Monitoring and Mapping of *Avian Resources* over the Great Lakes to Support Management

Goals

- Develop predictive models of water bird distributions and densities across the Great Lakes to support decision-making and conservation planning.
- Establish a foundational data management system that fosters a community of researchers contributing data beyond the life of the project, and that permits analyses and uses at multiple scales.

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Background

With 10,000 miles of shoreline and a watershed area of more than 300,000 square miles, the Great Lakes region provides important breeding, feeding, and resting areas for many birds. Much of the Great Lakes coastal aquatic and terrestrial landscapes that once supported migrating birds have been lost or degraded, yet the region supports hundreds of millions of migrants during both spring and fall migration. To assist in managing these bird populations and conserving the habitats that support them, the best information available on how these populations use the Great Lakes is needed.

Developing Predictive Species Models

From 2012 to 2014, the Great Lakes Commission and the U.S. Fish and Wildlife Service coordinated five research entities to conduct aerial surveys of selected areas of Lake Michigan, Lake Huron, Lake St. Clair, and Lake Erie during the non-breeding season (see fig. 1c).

Building on the survey, a team developed a modeling approach to better serve and inform conservation and planning efforts through the collaborative work with natural resource managers and other stakeholders.

Preliminary hotspot analyses (fig. 1) and environmental covariate analyses (table 1) were produced, but additional data will be necessary to have a clear understanding of the distribution of waterbirds in the entire Great Lakes region.

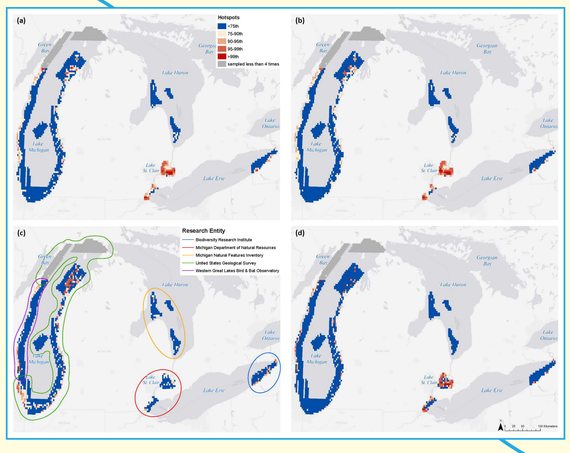

Figure 1. Potential hotspots (values above the 75th percentile within each method) for the all-species-combined species group as estimated with each of the four hotspot analysis approaches:

(a) kernel density estimation,
(b) Getis-Ord Gi*,
(c) hotspot persistence, and
(d) hotspots conditional on presence.

Grid cells sampled less than four times were excluded from the analysis and are shaded in gray. Note the survey regions are delineated for the hotspot persistence approach (c) because hotspots in this method are calculated relative to other grid cells within these specific regions. In this illustration, values below the 75th percentile are not considered hotspots.

Developing a Data Management System for Great Lakes Researchers

The Midwest Avian Data Center (MWADC, fig. 2) is a node of the Avian Knowledge Network (AKN). The AKN supports a network of people, data, and technology to improve bird conservation, management, and research across organizational boundaries and spatial scales. The MWADC provides the platform to manage scientific data, foster meaningful data visualizations, and coordinate partnerships around conservation questions.

MWADC users can manage point counts, aerial transects, area search and other types of data through on-line tools. By making the data discoverable, users can visualize and analyze information through different outputs, at multiple spatial scales.

