

ABSTRACT

The phytoplankton community composition, abundance and size fractionated biomass (chlorophyll *a*), along with various physical and chemical parameters, were assessed on a monthly basis at 9 stations throughout Hunts Bay between December 1993 and February 1995.

This study was conducted primarily to document the existing water quality of Hunts Bay, and to determine whether the water quality of the Bay has further deteriorated in the last two decades. A secondary objective was to investigate the forcing functions which determine the spatial and temporal distribution of the phytoplankton community.

Results indicated deterioration in the water quality of Hunts Bay since the 'historical' studies conducted more than 20 years ago, as indicated primarily by consistently higher phytoplankton biomass. Highest average concentration of chlorophyll *a*, in surface and deep water layers was 13.1 mg m^{-3} and 12.8 mg m^{-3} respectively, compared to the lower 'historical' value of $10.2 \text{ mg chl } a \text{ m}^{-3}$ for integrated surface and deep water samples. Maximum chlorophyll *a* recorded for Hunts Bay in this study was 42 mg m^{-3} .

The present phytoplankton abundance values (numbers of cells l^{-1}) of the Bay were also higher than previously determined. Hunts Bay was found to have an average phytoplankton abundance of 7×10^7 cells l^{-1} for surface water and 6×10^7 cells l^{-1} for deep water, compared to the lower 'historical' value of 5×10^7 cells l^{-1} for integrated surface and deep water samples. Maximum phytoplankton abundance for the Bay in this study was determined as 2.9×10^8 cells l^{-1} .

A doubling of nitrate+nitrite concentrations in the last two decades was observed. Average labile nitrate+nitrite concentrations for this study were determined as $4.46 \mu\text{Mol. l}^{-1}$ and $1.90 \mu\text{Mol. l}^{-1}$ for surface and deep water, respectively, compared to $2.02 \mu\text{Mol. l}^{-1}$ determined for integrated surface and deep water samples from past studies. Maximum nitrate+nitrite concentration for the Bay during this study was determined as $45.30 \mu\text{Mol. l}^{-1}$, compared to the previous maximum value of $4.75 \mu\text{Mol. l}^{-1}$. On the other hand, average phosphate concentrations of $0.28 \mu\text{Mol. l}^{-1}$ and $0.27 \mu\text{Mol. l}^{-1}$ obtained for surface and deep water, respectively, were much lower than the 'historical' value of $1.49 \mu\text{Mol. l}^{-1}$ determined for integrated surface and deep water samples. Maximum phosphate concentration for the Bay was determined as $3.96 \mu\text{Mol. l}^{-1}$, compared to the previous maximum value of $5.50 \mu\text{Mol. l}^{-1}$.

Stratification of the highly eutrophic water body of Hunts Bay was confirmed. The water column was stratified into a fresh or brackish water surface layer due to freshwater input from rivers and gullies which empty into the Bay, and a saline deeper layer. Surface waters were often supersaturated, in contrast to deeper waters which were regularly subject to oxygen deficiency. The surface water layer was further characterised by significantly higher nutrient concentrations, phytoplankton biomass and abundance than the deep water layer (MANOVA, $p < 0.0001$).

The stratification of the Bay was an important factor determining the distribution and composition of the phytoplankton community which was found to vary significantly both spatially and temporally. Factors such as seasonality (rainfall) and nutrient loading also played an important role in determining the phyto-

plankton community composition, distribution and size. During the wet season, there was stratification of the physico-chemical and biological parameters of the Bay. The lower rainfall of the dry season, on the other hand, resulted in homogeneity of the phytoplankton community and various physico-chemical parameters throughout the water column.

It was suggested from the community similarity indices (PSC and JCC) along with the dominance occurrence data, that the Bay can be zoned into four areas: an upper zone (stations 1 to 3), a middle zone (stations 4 and 5), a lower zone (stations 6 and 7) and an outer zone (stations 8 and 9). Each zone was dependent on and influenced by the nearest fresh water inflows, except for the outer zone which was influenced more by the closer proximity to the saline water of the Kingston Harbour.

Biological factors such as zooplankton grazing appeared to have some influence on the size of the phytoplankton community. Zooplankton abundance (numbers of zooplankters per m^3) recorded during this study showed an increase since the previous study, possibly indicating the further deterioration of the water quality of the Bay.

The phytoplankton community was composed of 434 identified and unidentified freshwater, estuarine and marine phytoplankton species. The presence of toxic phytoplankton species in the community was a disturbing observation particularly given the great paucity of information and research on toxic phytoplankton in Jamaica.