4.0 PROJECT ACTIVITIES - FINAL YEAR

Results for the previous years of the project are reported in Lincoln Smith (1994, 1996), Lincoln Smith and Bell (1996) and Lincoln Smith *et al.* (1997). This report completes the documentation for the project.

4.1 Progress of Research Work for the Final Year

4.1.1 Sampling Locations and Times

Sampling was done in two reef habitats, shallow reef terraces (depth range 0.5 to 3.5 m) and deep slopes (15 to 22 m). The reef terrace habitat consisted of flat reef pavement with live and dead coral and patches of sand. The substratum of the deep slope habitat was generally made up of sand and/or coral rubble. These habitats were described semi-quantitatively in Lincoln Smith and Bell (1996), where it was concluded that any habitat differences among sites would be unlikely to cause any bias in the surveys of invertebrates.

For each habitat, four sites were surveyed in each of two islands within each of four areas i.e., the Arnavon Islands MCA (Plate 1) and three reference areas or groups ñ Suavanao, Ysabel and Waghena (Fig. 1). Commercial harvesting of invertebrates occurred at all reference areas. The number of sites sampled for each habitat was 32, giving a total of 64 sites sampled during every survey. A brief description of each site and its latitude and longitude are presented in Table 1.

Eight surveys have been undertaken at all of the sampling sites. These include January-February, April-May and July-August, 1995; September-October, 1996, 1997 and 1998; and January-February 1999 and April 1999.

4.1.2 Methodology

4.1.2.1 SHALLOW TERRACE HABITAT

The invertebrates counted in this habitat were giant clams, trochus (*Trochus niloticus*), sea cucumbers, pearl oysters and false trochus (*Pyramis tectus*). The false trochus is not commercially valuable and was included to provide a comparison with harvested species. False trochuses were counted but not measured. Sea cucumbers commonly encountered in this habitat included lollyfish (*Holothuria atra*), orangefish (*Bohadschia graeffei*), greenfish (*Stichopus chloronotus*), surf redfish (*Actinopyga mauritiana*) and stonefish (*Actinopyga miliaris*).

The survey procedure for the shallow habitat was as follows. One SCUBA diver descended to the terrace, anchored a tape and swam in a straight line over the terrace to the 50 m mark on the tape. If there was a noticeable current, the diver laid the transect swimming into the current, so that it was easier for the observer to do the survey. The line was laid haphazardly with respect to depth, rather than along a depth contour.

A second diver (the observer) swam along the tape holding a PVC "t-bar", which was a 2†m long pipe with a handle and was used to define the transect width of 2 m (Plates 2, 3 & 4). Transects of four different sizes were compared during a pilot study conducted in 1994 (Lincoln Smith 1994, Lincoln Smith *et al.* 1997). 50 x 2 m transects were selected for sampling the shallow habitat since they provided adequate precision and several replicate transects could be completed during one SCUBA dive. The observer counted invertebrates within each transect and recorded the depth and time at the start and finish of each transect. Once the transect was surveyed, the first diver retrieved the tape and, after swimming for 10-20 m, re-laid the tape in a different direction. If the water depth was < 1.5 m, observers did the shallow survey using snorkel rather than SCUBA. If the depth was > 1.5 m, the observer always used scuba to maintain the efficiency of the survey.

Two teams of divers sampled invertebrates along three transects at each site, giving a total of six transects for each site.

All the exploitable invertebrates counted within transects were measured to the nearest 5†mm in

length, except trochus, which were measured to the nearest 1 mm. When time permitted, invertebrates seen outside the transects were also measured (but not counted) to increase the sample size for estimating size-frequency distributions. Measurements were done as follows. Sea cucumbers were measured from the mouth to the anus of the animal, over the top of the body, using a fibreglass tape measure. Each sea cucumber was disturbed as little as possible and the measurements taken quickly, so that there was minimal chance of the sea cucumber changing shape. Clams were measured along the top of the shell, as it was not possible to measure shell width because many individuals were buried. Trochus (*Trochus niloticus*) were measured across the widest point of the shell base. Pearl oysters were measured from the apex to the hinge of the shell.

