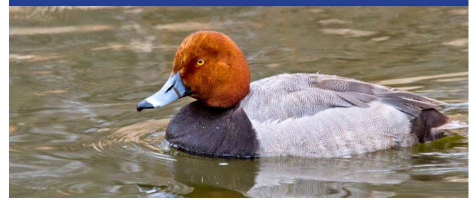
INTEGRATED WATERBIRD
Management & Monitoring

PUBLICATION SUMMARY

A continental landscape where non-breeding waterbirds have the right habitat, in the right place, at the right time.



Redhead. Shawn McCready

A generalizable energetics-based model of avian migration to facilitate continental-scale waterbird conservation. Ecological Applications, October 2015. DOI: 10.1890/14-1947.1

Eric V. Lonsdorf, Wayne E. Thogmartin, Sarah Jacobi, Kevin Aagaard, Jorge Coppen, Amélie Davis, Timothy Fox, Patricia Heglund, Rex Johnson, Tim Jones, Kevin Kenow, James E. Lyons, Kirsten Luke, Shannon Still, and Brian Tavernia

THE PROBLEM

Conserving migratory birds is a challenge because they winter in the south and breed in the north. It is a cycle repeated year after year, and as they migrate back and forth between wintering and breeding destinations, they stop at various locations along the way. To ensure that waterbirds have the right amount of habitat, in the right places and at the right time, successful conservation requires clear objectives and coordinated management and monitoring. However, monitoring efforts for nonbreeding waterbirds have not been coordinated to the extent necessary to inform decisions at the landscape scale.

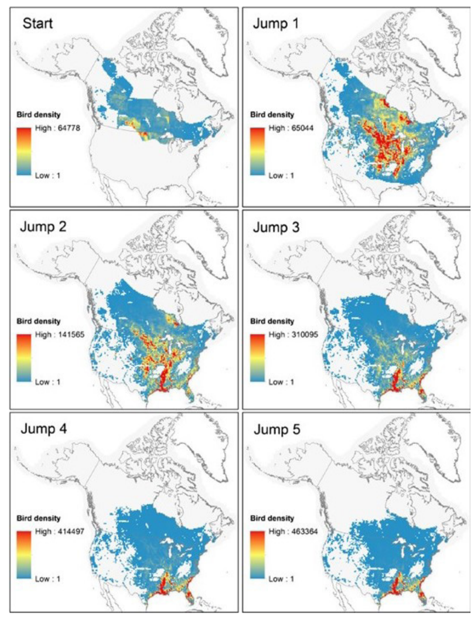


Figure 1. Model result from one iteration of fall migration: each panel represents the movement after a migratory jump. The upper-left panel represents the start of the model and jumps proceed left to right and top to bottom. Bird density increases from blue (low) to red (high).

THE IWMM APPROACH

To aid managers across the country in their decision-making for waterbirds, staff with the Integrated Waterbird Management and Monitoring program (IWMM) developed a tool that simulates waterbird migration at a landscape scale. Being able to visualize migration helps managers determine where and when birds may need to stop and refuel as they move across the continent and manage accordingly.

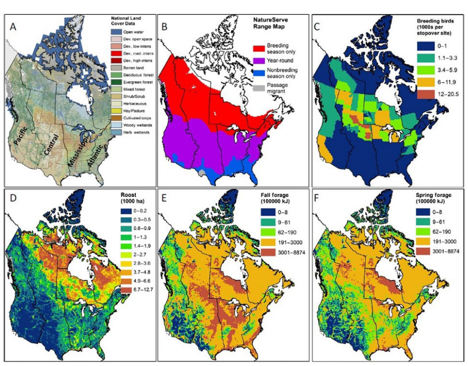


Figure 2. Examples of GIS data used in simulations. These panels show land cover, breeding and nonbreeding ranges, and distributions of breeding birds, roost habitat, fall forage, and spring forage.

METHODOLOGY

To identify the most important locations and timing of their use by waterfowl, we built a model that simulated migration of a mallard-like duck between wintering and breeding grounds. When birds travel between these areas, movements are dictated by the amount of energy available at stopover sites vs. the amount of energy used during flights, and consist of a series of "jumps" from one stopover site to another (Fig 1). Therefore our model simulated the spring and fall movements of our mallard-like duck as a function of its potential caloric gains and losses across a continental scale "energy map." The energy landscapes were based on assigning caloric values to roosting and foraging features and were created using ARC GIS (Fig 2).

