

Standardizing and Integrating Aerial Surveys for Population Size Estimation across the Great Lakes

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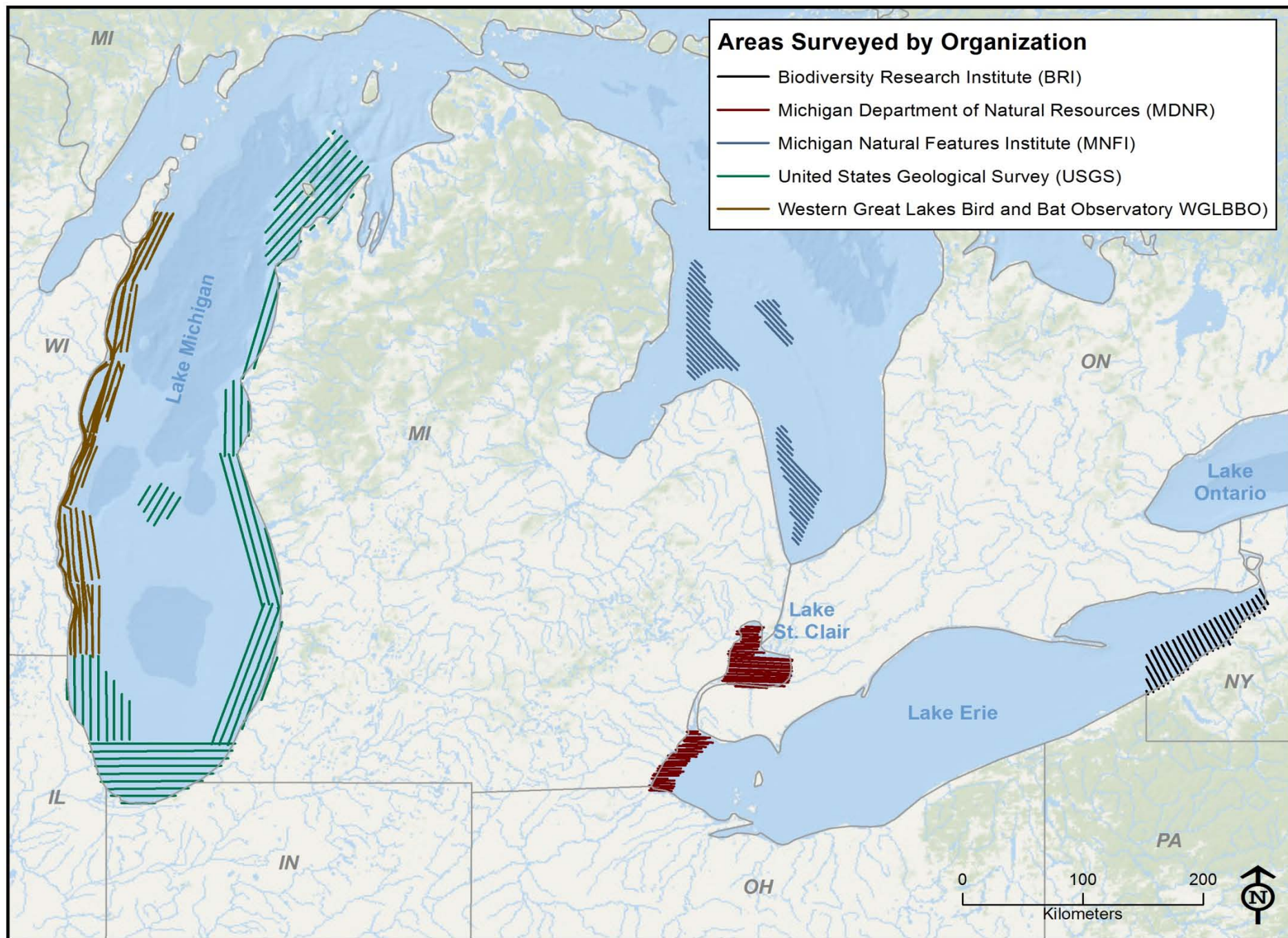