4.1.2.2 DEEP SLOPE HABITAT

Surveys in the deep habitat were done along coral, rubble and sand slopes. Sea cucumbers and goldlip and blacklip pearl oysters occurring in the deep habitat were counted and measured. The deep habitat contained some of the most valuable species of sea cucumbers, including white teatfish (*Holothuria fuscogilva*), black teatfish (*Holothuria nobilis*), elephant's trunkfish (*Holothuria fuscopunctata*) and prickly redfish (*Thelanota ananas*).

At each site, two teams of divers each laid their transect line three times to count and measure sea cucumbers and pearl oysters, giving a total of six counts per site (Plates 5 - 8). Each transect was 50 m long (defined by the tape measure) and 5 m wide. Transects of a different size were used to sample the deep habitat since the density of invertebrates differed between habitats and larger transects were required to obtain precise estimates of abundance in the deep habitat. Transect width was defined by two divers who swam parallel to each other holding on to either end of an extended 5†m length of rope. Each team of divers consisted of one diver who counted and measured invertebrates and another diver who laid and retrieved the transects. Invertebrates were measured as described in the previous section. Animals outside the transects were also measured if time permitted.

4.1.2.3 STATISTICAL ANALYSIS OF DATA

4.1.2.3.1 Abundance of invertebrates

The abundance of invertebrates was compared at three times before and three times after the establishment of the MCA and across three spatial scales using asymmetrical analysis of variance (ANOVA) (Winer *et al.* 1991, Underwood 1993). The three spatial scales examined were <u>Groups</u>, which included the Arnavons and the three reference areas Waghena, Ysabel and Suavanao, <u>Islands</u> within each Group and <u>Sites</u> within each Group and Island. Sites were the individual places where transects were laid. Separate analyses were done for the shallow and deep habitats because different species of invertebrates generally occurred between depths and different survey methods were used. The factors examined using asymmetrical ANOVA are summarised as follows:

- Before vs After, which was considered orthogonal and fixed.
- Times, which was nested within Before vs After and was random.
- Groups, which was considered a random factor and included a comparison of the Arnavon Islands with the three reference groups (the asymmetrical component) and a comparison among the three reference groups. Groups was orthogonal with respect to Before vs After and Times.
- Islands, which was nested within Groups, was orthogonal to Before vs After and Times and was a random factor. There were two Islands within each group.
- Sites which was nested within Islands and Groups, was orthogonal to Before vs After and Times and was a random factor. There were four sites sampled for each habitat within each Island and Group.

Six replicate transects were laid haphazardly within each site. Sources of variation in the abundance of invertebrates were partitioned, mean squares were calculated, and appropriate tests created according to Underwood (1993).

The study incorporated two temporal and three spatial scales. The establishment of the MCA may have had an effect on the abundance of invertebrates at a variety of temporal and spatial scales. Consequently, there were several ways that an effect of the establishment of the MCA may have been detected. In general, the MCA could have been shown to be effective if there was an increase in the abundance of invertebrates from before to after (or among times within before and after) the establishment of the MCA at the Arnavon Islands and no corresponding increase in abundance at the reference groups. Alternatively, the MCA could have been considered effective if there was no change in abundances within the MCA, but declines in abundances in the reference areas. These could be demonstrated by specific combinations of significant and non-significant temporal and spatial interaction terms.

There were no tests available for some terms but sometimes tests could be created by eliminating appropriate interactions that were non-significant at p(0.25 (Winer *et al.* 1991). The assumption of homogeneity of variance was tested prior to analysis using Cochran's C test. Attempts were made to stabilise heteroscedastic data by using a ln(x+1) transformation but if transformation failed to stabilise variances, untransformed data were used in the analyses. Analysis of heterogeneous data was considered acceptable since ANOVA is robust to violation of this assumption, particularly if data are balanced and sample sizes are large (Underwood 1997), as was the case in this study. Post-hoc SNK tests were done whneever significant tests were found to determine where the differences occurred.

4.1.2.3.2 Sizes of Invertebrates

Sizes of invertebrates were investigated using a combination of ANOVA and size frequency graphs. Due to the complex nature of the experimental design, variation in mean sizes was analysed using ANOVA. Different numbers of animals were measured at each site and time, but ANOVA should only be done on balanced designs (i.e. the same number of replicates in each treatment; Underwood 1997). The number of replicates available, therefore, was limited by the minimum number of animals measured in any one treatment. In all cases, there were too few measurements made to enable comparison across all temporal and spatial scales. For example, often less than 10 animals were measured in a treatment and this sample size was considered too small to accurately represent the mean size of the population at that place and time. Data were pooled, therefore, across spatial and/or temporal scales to increase the number of replicates available. Where necessary, equal numbers of replicates were achieved by randomly eliminating data. Two designs were used depending on the number of animals available after pooling.

