Temporal and spatial variation, and the interaction of a number of physical, chemical and biological properties were examined in Lake Baringo (0 degrees 46'N; 36degrees 15'E), a tropical freshwater Rift Valley lake, between July 1988 and March 1989. The study also included the four perennial rivers draining into the Lake (Rivers; Mukutan-R1, Ol-Arabel-R_2, Molo-R_3 and Perkerra -R_4) and the hot springs in the central island Kokwe.

The lake was very turbid (mean Secchi depth 0.05 m), a condition brought about by the excessively high silt in suspension. Vertical temperature measurement over a 24 hour period showed that the lake exhibits a diurnal mixing pattern in which stratification sets in under hot calm conditions and later on completely mixes. Mixing is wind induced and aided by nocturnal convective cooling. Owing to the above average rainfall received in the general area, during the study period, the lake level rose precipitously to a peak value, 1.75m above the original level.

The mean lake conductivity and total alkalinity showed some temporal variations that were negatively correlated to the lake level changes (r=0.93 and 0.83 respectively). The rivers' conductivity and alkalinity also showed some inverse relationship to their water volumes. The mean lake conductivity ranged from 690 to 1170 μS cm^{-1} and alkalinity from 6.0 to 9.1 meq 1^{-1} as $CaCO_3$. The other chemical properties of the lake showed no distinct temporal changes and had the following ranges: pH, 6.9 to 9.2; dissolved oxygen (DO), 82 to 96% saturation; ammonia nitrogen (NH_3-N), 11.4 to 61.6 μg 1^{-1}; nitrite nitrogen (NO_2-N), 0.9 to 3.0 μg 1^{-1}; total nitrogen (TN), 0.78 TO 3.50 mg 1^{-1}; soluble reactive phosphorus (SSP), 0.0152 mg 1^{-1}; total phosphorus (TP), 0.112 to 0.175 mg 1^{-1}; and nitrogen phosphorus ratio (N: P), 4.3 to 15.3. Conductivity and alkalinity showed an attributable to the predominance of carbonates and bicarbonates.

The lake showed no distinct spatial variation in its chemical composition except at the south end where increased river and stream inflows greatly decreased the water conductivity, alkalinity and pH. DO levels also decreased possibly due to the introduction of deoxygenating organic allochthonous materials by the floodwater. The mean river conductivities (uS cm-1) were: R_1, 450; R_2, 320; R_3, 240 and R_4, 130; the mean alkalinities (meq 1^{-1} CaCO3) were 4.8, 2.7, 2.1 and 1.4 respectively. The other chemical properties of rivers showed no appreciable variation and were all, except silica, lower than the mean lake levels. The saline hot springs in the N.E. shore and the W. Cliff had mean conductivities (μS cm^{-1}) of 3490 and 3470, and alkalinities (meq 1^{-1} $CaCO_3$) of 30.4 and 37.5 respectively. The saline hot spring inflows, the supply of salts by the rivers and the fact that the lake is topographically endorheic suggests that the lake has some mechanism of regulating its freshness. Seepage outflow is strongly suspected to be one such mechanism.

Phytoplankton chlorophyll a measured as an index of phytoplankton biomass lacked a distinct temporal variation pattern (coefficient of variation, 16.2%). The mean lake values ranged from 8.7 to 15.9 μg 1^{-1}. A much wider fluctiation was, however, observed in the individual sampling sites. The phytoplankton community was dominated by the coccoid cyanophyte Microcystis aeruginosa which had a mean cell count of 1.17 x 10^3 cells ml^{-1}. The other common species Pseudanabaena catenata (1.4 x 10^2 trichomes ml^{-1}) and Nitzschia sp. (1.4 x 10^2 cells ml^{-1})

appear to be epiphytic on the mucilagenous coat of M. aeruginosa. The success of M. aeruginosa in the turbid waters of Lake Baringo possibly relies on its ability to regulate its buoyancy with gas vacuoles. On the lake surface, the dominant alga exhibits a patchy distribution which is wind induced. This behaviour explains the wide fluctuation in the biomass content of the individual sampling sites, and possibly masks the temporal patterns of change in chlorophyll a concentration and phytoplankton density. Over time, however, some qualitative changes were observed. These included the disappearance of Botryococcus braunii some time in December and the appearance around this time of some other algal genera, e.g. Anabaena sp., Scenedesmus sp. and Melosira sp.

Primary production measurement gave an areal rate of 3.8 g O_2 m^{-2} day^{-1}, a value much lower than that of other shallow freshwater East African Rift Valley lakes. As the lake had an N: P ration of 11.8 and a high level of soluble reactive phosphorus, it is possible that neither nitrogen nor phosphorus limits phytoplankton growth and photosynthesis. As the lake is very turbid, the limiting role of light is strongly suspected.