Partners

- Modeling Collaborators
 - Elise Zipkin
 - Alli Sussman
- Data Providers
 - Kevin Kenow
 - Dave Luukenon
 - Mike Monfils
 - Bill Mueller
 - Kate Williams
- Project Coordination
 - Becky Pearson
 - Katie Koch
 - Leo Salas

Project Timeline

- Starting Project Date: April 1, 2016
- Draft Results: April 1, 2017
- Final Report: August 1, 2017



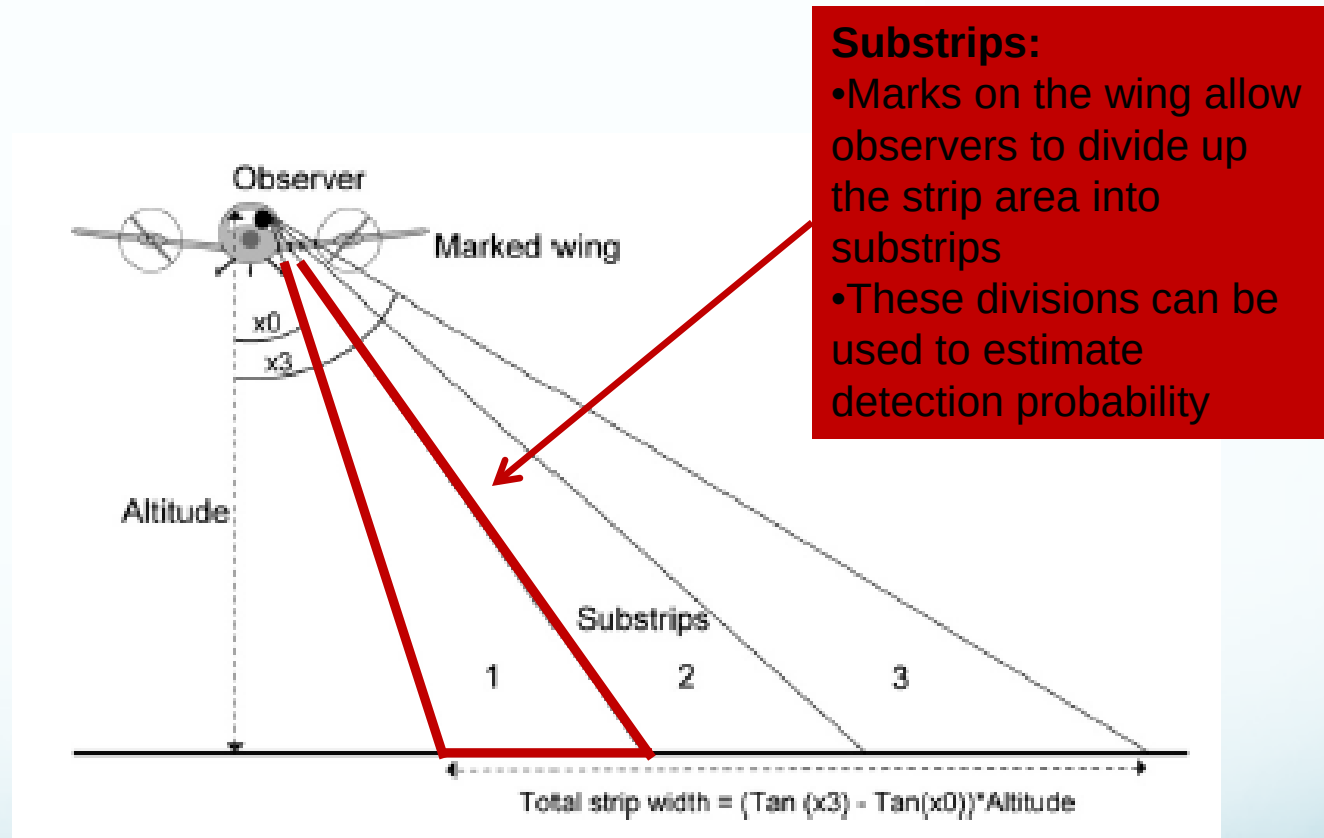
Survey Diversity

	U.S. Geological Survey (USGS)	Western Great Lakes Bird and Bat Observatory (WGLBBO)	Michigan Natural Features Inventory (MNFI)	Michigan Division of Natural Resources (MDNR)	Biodiversity Research Institute (BRI)
Geographic area	Lake Michigan	Western shoreline of Lake Michigan	Portions of Northern Lake	Lake St. Clair and western Lake Erie	New York's portion of Lake Erie
Years surveyed	2013-2014	2013-2014	2012-2014	2012-2014	2013-2014
Transect spacing	4.8 km	3.2 km	5 km	3.2 km	5 km