Design 1 was used for analysis of sizes of trochus (n = 33) in the shallow habitat, and for lollyfish (n = 69), white teatfish (n = 35) and elephant trunkfish (n = 40) in the deep habitat. Measurements were pooled across sites and islands within the Arnavons and across sites, islands and groups within the reference groups. Measurements were also pooled across all three times sampled before and three times sampled after the establishment of the MCA. Sizes were then compared between the Arnavons and reference groups, from before to after the establishment of the MCA using a two-factor ANOVA. The factors were Before vs After and Arnavons vs references. Both factors were fixed. Cochran's tests were used, prior to analyses, to test the assumption of homogeneity of variances. If variances were heterogeneous then appropriate transformations were performed. For the analysis of trochus, variances could not be stabilised, so analyses were performed on untransformed data.

More measurements were made for *Tridacna maxima* in the shallow habitat, hence it was possible to compare sizes of this clam using asymmetrical ANOVA (Design 2). Data were pooled across sites and islands within both the Arnavons and reference groups. The number of replicates (n) used was 47. The factors analysed were:

- Before vs After, which was considered fixed and orthogonal.
- Times which was nested within Before vs After and was a random factor.
- Groups, which included a comparison of the Arnavon Islands with the three reference groups

(i.e. the asymmetrical component) and a comparison among reference groups. Groups was a random factor and was orthogonal with respect to Before vs After and Times.

All data on sizes were transformed to ln(x+1) prior to analysis.

Where the results were consistent with the MCA influencing sizes (e.g. significant "Before vs After" x "Arnavon vs References" interactions), size frequency histograms were plotted to aid in interpreting the nature of the changes. Size frequency histograms were plotted using all available data.

4.1.3 Results

Four categories of general results were observed for abundances of invertebrates.

1) Numbers increased at the Arnavons from before to after the declaration of the MCA and numbers remained similar, or declined at the reference locations. This was observed for *Trochus niloticus* and for white teatfish. These results indicated that the establishment of the MCA had caused an increase in the number of commercially important invertebrates of these species.
2) Numbers remained similar at the Arnavons from before to after the declaration of the MCA, but numbers declined at the reference locations. This was observed for total holothurians in the deep habitat and, although not conclusive, there was some evidence for this trend for amberfish. This indicated lack of recruitment during the study and the ongoing effects of harvesting of these species at the reference areas (i.e. where fishing was not prohibited).
3) Similar changes in abundance occurred at both the MCA and reference locations from before to after the declaration of the MCA. This was observed for all giant clams combined, *Tridacna maxima* and greenfish in the shallow habitat and for elephant's trunkfish in the deep habitat. This indicated no effect of the MCA for these species.
4) Numbers remained similar at the Arnavon Islands and increased at the reference locations from before to after the declaration of the MCA. This was observed for *Tectus pyramis*, the only non-commercial species examined. This finding is difficult to interpret, but the trend may be due to less competition for space between *Tectus* and *Trochus* at reference areas, due to the small numbers of the latter.

Results of size analyses were varied. The mean size of *Trochus niloticus* increased after the declaration of the MCA, however the mean size of white teatfish decreased, due to recruitment of small individuals into the population. The MCA appeared to have no effect on sizes of other species.

Results for each variable analysed are discussed in detail in the following sections.

4.1.3.1 INVERTEBRATES IN THE SHALLOW HABITAT

4.1.3.1.1 Abundance

Trochus niloticus

The establishment of the MCA caused an increase in the abundance of *Trochus niloticus* (Table 2, Fig. 2a). There was a three-fold increase in the number of *T. niloticus* at the Arnavon Islands from before to after the establishment of the MCA, but numbers remained similar at the reference groups over the same time period. There was no test available for variation among islands (Table 2), however, examination of Figure 2b suggests that there was an increase in the number of *T. niloticus* at both of the Arnavon islands, but numbers remained similar, or decreased at all but one of the reference islands (Fig. 2b). The abundance of *T. niloticus* also increased at the scale of sites (Table 2). SNK analyses indicated that numbers increased substantially at two sites within the MCA but remained similar at the reference sites from before to after the declaration of the MCA (Table 2, Figure 2c).

