ABSTRACT

Biological, physical and chemical parameters of the Great Salt Pond were monitored between July, 1992 and May 1994 and again between August, 1995 and June, 1996 . Microalgal biomass and community structure were used as the indices of water quality of the Great Salt Pond. Physical and chemical parameters were monitored contemporaneously. Effluent from the Greater Portmore sewage treatment system was found to affect the quality of the pond water. Release of effluent prior to the completion of the sewage system resulted in a decline in the quality of the pond water. Increased flow from the system during this period led to greater deterioration. Mean biomass increased to over 15 mgm^{-3} chlorophyll *a* at some stations. The number of cells reached a maximum of 5.5 million cells $litre^{-1}$. The fully operational treatment system led to a rapid improvement. Biomass values at some stations were reduced to less than 25% of their earlier values, indicating a 75% improvement in pond water quality. Increased flow of treated effluent during this period improved the quality of the pond water. The phytoplankton community was found to respond to changes in levels of eutrophication rather than changes in salinity.

The community structure and biomass of the microphytobenthos were less variable than those of the phytoplankton. The microalgae of the pond were found to be phosphate-limited.

In studies following total treatment, the sediment of the pond was found to be more important than the treatment system as a source of inorganic nutrients to the waters of the pond. The sediment was found to provide between 55% and 98% of the total inorganic nitrogen (ammonia + nitrate-nitrite) supplied and between 33% and 58% of the orthophosphate supplied. The direction and rate of transfer of nutrients between sediment and water were dependent on the diffusion gradient existing between the water and the sediment. The microalgae were found to utilise nutrients supplied by the sediment, thus reducing the dissolved nutrient concentrations of the water column.

Nutrient loss to microalgal absorption led to the reduction in the export of nutrients from the pond to the Hellshire Bay by more than 80% in the cases of inorganic nitrogen, and over 50% in the case of inorganic phosphate. The role of microalgae as improvers of water quality and controllers of the spread of eutrophication was therefore established.

Three possible methods to increase the rate of recovery of the Great Salt Pond were proposed. Two of the proposed methods involved increasing the rate of nutrient release from sediment to water, while the other involved the removal of sediment along with its associated nutrients.

The terms effective layer and effective depth of sediment were defined. The effective layer of sediment was defined as the layer of sediment which contains nutrients and participates in processes affecting nutrient transfer between sediment and overlying water.

The effective depth of any sediment was defined as the depth below which the sediment does not contribute to the sediment nutrient pool nor participates in processes affecting nutrient transfer between sediment and overlying water.

An expression for the determination of net nutrient concentration changes in the Great Salt Pond, applicable to other lagoons and water bodies, was formulated. From this, a simple method of predicting recovery rates of enclosed and semi-enclosed bodies of water was proposed.

The investigation enabled the characterisation of shallow tropical enclosed and semi-enclosed water bodies impacted by sewage outfalls.