SUMMARY

In Vernon Hooper and Hartbeespoort Dams it was observed that low concentrations of algae and better water quality were associated with the occurrence of *Eichhornia crassipes* (Mart.) Solms. In Vernon Hooper Dam in the first six months following the introduction of hyacinth control a reduction in the cost of water treatment of 61% was reported (Anon, 1984). Musil (1983) calculated that nutrient removal by a population of *Eichhornia* of the size that occurred in Vernon Hooper Dam (*ca* 20 ha) would not have been sufficient to account for the observed reduction in water treatment costs. Also, the area occupied by *Eichhornia* (10 to 20% of the surface area at full supply level) was too small for shading to account for the reduction in water treatment costs. These observations led to the suggestion that *Eichhornia* was producing a substance which inhibited algal growth (allelopathy), therefore an investigation of the effects of water hyacinth on algal growth and water quality was initiated. This study included a review of allelopathy between aquatic plants, an experimental investigation of the allelopathic potential of hyacinth, case studies of Vernon Hooper and Hartbeespoort Dams and an assessment of the prospects of using hyacinth to improve lake water quality.

The literature review of allelopathy with particular reference to aquatic macrophytes showed that, in common with

most other supposedly allelopathic interactions, the evidence is limited and often contradictory. The data confirmed the hypothesis that allelopathy occurs in aquatic ecosystems but its general significance could not be established. Rather little research has addressed allelopathic interactions involving water hyacinth and that which has (Sharma, 1985) suggests that algae inhibit the growth of Eichhornia.

The experimental investigation of the allelopathic potential of Eichhornia in Vernon Hooper Dam, undertaken between April 1984 and May 1985, provided no evidence of allelopathy between Eichhornia and algae. Inhibitors were found on only two occasions, apparently not associated with the presence of Eichhornia. Such infrequent occurrence of inhibition could hardly significantly reduce algal standing crops and thus treatment costs.

Contrary to earlier estimates (Musil, 1983), Musil and Breen (1985) calculated that in Vernon Hooper Dam a 20 ha population of Eichhornia could remove sufficient nutrients to affect algal growth. In addition to its effect on nutrient availability Eichhornia also tends to reduce the algal standing crop principally by shading and increasing sedimentation rates. However, the Vernon Hooper case study indicated that since the introduction of hyacinth control in September 1981, the algal standing crop increased, water quality deteriorated and chemical treatment costs increased.

Thus it seems unlikely that Eichhornia produces significant quantities of an algal inhibitor and although the population of Eichhornia on Vernon Hooper Dam probably improves water quality, its effect is not sufficient to limit the algal standing crop and maintain water quality within acceptable levels.

In Hartbeespoort Dam at the peak of the infestation, Eichhornia occupied ca 60% of the surface area. Compared with periods before and after, the period of high Eichhornia cover was associated with lower chlorophyll a concentrations and an altered phytoplankton species composition. These changes were not due to reduced nutrient loading rates and nutrient availability, and were probably due to the effect of Eichhornia on other chemical and physical conditions in the impoundment. In Hartbeespoort Dam the exponential increase in algal numbers following the submergence of large areas of Eichhornia killed by the application of herbicide, suggests that the major effect of Eichhornia on the phytoplankton was probably to act as a barrier to light penetration, resulting in light limitation of algal production. In common with the investigation of the allelopathic potential of Eichhornia and the Vernon Hooper Dam case study, the Hartbeespoort Dam case study suggested that allelopathy between Eichhornia and phytoplankton was of little or no significance. However a broader based approach to the investigation of the allelopathic potential of Eichhornia is needed before it is possible to make a conclusive statement regarding the significance of allelopathy between *Eichhornia* and phytoplankton.

The prospect of using *Eichhornia* to improve the water quality of lakes was assessed. Although allelopathy does not appear to play a role, *Eichhornia* tends to improve water quality primarily by removing nutrients, causing light limitation of algal production and increasing sedimentation rates. Use of complete *Eichhornia* cover in lakes does not appear to be an economically viable option as it would prevent recreational use of the waterbody and the reduced rate of oxygen replacement would tend to reduce water quality and increase water treatment costs. Partial cover of *Eichhornia* would permit the recreational use of the waterbody and allow gaseous exchange between the atmosphere and the water. In Vernon Hooper Dam, a severely eutrophic impoundment, the partial cover of *Eichhornia* is not sufficient to contain water quality problems within acceptable limits, however in waterbodies of lower trophic status a partial cover of *Eichhornia* could be sufficient to significantly improve water quality especially if the impoundment was relatively shallow.

Eichhornia could be most effectively used for nutrient removal and water quality improvement if grown on artificial ponds at point source nutrient inputs. Provided diffuse source nutrient inputs to downstream waterbodies were small to point source inputs. However further research into the potential of using Eichhornia to improve water quality in mesotrophic or meso-eutrophic lakes is required.