1.0 BACKGROUND

As humans first exploit and then potentially over-exploit living resources, there is often a recognition that areas need to be set aside to help protect or restore these resources. This concept has been applied in both terrestrial and aquatic ecosystems and has, in many cases, led to the declaration of aquatic reserves or parks. Within the marine environment, there has been a broad expansion of the use of marine reserves over the last four decades.

Good summaries of the potential benefits of marine reserves to the management of fisheries are provided by Bohnsack (1993), Carr and Reed (1993), Dugan and Davies (1993), Polunin and Roberts (1993), Sladek Nowlis and Roberts (1997, 1999), Babcock *et al.* (1999), Parrish (1999) and Kelly *et al.* (2000). Briefly, these include:

1) Conservation of habitats, species diversity and genetic diversity (so-called heritage benefits - Parrish 1999).
2) Maintenance of large populations of organisms and large individuals within such populations, leading to increased egg production.
3) Sources of propagules to replenish areas depleted by over-exploitation.
4) Replenishment of adjacent, non-protected areas by movement of larger individuals (e.g. either by random movement or density dependent processes).
5) Changes in habitat structure due to changes in habitat-forming organisms (e.g. increases in benthic primary productivity as an indirect result of changes in fishing activity - Babcock *et al.* 1999).

Whilst there are strong theoretical arguments in support of these benefits, the evidence from field investigations is less compelling. Based on the scientific literature, it would be difficult to demonstrate unequivocally the replenishment of non-protected areas, either through supply of propagules or movement of larger individuals. Carr and Reed (1993) argued that the extent to which reserves may supply propagules to non-protected areas depends on numerous factors, including locations of reserves and non-protected areas relative to larval duration, local currents and the size of reserves. Demonstrating a significant reserve effect in terms of larval supply may require examination of samples at the genetic level to trace biota between sites (Carr and Reed 1993).

To demonstrate unambiguously the effects of a marine reserve, it is necessary to monitor populations within the reserve and at reference locations prior to, and for some time after, declaration. This type of approach is analogous to sampling often done for environmental impact assessment, where changes in mean diversity and abundance at an impact site are compared against appropriate spatial and temporal controls. Carr and Reed (1993) suggested that, for the purpose of such analysis, the reserve can be considered an "impact" on species of interest.

In the mid-1990ís, an opportunity to test some of the theory on marine reserves arose in Solomon Islands. The Nature Conservancy (TNC) negotiated with local fishermen a total closure on fishing of commercially important invertebrates (mainly trochus, sea cucumbers and giant clams) for three years within The Arnavon Islands Marine Conservation Area (MCA). The Arnavon Islands consist of two main islands, Kerehikapa and Sikopo, which lie in the Manning Strait, between Choiseul Island and Ysabel Island, in Solomon Islands (Fig. 1). The MCA covers an area of approximately 83 km^2 and was traditionally an important area for harvesting turtles, marine invertebrates and fish. The closure came into effect in September 1995 and has continued to this time.

The International Centre for Living Aquatic Resources Management (ICLARM) informed the Great Barrier Reef Marine Park Authority (GBRMPA) of the opportunity to study the effects of fishing protection on commercially exploited invertebrates at the Arnavon Islands. GBRMPA obtained an ACIAR Small Grant to work with ICLARM and TNC to study the effects of the fishing closure.

This is one of the few studies of the effects of marine protected areas that involves sampling a conservation area and a suite of reference areas that remain open to fishing, before and after the implementation of the fishing closure (cf. Kelly *et al.* 2000). It is also unusual in that it focuses on the effects of fishing on tropical marine invertebrates, rather than fish.