Available at: http://data.pointblue.org/partners/mwadc/index.php

Response	Parameter	*Long-tailed Duck* mean (95% CI)	*Gulls* mean (95% CI)	*Goldeneyes* mean (95% CI)	*Loons* mean (95% CI)	*Mergansers* mean (95% CI)	*Scaup* mean (95% CI)
Zero-inflation	Intercept	1.1 (0.8 , 1.5)	0.3 (0.1 , 0.5)	-1.3 (-1.7 , -0.8)	-0.5 (-0.9 , 0.1)	-0.6 (-0.8 , -0.3)	-1.3 (-1.9 , -0.6)
	Longitude	1.1 (0.9 , 1.4)	-0.8 (-1 , -0.7)	-1.1 (-1.4 , -0.8)	0.1 (-0.1 , 0.4)	-1.2 (-1.4 , -1.1)	0.9 (0.7 , 1.2)
	Longitude^2	0 (-0.2 , 0.2)	0.4 (0.3 , 0.5)	0.7 (0.5 , 1)	0.1 (0 , 0.2)	0.5 (0.5 , 0.6)	-0.5 (-0.8 , -0.3)
	Ice Coverage -- >95%	-1.1 (-1.5 , -0.7)	-0.7 (-1 , -0.4)	-1.8 (-2.6 , -0.9)	0.6 (-1.3 , 2.8)	-0.6 (-1 , -0.2)	0.8 (0.2 , 1.6)
	Season -- Fall	-1.7 (-1.9 , -1.4)	1.1 (0.9 , 1.4)	-2.3 (-2.6 , -1.9)	0.2 (0 , 0.5)	-1.2 (-1.4 , -0.9)	-0.1 (-0.4 , 0.1)
	Season -- Winter	0.1 (-0.2 , 0.4)	-0.4 (-0.6 , -0.2)	0.9 (0.5 , 1.5)	-1.4 (-1.8 , -1)	-0.4 (-0.8 , -0.1)	-0.1 (-0.5 , 0.2)
Abundance	Intercept	-2.4 (-2.7 , -2)	-1.7 (-2 , -1.4)	-3.5 (-4.1 , -2.9)	-2.1 (-2.8 , -1.5)	-2.4 (-2.7 , -2.1)	-2.8 (-4.2 , -1.9)
	Substrate -- Clay	1.5 (1.2 , 1.8)	0.6 (0.3 , 0.9)		0.3 (-0.1 , 0.7)		
	Substrate -- Hard	1.7 (1.4 , 2)	0.6 (0.4 , 0.9)	1.9 (1.4 , 2.3)	0 (-0.3 , 0.4)	1.8 (1.5 , 2)	1.1 (0.5 , 1.8)
	Substrate -- Mud		1.1 (0.8 , 1.4)		1.8 (1.3 , 2.4)		
	Substrate -- Sand	1.7 (1.4 , 2)	0.9 (0.7 , 1.2)	1.4 (1 , 1.8)	0.8 (0.5 , 1.1)	0.9 (0.7 , 1.1)	0.5 (0.2 , 0.8)
	Substrate -- Silt		0.3 (0 , 0.6)				
	Bathymetry	-1.3 (-1.5 , -1.2)	-0.6 (-0.7 , -0.6)	-2.4 (-2.7 , -2.1)	-0.8 (-1 , -0.7)	-2.1 (-2.3 , -1.9)	-1.2 (-1.5 , -0.9)
	Ice Coverage	0.2 (0.1 , 0.3)	0 (0 , 0.1)	0 (-0.2 , 0.1)	-0.5 (-0.8 , -0.1)	0.1 (0.1 , 0.2)	0 (-0.2 , 0.2)

Table 1. Posterior means of the abundance parameters for Long-tailed Duck, gulls, goldeneyes, loons, mergansers, and scaup. Covariates are shown for the zero-inflation component and the conditional upon presence abundance component of the model. 95% CI is the lower and upper 95% Credible Interval for each parameter estimate.

Figure 2. Home page of the MWADC.

Informing Management and Conservation

This project makes significant contributions toward filling critical data gaps in our knowledge of avian distributions and abundances in the open waters of the Great Lakes. These data can be used to inform future management and conservation decisions related to activities that might affect waterbirds through their life cycles.

Armed with this knowledge, natural resource managers, conservationists, and other stakeholders can make better-informed decisions about habitat restoration investments and identify important over-lake habitats that should be protected from human impacts, closely monitored, and carefully managed.

For more information on the project, visit:
http://glc.org/work/avian-resources

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