ABSTRACT

MODELING AND FORECASTING OF LAKE PRIMARY PRODUCTION IN LAGUNA DE BAY USING ARTIFICIAL NEURAL NETWORK

Jonah John G. San Pedro

Adviser:
Dr. Mylene G. Cayetano

Laguna de Bay is one of the largest producer of fish in the country. Fish productivity is largely determined by lake primary production (LPP), commonly referred to as phytoplankton production. LPP is of vital importance to the maintenance of ecosystem functions and services as it represents the base energy/biomass level available for aquatic consumers and the succeeding trophic levels. With this, primary production gives a snapshot of the supportive carrying capacity of the lake, allowing policy – makers to decide on regulating the allowable area intended for aquaculture. However, rapid urbanization coupled with industrialization of the surrounding cities and municipalities has resulted to array of environmental and ecological degradation of the watershed. One of which is the decline in water quality that further impacts primary productivity and, thus, fish productivity. As these pressures are expected to intensify in the next few years, the importance of forecasting lake primary production as a tool for lake management increases.

In recent years, Artificial Neural Network (ANN) has been demonstrated to be capable of modeling dynamic non-linear systems and forecast water resource variables with higher accuracy relative to traditional statistical counterpart. This study aims to develop a neural network model of primary production in Laguna lake, specifically using a non-linear autoregressive with exogenous input (NARX) network based on twenty-year monthly water quality data (1997-2016) collected by Laguna Lake Development Authority (LLDA). Best input combination will be determined using Principal Component Analysis (PCA) and forward stepwise selection method. NARX Model will be calibrated using Bayesian Regularization algorithm and will be tested using present onsite data as inputs. Model performance will be evaluated using coefficient of determination (R^2), correlation coefficient, mean absolute error (MAE), root mean square error (RMSE) and mean square error (MSE). Lastly, a comparison of performance will be assessed between the NARX model and that of linear-based model.

Keywords: Lake Primary Production (LPP), Artificial Neural Network (ANN), Non-linear Auroregressive with eXogenous input (NARX), Fish Production, Carrying Capacity