Tectus pyramis

The abundance of *Tectus pyramis* remained unchanged from before to after the establishment of the MCA at the Arnavon Islands. At the 24 reference sites, however, abundances increased at 11 sites, decreased at 2 sites and remained unchanged at 11 sites (Fig. 3c). The observation that numbers

decreased at 2 sites and remained unchanged at 11 sites (Fig. 3c). The observation that numbers increased at almost half of the reference sites, but remained unchanged at all of the MCA sites indicates that the MCA may have inhibited increases in abundances observed at many sites outside the marine conservation area.

Total giant clams

The MCA had no effect on the abundance of clams (Table 4). The abundance of clams almost doubled from before to after the declaration of the MCA but increases occurred at both the MCA and the reference groups (Fig. 4). Consequently, the increase in the number of clams could not be attributed to the establishment of the MCA. The increase in the number of clams appeared to occur at the scales of groups, islands and at the majority of sites (Figs. 4a,b,c), although the magnitude of the increase was not consistent among reference sites (Fig. 4b)

Tridacna maxima

The MCA had no effect on the abundance of *T. maxima* (Table 5). There was a general increase in the abundance of *T. maxima* with numbers increasing at 7 of the 8 sites within the MCA and at 20 of the 24 reference sites (Fig. 5c). Since similar variation was observed at both the MCA sites and reference sites, the increase in abundance cannot be attributed to the establishment of the MCA.

Total holothurians - shallow habitat

The establishment of the MCA had no effect on the abundance of holothurians in the shallow habitat (Table 6). Examination of Fig. 6, however, suggested that abundances almost doubled at the Arnavon group from before to after the establishment of the MCA, but remained similar the reference groups. The test to detect changes at the MCA relative to reference groups (B x MCA vs References interaction) had few degrees of freedom and the power of the test was probably too low to identify the trend. There was temporal variation in the abundance of holothurians among Arnavon sites after the establishment of the MCA, however, temporal variation after the establishment of the MCA did not differ from temporal variation before the establishment of the MCA and was not attributable, therefore, to the MCA (Table 6).

Greenfish

The establishment of the MCA had no effect on the abundance of greenfish (Table 7). Abundances varied among sites at the Arnavon group after the establishment of the MCA but remained similar at the reference sites (Figure 7). SNK analysis indicated that the variation was caused by a decrease in abundance of greenfish at one site at the Arnavon Islands. The establishment of the MCA, therefore, had no effect on numbers of greenfish. During the field studies we did observe large numbers of green fish in parts of the MCA but away from the study sites. These included some very shallow areas of reef terrace (<0.3 m), particularly at the entrances to narrow embayments and lagoons. The abundance of greenfish was low compared with the other species of invertebrates sampled (less than 0.2 animals per 100m^2) and greenfish were found at only one site at Waghena and at no sites at Suavanao during the study. None were observed outside the study sites within the reference areas.

4.1.3.1.2 Sizes of invertebrates in the shallow habitat

The MCA had no effect on the size of *Tridacna maxima* (Table 8). There were, however, differences in the mean size of *T. maxima* among groups, with the mean size of clams being largest at the Arnavon Islands and smallest at Waghena (Fig. 8a). There was also variation in the mean size of clams among times sampled before and after the declaration of the MCA (Fig. 8b).

The mean size of *Trochus niloticus* increased at the Arnavons and decreased at the reference locations from before to after the declaration of the MCA (Fig. 9, Table 9). This result was consistent with the MCA causing an increase in the mean size of individuals. Examination of size frequency histograms for the Arnavon group and reference groups, before and after the establishment of the MCA indicated that there was a shift towards larger size classes at the Arnavon group. Interestingly, despite large increases in abundances, there was no evidence of small recruits entering the population, possibly due to the cryptic habits of juveniles and associated difficulty in detecting them. Alternatively, juveniles may settle into habitats away from the study sites.

