great Barrier Reef Marine Park Authority is implementing the Representative Areas Program to help ensure better protection of the Marine Park's biodiversity. This will involve a review of the existing zoning throughout the Marine Park. This information sheet is part of a package of materials that help explain various technical elements of the Representative Areas Program and the zoning review.

Do no-take areas work?

Researchers have shown that no-take areas can reverse a decline in species' richness and genetic diversity. This effect has been seen in Tasmania, New Zealand, Belize, Kenya and elsewhere (Samoilys 1988, Cole et al. 1990, Barrett & Edgar 1999 in Ward et al 2001), and is likely elsewhere, including the Great Barrier Reef Marine Park (the Marine Park). However, the significance of the effect depends on the population dynamics and role of the target species in the community, the fishing intensity and selectivity, and whether habitats are impacted by extractive activities.

When humans take out the top predators of a system, such as carnivorous fish, that whole system can change. We can affect the entire food web if links in the food chains are broken. Once that human impact ceases, and provided the level of impact has not been catastrophic, the whole community adjusts back to a more natural state, more resilient to other human pressures (Jackson et al 2001).

Local fishers often bear more of the immediate burden of no-take areas. On the other hand, they are also likely to reap the benefits in the medium-term. Spill-over and recruitment of fish stocks from no-take areas to adjacent fished areas have been documented. Highly protected coral reef areas allow population densities of animals, including fish, to significantly increase over two to four years (Clark et al. 1989; Polunin & Roberts 1993; Roberts & Polunin 1994; Sluka et al. 1997, Williamson 2000).

As population densities increase inside no-take areas, we might expect mobile animals to move to the lower density areas. Tag and release studies of crustaceans (e.g. prawns) and fish show that these animals can and do travel sufficiently to move out of reserves (e.g. Attwood & Bennett 1994). If animals actually do move out of reserves, we would expect their densities adjacent to no-take areas to be greater than away from no-take areas. This is supported by data from Barbados and Apo Island in the Philippines (Rakitin & Kramer 1996; Russ & Alcala 1996).

Modelling studies have focused on the potential for recruitment of fish stocks in no-take areas (e.g. Bohnsack 1992, McGarvey & Willison 1995). This work indicated that closures of 20% could increase egg production significantly (1200–1500%). These increases reflect the disproportionate degree to which large adults produce more eggs than smaller adults. Empirical work by Murawski et al (in press) shows positive recruitment effects in reserves that had been closed to scallop fishing on Georges Bank, Canada, for four years.

Several studies show evidence of improvements in actual catch per unit effort due to no-take areas (McClanahan & Kaunda-Arara 1996; see also Ward et al. 2001). Fishers themselves seem informed about the benefits and spill-over effects of no-take areas. Roberts & Hawkins (2000) have documented the phenomenon of 'fishing the line', where fishers target areas close to the boundaries of no-take areas. This phenomenon would be unlikely to persist if the fisher's efforts were not successful. Altogether there is evidence that, in the medium- and long-term, fishers can expect to benefit from the GBRMPA's efforts to protect the biodiversity of the GBR region (Ward et al. 2001).

Increases in no-take areas will result in a displacement of fishing and collecting effort. The GBRMPA will try to minimise displacement of fisheries and work with the Queensland Government to ensure the ecological sustainability of fisheries overall, but there is concern about potential negative impacts caused by concentrating fishing effort.

Throughout the world, various types of marine reserves have been established without proportional reductions in fishing efforts. Studies exploring the effects on fish populations outside these reserves detected no harmful effect from displaced fishing effort (Roberts & Hawkins 2000). The only evidence of the effects of displacement, at Apo Island in the Philippines and St. Lucia, Caribbean, points to increases in populations of target fish outside reserves despite displaced effort (Russ & Alcala 1996, Roberts & Hawkins 1997). Crowder et al. (2000) also strongly support the implementation of marine protected areas with biodiversity conservation goals, reasoning that such areas can produce detectable benefits to fish stocks and so gain public support.

It is broadly recognised that the design and implementation of no-take areas must be undertaken in a collaborative and consultative way, to ensure reserves use local expertise and are respected by local stakeholders.

