INTRODUCTION

The structural heterogeneity of coral reefs severely limits the use of traditional sampling gears for the quantitative assessment of stocks of reef fishes. For example, trawl nets cannot be used on reef slopes or rough bottom and gill nets only with great difficulty. Additionally, underwater visual survey methods which have been widely used on coral reefs (e.g. DeMartini and Roberts 1982; Sale and Sharp 1983; Thresher and Gunn 1986) are confined by depth restrictions because of the decompression limits of observers. Further, underwater visual survey methods can only be used diurnally. The quantitative sampling of reef fishes of commercial and recreational importance beyond the effective depth limit of SCUBA diving (20 m) has not yet been successfully developed on the Great Barrier Reef. Potential sampling techniques include demersal longlines, traps and drop-lines. Trials with demersal longlines have demonstrated major problems with hook-ups on rough bottom and subsequent loss of gear, as well as serious problems with sharks taking fish at night (Williams, unpublished data). Demersal longlines also have the problem of sampling necessarily large areas when reef fish are often highly clumped and associated with specific bottom features.

Fish traps are a non-destructive sampling methodology that can be utilised in conditions which prevent the use of other techniques such as visual census, trawls, seines and other nets, and along with drop-lines, handlines and rod and reel, offer the advantage of being essentially point samplers that can be used to target very specific features where fish are expected to aggregate. Additionally, they can be used in almost any kind of habitat. They have been used widely throughout the world as an artisanal or commercial method of fishing (e.g. Prabhu 1954; Kawamura et al. 1970; Smith et al. 1980; Munro 1983; Dalzell and Aini 1987; Desurmont 1989). More recently they have been developed as sampling tools in the quantitative assessment of stocks of reef fishes (Munro 1974, 1983; Wolf and Chislett 1974; Powles and Barans 1980; Stevenson and Stuart-Sharkey 1980; Koslow et al. 1988; Desurmont 1989; Guerin and Cillaurren 1989). They have been used also to assess changes in community composition in response to varying levels of fishing pressure (e.g. Ferry and Kohler 1987; Koslow et al. 1988; Moran and Jenke 1989). A modified North West Shelf 'O' trap design has proved to be an effective methodology for the sampling of species of commercial and recreational fishing significance, such as snappers (Lutjanidae) and emperors (Lethrinidae) on the Great Barrier Reef (Newman and Williams 1995a). These traps have proven more effective for short soak times (< 24 h) than 'Z' traps (cf. Whitelaw et al. 1991).

Trap fishing on the Great Barrier Reef has demonstrated strong day-night, day-to-day and habitat and depth differences in catch rates and species composition (Newman and Williams 1995a, b; Newman et al. 1995a, b). In addition to these sources of variation, high variability in catch occurs among traps set at the same time within a depth stratum. It would be highly desirable to decrease this among 'replicate' variability if traps are to be a statistically powerful tool for monitoring catch rates as an indicator of changes in fish abundance, as will be required, for example, in any Effects of Fishing Experiment. We propose that the variance in catch between 'replicate' trap sets can be reduced, and catch rates increased, by more effective sampling stratification, i.e. by more selective locating of traps within sites.

While our traps have proven effective at catching a range of lutjanid and lethrinid species, catch rates of *Plectropomus* spp. and *Lethrinus miniatus*, which dominate the commercial line fishery, have been relatively low. On the basis of preliminary trials, we believed that these species might be more susceptible to drop-lines than traps and that larger individuals might be more readily caught on lines than in traps.

The aims of this study are to:

1. Quantify the catch variability associated with trap sampling within a depth stratum.
2. Determine the effects of within-depth habitat stratification on this variability.
3. Determine the sampling power (in terms of minimum detectable differences and sample size) of the fish traps in stratified and unstratified sampling designs.
4. Compare the species composition and size of fish caught by traps and drop-lines in the same habitat.