PREFACE

Aquatic plants play a significant role in maintaining water quality, due to their ability of absorbing nutrients. This book aims to show the value of macrophyte use as a tool for biological water treatment of aquaculture farms and also as a culture medium for microalgae. It also discusses the translocation and monitoring of wetland plants; responses of floating macrophytes to different environmental stressors; and vegetation structure of lagoon environments as a result of sediment biogeochemical dynamics and organic matter load.

Chapter 1 – Wet habitats are among the most threatened ecosystems all over the World and the importance of wetland protection is well recognized in several international treaties. Threats for wetlands are numerous; drainage in agriculture, use of water for the industry and agriculture, climate change-mediated drought or intrusion of salt water into freshwater wetlands, water pollution and eutrophication. Consequently, wetland destruction, fragmentation and degradation have led to negative direct and indirect impacts on wetland-dependent plants. Habitat protection, restoration or reconstructions are widely used ways to recover aquatic ecosystems.

Habitat restoration and reconstruction require wetland plants to be translocated into restored sites or new sites. However, translocation of wetland plants can be very challenging because it also includes the water quality management. In many times, this is the most difficult part in translocation programs. Water quality can be assessed through the analysis of several physical and chemical variables and long time series of sampling is needed to obtain reliable data on water quality. In fact, while soil accumulates pollutants and nutrients, the concentration of pollutants in running water may reach high values during acute and short-lasting episodes, which makes them difficult to

be detected. In some cases, also toxicological analysis may be needed to understand the thresholds of specific factors affecting the survival of the target species.

In general, translocations require sound knowledge on species and habitats, like population dynamics, mating system and ability of dispersal. The selection and restoration of the target sites are one of the most important phases in a translocation program. Although different techniques are available to avoid mistakes in choosing the target sites, it must be considered that their selection should be quick and cheap. Here the authors present different approaches for the selection of suitable translocation sites for wetland-dependent plants species.

Although several guidelines to translocation have been recently developed, few specific best practices for wetland-dependent plants are available. Thus, here the authors provide some practical advices and examples useful to improve the translocation success of wetland plants, from the preliminary phases of translocation to the monitoring program.

Chapter 2 – During their life plants have to cope with natural or anthropogenic environmental stressors, including different pollutants. The exposure of aquatic macrophytes to these compounds mobilizes or generates, directly or indirectly, diverse signalling molecules and regulates many processes that amplify and specify the physiological response through transcriptional and metabolic changes. Due to consistent enhancement of water pollution and in order to better preserve aquatic ecosystems, the knowledge of response mechanisms used by the plants to cope with stress is of increasing significance. In this paper, the stressor driven changes and responses induced by different pollutants and phytoremediation potential of some floating macrophyte species will be considered and discussed.

Chapter 3 – Shallow lagoons with low water renewal tend to be eutrophic. Eutrophic conditions may become extreme if there is strong human pressure in the surrounding area. They promote opportunistic macroalgae which can constitute vast dense mats. Subsequent decay of biomass enriches sediment with organic matter and may lead to dystrophic status. During these phases, mineralization processes involving bacterial activities, such as ammonification, nitrification, denitrification and sulphate reduction, occur in sediment. Decay and mineralization of biomass imply release of toxic catabolites and nutrients, the latter supporting new blooms of vegetation. Under extreme conditions, macroalgal blooms repeat with increasing frequency, culminating in a dissipating event, which manifests as an extended dystrophic crisis. Here the authors report a conceptual model of the sediment

energy cycle, from low organic matter content of sediment to accumulation and anoxigenic dissipation, and thence to new accumulation, and so on. At the various stages, different quantities and qualities of nutrients are released from the sediment, creating different environmental conditions and blooms of vegetation that differ in quantity and quality.

Chapter 4 – Aquatic plants play a significant role in maintaining water quality, due to their ability of absorbing nutrients. The aim of this chapter is to show the value of macrophyte use as a tool for biological water treatment of aquaculture farms and also as a culture medium for microalgae. In southeastern Brazil, aquaculture farming is mainly carried out in flow-through systems, in which large earthen fishponds are commonly arranged in line, each pond receiving the effluent from the previous one, without any prior treatment. The continuous water flow through the fishponds strongly depends on seasonal rains. The current system for production of aquatic organisms could benefit greatly from the development of low cost strategies to mitigate its impacts in the environment. Maintenance of good water quality is of primary importance to maintain an ideal culture ecosystem, with adequate feed for optimal fish yield potential, and preservation of a eutrophic situation. Fish production may cause serious environmental issues, especially when there is little concern over excessive plant growth, which can influence the functioning and structure of ecological processes in the fishponds. The use of macrophytes as bio-filter and / or wetland or as microalgae culture medium in aquaculture farms can serve as a tool for maintenance of good environmental conditions and improve the cultivation of microalgae. These microalgae can in turn be used as a nutritional source for the fish larvae, pigment in aquaculture and also as a supplementary additive in the food industry. This alternative medium should allow efficient production of microalgae, at a low cost for the laboratory. The understanding of local characteristics and development of proper feeding techniques, aimed at the integration and optimization of fish production, are important factors in obtaining and maintaining water quality appropriate for microalgae culture.