There is also an argument regarding imperfect compliance with the 'no-take' rule within no-take areas. No place in the world, including the Great Barrier Reef Marine Park, can ensure complete compliance to its natural resource management rules. Halpern (in press) reviewed 76 studies of reserves that were protected from at least one type of fishing. His study included reserves where some kinds of fishing were allowed, where protection had lapsed, or where there had been significant violations. Across all reserves, he found that fish density approximately doubled and that biomass (the total mass of all living creatures in a given location) increased to two and a half times that found in adjacent fished areas. He also found that the average fish body size increased by approximately one third and the number of species sampled increased by a third in comparison with non-reserve areas. Halpern's (in press) review suggests that failures in compliance do not make no-take areas ineffective. However, greater degrees of compliance will generate greater benefits.

References

Attwood C G, Bennett BA (1994) Variation in dispersal of Galjoen (Coracinus capensis) (Teleostei: Coracinidae) from a marine reserve. *Canadian Journal of Fisheries and Aquatic Science.* 51: 1247–1257.

Barrett N, Edgar G (1999) How marine reserves work for the fish. *Fishing Today*. 11: 23-27.

Bohnsack J (1992) Reef resource habitat protection: the forgotten factor. *Marine Recreational Fisheries.* 14: 117-129.

Clark J R, Causey J A, Bohnsack (1989) Benefits from coral reef protection: Looe Key reef, Florida. 6th Symposium on Coral and Ocean Management. Charleston, South Carolina, USA.

Crowder LB, Lyman SJ, Figueira WF, Priddy J (2000) Sink-source population dynamics and the problem of siting marine reserves. *Bulletin of Marine Science*, 66(3): 799–820.

Halpern B (In press) The impact of marine reserves: does size matter? *Ecological Applications.*

Jackson et al (2001) Historical overfishing and recent collapse of coastal systems. *Science*. July 27 2001: 629–637.

McClanahan TR, Kaunda-Arara B (1996) Fishery recovery in a coral reef marine park and its effects on the adjacent fishery. *Conservation Biology*. 10:1187-1199.

McGarvey R, Willison JHM (1995) Rationale for a marine protected area along the international boundary between U.S. and Canadian waters in the Gulf of Marine. Pages 74-81 in N. L. Shackell, J. H. M. Willison, (eds), *Marine Protected Areas and Sustainable Fisheries*. Science and Management of Protected Areas Association, Wolfville, Canada.

Polunin NVC, Roberts CM (1993) Greater biomass and value of target coral reef fishes in two small Caribbean marine reserves. *Marine Ecology Progress Series.* 100: 167–176

Rakitin A, Kramer DL (1996) Effect of a marine reserve on the distribution of coral reef fishes in Barbados. *Marine Ecology Progress Series*. 131: 97–113.

Roberts CM, Hawkins JP (1997) How small can a marine reserve be and still be effective? *Coral Reefs.* 16: 150.

Roberts CM, Hawkins JP (2000) *Fully protected marine reserves: a guide*. WWF Endangered Seas Campaign, Washington DC and Environment Dept, University of York, UK.

Roberts CM, Polunin NVC (1994) Hol Chan: demonstration that marine reserves can be remarkably effective. *Coral Reefs.* 13: 90.

Russ GR, Alcala AC (1996) Do marine reserves export adult fish biomass? Evidence from Apo island, Central Philippines. *Marine Ecology Progress Series.* 132: 1–9.

Sluka R, Chiappone M, Sullivan KM, Wright R (1997) The benefits of a marine fishery reserve for Nassau grouper (*Epinephelus striatus*) in the central Bahamas. Proceedings of the 8th International Coral Reef Symposium, Panama. 2: 1961–1964.

Ward TJ, Heinemann D, Evans N (2001) *The Role of Marine Reserves as Fisheries Management Tools—A review of concepts, evidence and international experience.* Bureau of Rural Sciences, Canberra.

Williamson, D (2000) *An assessment of the effectiveness of management zoning in protecting reef fish stocks of the Palm Islands and the Whitsunday Islands, Central Section, Great Barrier Reef*. Unpublished report, Dept of Marine Biology & Aquaculture, James Cook University.

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