

Comparative evaluation of three environmental flow calculation methods at Ketawala anicut of Aththanagalu Oya, Sri Lanka

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Abstract

Calculation of Environmental Flows (EFs), which are required for the sustenance of aquatic ecosystems in their original pristine state, often emerge as a prominent challenge to the sustainable management of water resources due to their complicity and difficulty of estimation. Being a tropical country that is heavily depended on its agriculture based economy, Sri Lanka often face the challenge of EF estimation during diverse irrigational and drinking water extractions. Lack of technology and expertise, and limitations in the long-term data have directly contributed for the wide utilization of rapid EF estimation methods. Therefore, the current study intends to evaluate the performance of such three widely practiced EF estimation methods, namely Tennant, IUCN and CEA methods for the EF estimation at Ketawala irrigational scheme. The Hydrologic Engineering Centre - Hydrologic Modelling System (HEC-HMS) version 3.5 model was calibrated and validated for the Aththanagalu Oya catchment and the daily river flow values for the past thirty five years (1981-2015) were generated at the pre-weir of the Ketawala anicut. The flow duration curve at the pre-weir of the Ketawala anicut was constructed (via the Gumbel approach) using the above simulated flow regime and the EFs that are applicable for the anicut were estimated via Tennant, IUCN and CEA methods in accordance with the standard methodologies. The Tennant method recommended an EF regime of 4.08 m³/s to be maintained at the post weir of the Ketawala anicut, while IUCN and CEA methods recommended EFs of 11.11 and 11.91 m³/s, respectively. Yet, EFs recommended by all these methods mostly remained higher than the average monthly flows in the dry season while considerably lower than the average monthly flows in the wet season at Ketawala, limiting the practical applicability of the estimated EFs. Furthermore, all these methods remained subjective and less responsive to the variations in the hydrological regime, while neglecting other major

ecological components (biota and physic-chemical factors etc.) in an aquatic ecosystem. Hence, regardless of their wide applicability for EF estimation in Sri Lanka, the Tennant, IUCN and CEA methods failed to yield practically and environmentally acceptable EFs for the Ketawala anicut.

Keywords: Environmental flow, Ketawela Anicut, HEC-HMS, Aththanagalu Oya