Correlating Habitat Quality to Dock Frequency:
A Measure of Human Impact on Glacial Lakes

Abstract

The Midwest Glacial Lakes Partnership (MGLP) supplied a grant to study the glacial lakes in Iowa to ascertain human impact caused by piers and docks. MGLP recognizes 100 lakes of glacial origin (greater than 25 acres) in Iowa. A combination of ArcGIS and Google Earth Pro were used to locate and survey each lake to identify structures. Additional information was obtained from the Iowa Department of Natural Resources. Out of the 100 lakes, 40 were found to have one or more piers/docks. Several previous studies in other states were used to assist with determining methodology in identifying and categorizing the structures, aiding in the definition of surface and shoreline area impact, and formulating turbidity testing. The hypothesis of this study is that docks/piers cause a littoral and adjacent area impact whether through shading or, direct and indirect human actions on the flora and fauna within a 25-foot buffer zone of the structures and along the associated shoreline. The research question is that by using available data in conjunction with ground-truthing (in situ) fact finding trips, can it be shown that humans and their artificial piers and docks are having an effect (pro or con) upon the flora and fauna in the Iowa glacial lakes identified by the MGLP? The methodology consisted of visually inspecting the lakes using Google Earth Pro to identify, enumerate and categorize the structures; random sample ground-truthing for
verification of correct dock categorization from satellite/areal overhead views; random sample ground-truthing to measure turbidity of the lakes; and the use of various data sources and overhead views to determine surface area of the structures and their associated shoreline impact areas.

Using MGLP provided data for the individual predictors that were anthropogenic in nature (e.g., impervious surface cover) to generate the Cumulative Anthropogenic Stress Index (CASI), and the predictors that were of “natural” origin (e.g., bedrock geology) to generate the Cumulative Natural Quality Index (CNQI) and comparing those factors with dock frequency on the random sample of lakes, it was determined that there was very little relationship, if any based on dock frequency. These tests and comparisons were conducted with the four main groups of interest to MGLP, and those were the cold water species consisting of lake trout (*Salvelinus namaycush*), cisco (*Coregonus artedi*) and lake whitefish (*Coregonus clupeaformis*), northern pike (*Esox lucius*), cool water species represented by walleye (*Sander vitreus*), and warm water species represented by bluegill (*Lepomis macrochirus*).

The MGLP database collectors determined that CNQI values were positive growth factors and that CASI values were negative growth factors. It was further determined that a ratio (CNQI divided by CASI) would yield an indicator (Habitat Quality Index) for growth if the value was greater than one (positive growth potential) or signal possible remediation requirements if the value was less than one (negative growth potential).
Calculations were completed on total pier/dock surface area, with and without a buffer zone, as well as the shoreline impact area. Relationships of the number of docks with habitat quality indicators showed very little influence caused by the docks. There was very little influence on the size of the lake when compared with the habitat quality indicators. Additionally, Habitat Quality Indices were checked against the north-to-south and west-to-east Global Positioning of the central point of the lakes with structures to determine the general areas with the best Habitat Quality Indices favorable for the highest potentials for species growth.

Turbidity measurements were conducted on a random sampling of four structured lakes recognized by MGLP as glacial in origin. All readings were taken on clear days, but winds were significant at about 10-25 mph. The average “K” value was 5.183571429, which is rather high and the measured Secchi disc depths averaging about 0.75 meters, which amounts to approximately 2.5 feet of standard light penetration depth.