RESULTS/FINDINGS

For our computer generated "birds," we found that the duration of migration was slightly shorter in spring, 23.5 days, than during fall, 27.5 days. Survival rates during both periods of migration were also similar: 90.5% in fall and 93.6% in spring. Using our model we learned that survival during migration was influenced by flight speed, the energy it took to make the flight (cost), the amount of energy (fuel) birds could carry and the spatial pattern (distribution) of available energy resources (habitat); survival was generally insensitive to total energy availability. The model allowed us to distribute "birds" across the continent in relation to wetland cover and agricultural habitat. We ran the model repeatedly, changing a few variables each time to see how they might influence the distribution of birds. In general, bird-use days in both spring and fall were highest in the Mississippi Alluvial Valley and along the coast and near-shore environments of South Carolina (Figure 1). During spring, stop-over locations mid-way between wintering and breeding areas were essential for efficient migration and high survivorship, while locations closer to the breeding or wintering grounds (migratory endpoints) were less important. Visualizations based on these simulated movements (e.g., Figure 3) can help decision-makers direct their conservation actions toward locations that have the greatest influence on migratory success. Currently, members of the IWMM Technical Team are working to extend this model to include the entire non-breeding season and adding realism such as the effects of weather and loss of food to decomposition.

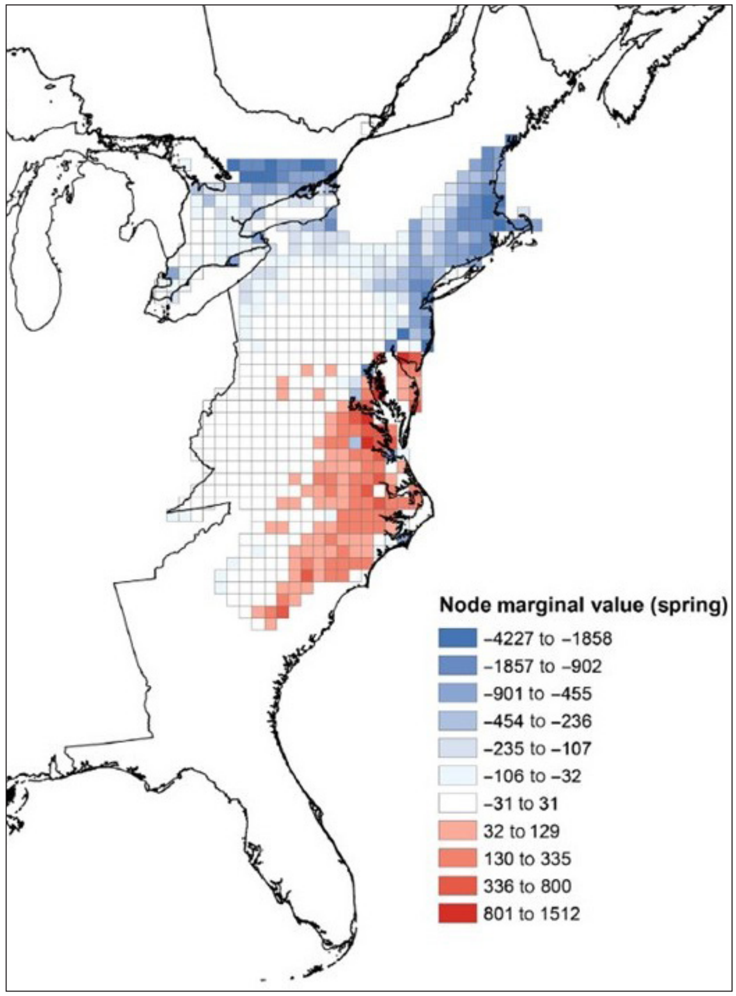


Figure 3. Importance of areas for survivorship in the Atlantic Flyway during spring migration. Warmer colors indicate the most essential locations for improving survival during migration.

FOR MORE INFORMATION

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