

Water temperature and riverine ecosystems: An overview of knowledge and approaches for assessing biotic responses, with special reference to South Africa

Helen Dallas*

Freshwater Research Unit, Department of Zoology, University of Cape Town, Private Bag X3, Rondebosch 7700, South Africa

Abstract

Available information pertaining to water temperature in riverine ecosystems is examined and consolidated into an overview that describes the spatial and temporal variation in water temperature, the importance of water temperature in lotic ecosystems, the measurement and modelling of water temperature, anthropogenic factors that modify water temperature, the effects of temperature changes on the physical and chemical characteristics of water; and on aquatic organisms and ecosystems. Methods for assessing the effects of temperature changes on aquatic organisms are discussed and current water temperature guidelines for the protection of aquatic ecosystems are outlined. This paper highlights the complexity of water temperature in the aquatic environment and the importance of understanding the spatio-temporal variability in water temperature and the variable responses of aquatic organisms to thermal stress. Anthropogenic modifiers of the thermal regime, which include heated discharges, flow modifications, riparian vegetation removal and global climate change; present ongoing threats to aquatic ecosystems. Whilst Northern Hemisphere information on water temperature is plentiful, this overview has identified the huge gap that exists in temperature-related data in South Africa. Without baseline data on water temperature and the thermal requirements of aquatic organisms, it is extremely difficult to adequately manage aquatic ecosystems. The risk of increasingly harsh conditions caused by greater water demands and climate change accentuates the need for a greater understanding of the thermal conditions in aquatic ecosystems in South Africa and the requirements and triggers of the associated aquatic biota. Future directions for thermal research are described.

Keywords: water temperature, riverine ecosystems, rivers, thermal regimes, biotic responses, aquatic organisms