CHAPTER 5

CONCLUSIONS

5.1 Introduction

There is a large and expanding literature on seagrass ecology. However, it is "dominated by descriptive research (>60% of papers), with a paucity of efforts to synthesis results and derived general relationships" resulting in "a present lack of predictive ability, and scientific basis for the management of seagrass ecosystems" (Duarte, 1999). If our capacity to predict seagrass responses is limited, the capacity to predict the consequences of these responses still remains more elusive. Therefore, it is quite hard to formulate quantitative predictions on the changes in the seagrass ecosystem (e.g. faunal abundance and biogeochemical fluxes) likely to occur from changes in water quality.

With limited present literature/research on habitat requirements for tropical seagrasses especially on the species found in the study area, the discussion on responses of seagrass to water quality were simple and ordinary. Adding to it, limitations of this project made it difficult to draw conclusive results. Methods used in the UMMReC Project could have been more useful if more data were available or there would have also been merit in conducting this study over a longer time period if resources were available.

The statistic tests used enabled trends to be detected in the water quality however they could not be used to evaluate some of the relationship between seagrass and water quality due to a lack of data and appropriate tests.

5.2 Seagrass Diversity and Distribution

The following conclusion can be drawn based on the findings from the study:

(i) The species diversity of seagrasses in Sungai Johor is small with three (3) species identified which are *Halophila ovalis*, *Halophila spinulosa* and *Enhalus acoroides*. *Halophila ovalis* was the most dominant species, occur at all sites and cover up to 100% in most transect studied;

(ii) There was a definite pattern in the distribution of seagrasses at Sungai Johor, in relation to water quality. S3 was dominated by *H. ovalis* and *H. spinulosa*; only *H. ovalis* was observed at S4; and at S5, *H. ovalis* dominant near shore and *E. acoroides* nearer the sea; and

(iii) In terms of dry weight (DW) biomass, the average value of DW biomass shows that S3 (Tanjung Kopok) has the highest biological productivity, followed by S5 (Pasir Gogok) and S4 (Tanjung Surat). The biomass of *H. ovalis* were increasing towards the sea at S3 opposed to S4 and S5 where it decreasing towards the sea.

5.3 Seagrass and Water quality

The results of this study are relevant to the current knowledge of seagrass presence and abundance in relations to water quality, and could contribute towards providing background information essential for management. These relationships were primarily explained by differences in water quality between sites (seagrass areas and area without seagrass), within seagrass areas and the species present at that location (e.g. function and form of structurally small seagrass cf. structurally large seagrass). A number of factors may be contributing to low species diversity, and to limited distribution and abundance of seagrasses in Sungai Johor, Malaysia.

Area without seagrass (S1 and S2), were treat as the control for this study. Overall, seagrass areas (S3, S4 and S5) have a greater value for salinity, conductivity and Total Nitrogen, while having a very much lower value for TSS (turbidity), *E. coli* and Cuprum. There were no obvious differences between sites for temperature, pH, Dissolved Oxygen (DO), Ammonia, Nitrate and Ferum.

DW biomass correlate positively with salinity, conductivity, light and Total Nitrogen; and correlate negatively with temperature, pH, TSS, Secchi depth, ammonia, Nitrate, *E. coli*, Cuprum and Ferum. There was no correlation between DW biomass and Dissolved Oxygen (DO). In terms of seagrass growth and productivity, the most significant water quality parameters are those that influence light penetration and aquatic nutrient levels. S3 which has the best water clarity exhibit the highest DW biomass, whereas S4 which has the most turbid water exhibit the lowest DW biomass and species diversity, and S5 which has the highest TN value exhibit the highest number of species, thus S4 which has the lowest TN value exhibit only one species in the area.

From the results, one can concluded that water quality has significant relations and effects to the seagrass present and distribution in the study area.

5.4 GIS

This study shows that GIS technology has a strong potential to be used in environmental management systems both at local, regional and national levels. The GIS-based tool is an example of a goal-to-practice translation process where biological data are converted into accessible information for the physical planners. Making biological data broadly accessible in the public system is the only way to integrate the challenge of preserving, further develop and manage biodiversity in urban environments.

One of the capabilities and advantages of GIS shown in this study is the geodatabase, which technology can assist the hydrographic user community in maximizing the value added dimension to its digital data holdings. The geodatabase integrates the vast flexibility of the ArcInfo coverage and incorporates a variety of new features, which ultimately make geospatial editing less time-consuming and more intuitive. With features such as subtypes and domains, feature-linked annotation, multiuser editing with versioning, and advanced geometric network, GIS users can effectively take their geospatial analysis to the next level. As such, the geodatabase is sometimes referred to as the next generation coverage. It is that and much more. The geodatabase data model centralizes data management and opens up the use of GIS to applications that were not feasible before.

The contributions of GIS technology in this study are:

(i) Spatial mapping (mapping the seagrass);

(ii) Database development (geodatabase for seagrasses and related parameter); and

(iii) Spatial Analysis (Point Distance Analysis).

5.5 Recommendations

Some recommendations for future studies based on gaps in our existing knowledge and understanding on seagrass meadows are:

(i) To do small-scale manipulative experiments, yet they must be conducted over a large enough spatial scale to enable us to define the baseline conditions for the seagrass communities and make generalizations about the habitat requirement for continued seagrass viability;

(ii) To conduct more studies to determine the effects of land use on seagrass status. Studies also should be carried out in longer time period to access the responses of seagrass to changes in habitat quality (such as reduced light intensity, increased suspended solids, increased nutrients, increased temperature) resulting from jetties, dredging, catchment outputs and etc. There are evident that seagrass beds are being lost due to reduced habitat quality even before documentation of their existence has been made. Assessment and monitoring requires long-term consistent effort but yields valuable information on incremental changes that otherwise may escape perception; and

(iii) To evaluate the biodiversity value of different seagrass community types and to gain a better understanding of the different ecosystem services these seagrass meadow provide, in particular with reference to their role as food resource for grazers such as dugong and turtle and as habitat for species of fisheries value. It'll improve our knowledge of the inter-connectivity of coastal marine habitats to better understand the consequences of habitat fragmentation or loss on the ecology of the area.