

ABSTRACT

Diatoms, microscopic algae of great ecological importance, are known to be sensitive indicators of environmental change in the temperate zones. Their response to such changes in a Jamaican river system was investigated with a view to using their reactions to indicate both environmental conditions and change, in the absence of chemical analyses.

To test the use of diatoms as biological indicators of water quality in the Black River waterways, studies were initiated into:

1. The environment of the waterways.
2. The diatom species present in the waterways.
3. The changes in diatom community structure and species composition through space and time.
4. The correlation between community and environmental changes.

The variation in ammonia, nitrates and nitrites, organic nitrogen, orthophosphate, sodium, potassium, calcium, magnesium, zinc, chloride, reactive silicate, conductivity, pH, temperature, dissolved oxygen, transmitted light and flow rates was recorded monthly for one year at eight survey stations. Diatom collections were made simultaneously with water sample collections and a limited number chosen for study.

A diatom flora, the first in the Caribbean, describing 230 taxa was prepared here as a supplement to the "The diatoms of the United States" by Patrick & Reimer, 1966, 1975. 10% of these taxa appeared not to have been previously described and a further 20% had not been described in

English. Taxa only previously found in Java and Zaire were recorded. In comparison to Puerto Rico, the Black River Waterways had significantly more Achnanthes spp., Navicula spp. and Fragilaria spp. though fewer Pinnularia spp. Only 21% of the recorded taxa were common to both islands, an observation attributed to collection bias and to climatic and geographical factors.

A one year series of epiphytic diatom collections from one station plus one additional collection were analysed for species composition and community structure. The results were modelled by truncated log-normal curves, the Shannon-Wiener Diversity Index and the communities were compared by the method of Patrick (1973). A distinct 'island effect' was demonstrated by the lower modal height and smaller number of species in the theoretical universe of the truncated log-normal curve in comparison to continental diatom communities and this was mirrored by the low diversity indices.

Significant variations through time were recorded for the community parameters derived from the truncated log-normal curves. The variation in modal height was directly correlated with the marginal flow rate, sodium and organic nitrogen concentrations and inversely correlated with pH; modal position varied directly with marginal flow rates, conductivity, pH and sodium concentrations; sigma squared values varied with marginal current, conductivity and pH, though the correlations were poor;

and the size of the theoretical universe varied with the sodium and organic nitrogen concentrations and marginal flow rate. Several factors acting in conjunction thus controlled community structure.

Predicting environmental conditions from the previously published results of the requirements of the component species in the communities revealed only a broad correspondence between the two. A species' reaction to the environment in the Jamaican waterways studied was shown to be subtly different from their reaction elsewhere. The reaction of 25 species to environmental conditions was determined and shown to be once again influenced by several factors.

By analysing both the community structure and its species composition, a detailed record of the environmental conditions present at any time or place can be predicted.