

Water Quality Index Estimation Model for Aquaculture System Using Artificial Neural Network¹

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Abstract: Water Quality plays an important role in attaining a sustainable aquaculture system, its cumulative effect can make or mar the entire system. The amount of dissolved oxygen (DO) alongside other parameters such as temperature, pH, alkalinity and conductivity are often used to estimate the water quality index (WQI) in aquaculture. There exist different approaches for the estimation of the quality index of the water in the aquatic environment. One of such approaches is the use of the Artificial Neural Network (ANN), however, its efficacy lies in the ability to select and use optimal parameters for the network. In this work, different WQI estimation models have been developed using the ANN. These models have been developed by varying the activation function in the hidden layer of the ANN. The performance of the ANN based estimation models was compared with that of the multilinear regression (MLR) based model. The performance comparison depicts the ANN model case 3 with a tangent activation function as the most accurate and optimal model as compared with MLR model and other ANN models based on the mean square error (MSE), root mean square error (RMSE) and regression (R) metrics. The optimal model has a goodness of fit of 0.998, thereby outweighing other developed models in its capability to estimate the WQI in the aquaculture system.

Keywords: Artificial Neural Network (ANN), Water Quality Index (WQI), WQI Estimation, Dissolved Oxygen (DO), Aquaculture.

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I. INTRODUCTION

The activities involved in the cultivation of aquatic animals under controlled conditions and environment are referred to as Aquaculture [1, 2]. The quality of water

available for use in this system of farming practice remains a challenge, as it has effects on the system performance [3]. The water quality is a measure of the suitability of the environment to the aquatic organisms [4]. A good water quality encourages improved productivity and vice-versa for a bad quality. The chemical, biological and physical properties as well as the activities of organisms are known to have effect on the state of the water quality [5]. The known parameters that influences the water quality in any aquaculture system includes the

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