

First steps in the development of a water temperature model framework for refining the ecological Reserve in South African rivers

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Abstract

Ecological Reserve determination for rivers in South Africa presently does not include a water temperature component, in spite of its importance in determining species distribution patterns. To achieve this requires an understanding of how lotic thermographs from South African rivers differ from northern hemisphere rivers, to avoid mismanaging rivers based on incorrect regional assumptions. Hourly water temperatures from 20 sites in four river systems, representing a range of latitudes, altitudes and stream orders, were assessed using a range of metrics. These data were analysed using principal component analyses and multiple linear regressions to understand what variables a water temperature model for use in ecoregions within South Africa should include. While temperature data are generally lacking in low- and higher-order South African rivers, data suggest that South African rivers are warmer than northern hemisphere rivers. Water temperatures could be grouped into cool, warm and intermediate types. Based on temperature time series analyses, this paper argues that a suitable water-temperature model for use in ecological Reserve determinations should be dynamic, include flow and air temperature variables, and be adaptive through a heat exchange coefficient term. The inclusion of water temperature in the determination and management of river ecological Reserves would allow for more holistic application of the National Water Act's ecological management provisions. Water temperature guidelines added to the ecological Reserve could be integrated into heuristic aquatic monitoring programmes within priority areas identified in regional conservation plans.

Keywords: water temperatures, conservation planning, water temperature modelling, management