4.1.3.2 INVERTEBRATES IN THE DEEP HABITAT

4.1.3.2.1 Abundance

Total holothurians

The establishment of the MCA did not cause abundances of holothurians in the deep habitat to increase, however, it appeared to prevent further declines in abundances occurring in the region. SNK analyses indicated that the abundance of holothurians remained similar at the Arnavon group from before to after the declaration of the MCA, but declined, on average, by approximately one third at the reference groups (Table 10, Fig. 10). The effect was also observed at the scale of sites. There was no variation in abundances among sites at the Arnavon group from before to after the establishment of the MCA. At the reference sites, however, abundances declined at 11 sites, increased at one site and remained unchanged at 12 sites. This suggests that the MCA was effective at maintaining population levels, but ineffective at enhancing abundances.

White teatfish

The establishment of the MCA did affect abundances of white teatfish which differed between the Arnavon group and the reference groups from before to after the establishment of the MCA (Table 11). SNK tests failed to identify where the differences occurred, largely due to the small number of degrees of freedom associated with the test. Examination of the Fig. 11a, however, suggests that abundances doubled at the Arnavon group and decreased by up to 90% at the reference groups from before to after establishment of the MCA. This trend was more easily identified at the scale of sites (Fig. 11b). Abundances increased greatly at 2 sites at the Arnavon group and decreased at four sites at the reference groups. Abundances at all other sites remained unchanged. Although the number of sites where differences occurred was small, the direction of the trends suggested that the MCA had an effect in increasing abundances at some sites at the Arnavon group and preventing further declines in abundances apparent at some sites at the reference areas.

Lollyfish

The declaration of the MCA had no effect on the abundance of lollyfish (Table 12). Lollyfish were most abundant at the MCA, but patterns of abundance among groups did not change from before to after declaration (Fig.12). Moreover, no small-scale effects were detectee between islands or among sites (Table 12). Some short-term temporal variation was observed at the Arnavon group following declaration, but similar variation was also observed before the MCA was established, indicating that it was not caused by the MCA (Table 12). Similarly, short-term temporal variation was identified among sites within the Arnavon Group after the declaration of the MCA. This variation was inconsistent from before to after the declaration of the MCA but similar differences in temporal variation were observed at the reference sites, indicating the MCA did not cause this temporal variation.

Amberfish

The establishment of the MCA had no effect on abundances of amberfish at the scale of groups (Table 13). There was some evidence, however, to suggest that the MCA may have prevented further declines in abundance from occuring at some sites. There was no change in abundance at all sites in the Arnavon group, however, SNK tests indicated that abundance decreased at four of the

reference sites, remained unchanged at 19 sites and increased at one site (Fig. 13). Although the evidence is not strong, it does indicate that the establishment of the MCA may have had some role in preventing declines in this species at the Arnavon group.

Elephant trunkfish

The declaration of the MCA had no effect on the abundance of elephant trunkfish (Table 14). Abundances increased at one site within the Arnavon group after the establishment of the MCA (Table 14, Fig. 14), however similar variation was observed among reference sites indicating that the MCA had no effect at the scale of sites (Fig. 14).

4.1.3.2.2 Sizes of invertebrates in the deep habitat

The MCA had no effect on the sizes of lollyfish or elephant trunkfish (Table 15). There were differences in the mean sizes of lollyfish (Fig. 15a) and elephant trunkfish (Fig. 15b) between the MCA and reference areas. Lollyfish were larger at the reference areas, but elephant trunkfish were larger at the MCA.

The mean size of white teatfish varied between the MCA and reference areas from before to after the declaration (Table 15). The mean size of white teatfish increased at the reference areas, and decreased at the MCA (Fig. 15c). Examination of the size frequency distributions (Fig. 15d) indicated that the decrease in size at the Arnavon group was probably due to recruitment of small holothurians into the population after the establishment of the MCA. In contrast, there were few small holothurians at the reference areas after the declaration of the MCA and the mode of the population had increased, probably due to growth of the population.

4.1.4 Importance of the Results

The findings of the study are of great importance at a local and international scale. In particular, the study has developed and applied a methodology that can be used to evaluate the success of marine reserves through "baseline" comparisons with multiple appropriate reference areas.

The results show that some species increased in abundance in the MCA over time while others did not, suggesting that there is considerable variability in the response of invertebrates to the removal of fishing pressure. The results also show that estimates of recovery can depend on the actual sites surveyed within the MCA. This suggests that effective monitoring of marine reserves will depend on sampling a large number of sites within the protected area. In this study, four sites were sampled at each of the two islands within each group. The sensitivity of the monitoring program to detecting increases in abundance in the MCA would be improved by expanding the number of sites to provide a better measure of variability within the MCA (see below).

