

Abstract

With advancements in GIS technology and computer capabilities there has been an increased interest in species distribution modeling (SDM). Previous works have focused on creating SDMs to determine presence while many ignore how the environment interacts with the species abundance levels. This study attempted to determine the most suitable method for predicting spatial distribution as well as the abundance of several different fish species in Lake Ontario. Ten fish species that were observed in Lake Ontario benthic trawling surveys at least 5% of the time between 1978 - 2014 were used to develop models. Subsets of the original dataset were also used to account for periods of time that saw major changes in Lake Ontario. This included a dataset before the invasion of dreissenid mussels, a dataset after the invasion of dreissenid mussels, and a dataset for the years limited to when Round Goby (*Neogobius melanostomus*) occurred within the trawling surveys. Generalized Linear Models (GLM), Generalized Additive Models (GAM), and Geographically Weighted Regression (GWR) were compared to each other to determine the best method. Habitat variables used to determine abundance relationships consisted of depth, fetch, fishing depth temperature, distance to major rivers and wetlands, as well as the presence of other fish species in the trawl. Adjusted R^2 and Cohen's Kappa were the primary indicators for determining the best method. None of the methods were able to produce good models with the habitat and biological data used. GWR did show an improvement in overall modeling performance, based on this study's criteria, over GLM and GAM. This was done by producing adjusted R^2 and Cohen's Kappa values similar to the GAM models while using a less complex regression model by using fewer predictive variables.