

Early detection monitoring of aquatic invasive species: Measuring performance success in a Lake Superior pilot network.

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The Great Lakes Water Quality Agreement, Annex 6 calls for a U.S.-Canada, basin-wide aquatic invasive species early detection network by 2015. The objective of our research is to explore survey design strategies that can improve detection efficiency, and to develop performance metrics to evaluate survey success. We piloted elements of the network in the three largest ports in Lake Superior (Duluth-Superior, Thunder Bay, and upper St. Mary's River). In 2010-2012 our program detected similar overall fish species richness among these locations, but larger differences in the number of non-native fishes detected. We used randomization approaches and rarefaction theory to estimate the effort required to detect 100% of the predicted species pool. Based on rarefaction, to sample >95% of the species pool would require >110 samples and as many as 350 samples. We also used these performance metrics to examine the impact of steps taken to optimize sampling designs. Examination of a 5-yr monitoring time-series from the Duluth-Superior harbor, shows that the cumulative effort offers increased potential to detect rare, newly introduced non-native fishes; however, the detection power is relatively low for any given year and annual data tend to present artificially high confidence compared to the longer time-series. These results indicate a sustained, long-term program is necessary to effectively interpret and report monitoring results.