The results also show that local communities can use closures as short as three years to help manage stocks of trochus, since trochus populations increased in both number and size within this time frame. This suggests that a management plan could be initiated for trochus throughout the Solomon Islands in which some reefs are closed for long enough to ensure that they have large stocks. Others areas would be harvested and then closed for three years on a rotational basis to provide sustainable production. It also helps to vindicate the decisions made by the local management committee in supporting the declaration of the MCA.

Notwithstanding the results of the study, it should be noted that, although significant differences were detected, the actual increases of animals in terms of numbers per hectare remained low relative to what may be expected within the region (Table 16). For example, three years after the establishment of the MCA, densities of *Holothuria fuscogilva* were estimated at 16 ha-1 which was within the range compared with other fished areas in the Pacific, but was much lower than maximum density estimates of 82 ha^{-1} observed in Tonga. Similarly, Although abundances of *T. niloticus* increased to approximately 57 ha^{-1}, this was also well below estimates of densities from other areas (62-2016 ha-1; Table 16). This indicates just how heavily over-exploited the stocks were at

the beginning of the study and how long it may take stocks to recover to densities recorded elsewhere in the region.

4.2 Travel and Meetings During the Final Year

Travel by Dr Marcus Lincoln Smith during the final year included participation in the first of the series of the final three surveys designed to provide the data for statistical comparison with the data collected prior to declaration of the MCA. In addition, Mr Peter Ramohia, a Scientific Officer from the Solomon Islands Fisheries Division traveled to Sydney for training in statistical analysis of the survey data and the preparation of scientific publications. The outcome of this visit is discussed in more detail below.

4.3 Budget Discussion

The budget was adequate for the study but it was slightly overspent. The additional costs were borne by ICLARM. An extra budgetary item was the visit by Peter Ramohia to Sydney in June 1999. This trip was covered by a separate allocation of funds from ACIAR.

One minor budgetary problem encountered was that there were some unforeseen costs in the operation of the research vessel, *Daula,* due to increases in seagoing allowances. Such increases should be included in the budget for any continuation of the monitoring. Copies of the budgetary expenditure on the project by The Ecology Lab and ICLARM are provided separately.

4.4 Conclusions

The project set out to examine the effectiveness of marine reserves using the MCA as a case study. The study design included the use of data from before and after declaration at both the MCA and reference groups. All the sampling was completed successfully in the context of the original objectives, and every required sample was taken. This represents a major achievement in terms of organisation and implementation.

The outcomes of the study provide encouraging results for the restoration of populations of trochus, but it appears that a substantial recovery time may be required for this species within the MCA and even longer duration for other species, including some sea cucumbers and giant clams. Consequently, the closure on harvesting at the MCA should continue and there should be additional monitoring, using the same general approaches as developed for the shallow and deep habitats.

Another important finding was that recovery tended to occur at small spatial scales within the MCA. Thus, larger increases in trochus (and some encouraging increases for other species), occurred at only some sites, while other sites showed little or no increase. Some of these results may be due to poaching (see Section 5), however, others can be explained by, patchy recruitment within the MCA, or by differences in habitat that were not readily apparent during site selection. A primary goal of future monitoring should be to observe if those sites in the MCA with fewer invertebrates show a significant increase in abundance over a longer time. In the longer term, if recovery does not increase in the MCA, this in itself will be important for the management of fisheries based on tropical invertebrates. For example, it might suggest management alternatives such as re-stocking or broader limits on size or seasonal harvesting within the region.

A closure on the harvesting of trochus within the MCA has lead to an increase in the size of trochus, consequently use of a rotational closure will not only enhance abundances of trochus, but it will also increase the yield per animal harvested. Although mean sizes of white teat fish declined, this was largely due to recruitment of small animals into the population.

An important advantage of the statistical procedure used for this study is that additional surveys can be readily incorporated into the analysis of data. The analysis used here included factors for Times (Before) vs Times (After), with three surveys within each Time. This could now be expanded readily to include Times (Before) vs Times (After 3 yrs) vs Times (After 6 yrs). This would require collection of data on three occasions approximately 6 years after declaration of the MCA.