Plane type	Partenavia P.68		Partenavia P68C	amphibious Cessna	amphibious Cessna
Altitude of flights	61-76 m (200-250 ft)	100 m	91 m (300 ft)	91 m (300 ft)	61 m (200 ft)
Flight speed	200 km/hr	148 km/hr	130-200 km/hr	145 km/hr	145-169 km/hr
Strip width (when no distance provided)	200 m		412 m		200 m
Distance bands		2	3	4 or 5	5
Species recorded	Waterbirds and waterfowl	Waterbirds and waterfowl	Waterbirds and waterfowl	Waterbirds and waterfowl	Waterbirds and waterfowl

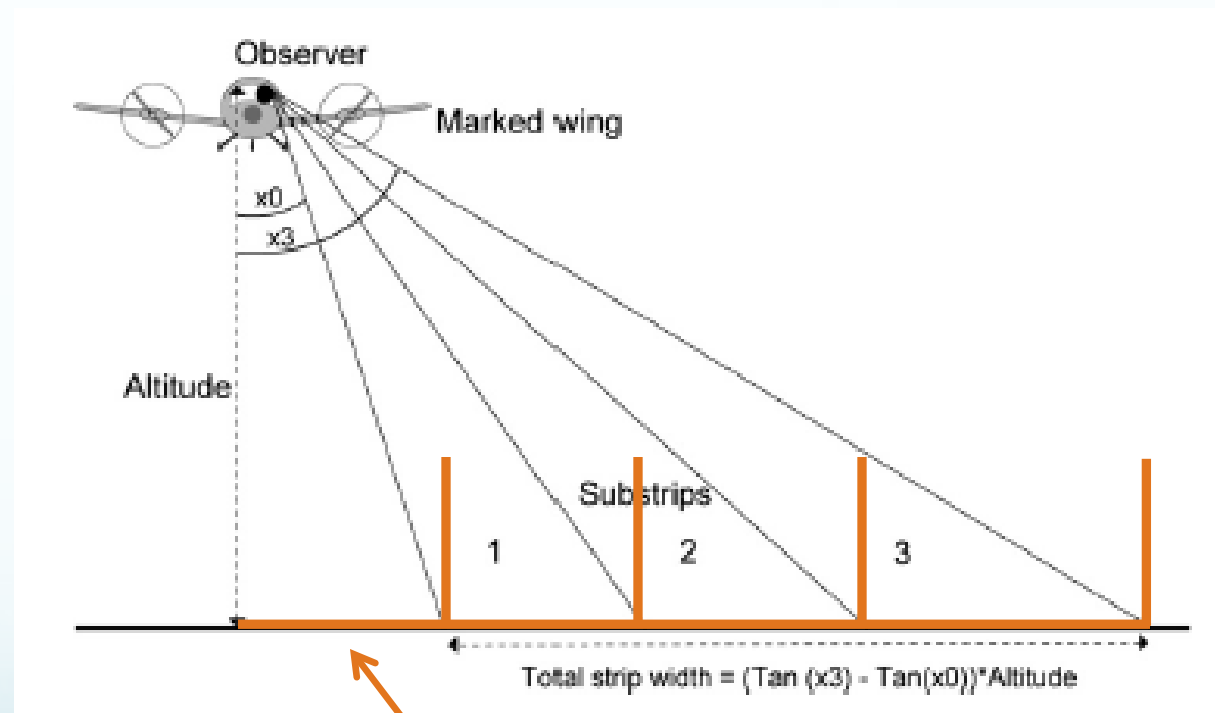
Why Does This Matter?

- We want to learn something about the Great Lakes as whole and be able to **compare surveys** to one another.
- We want to correct for **detection bias** across all these surveys
- We want to be as **accurate** as possible in predictions of where animals are using the Great Lakes

Aerial Survey Techniques



Aerial Survey Techniques

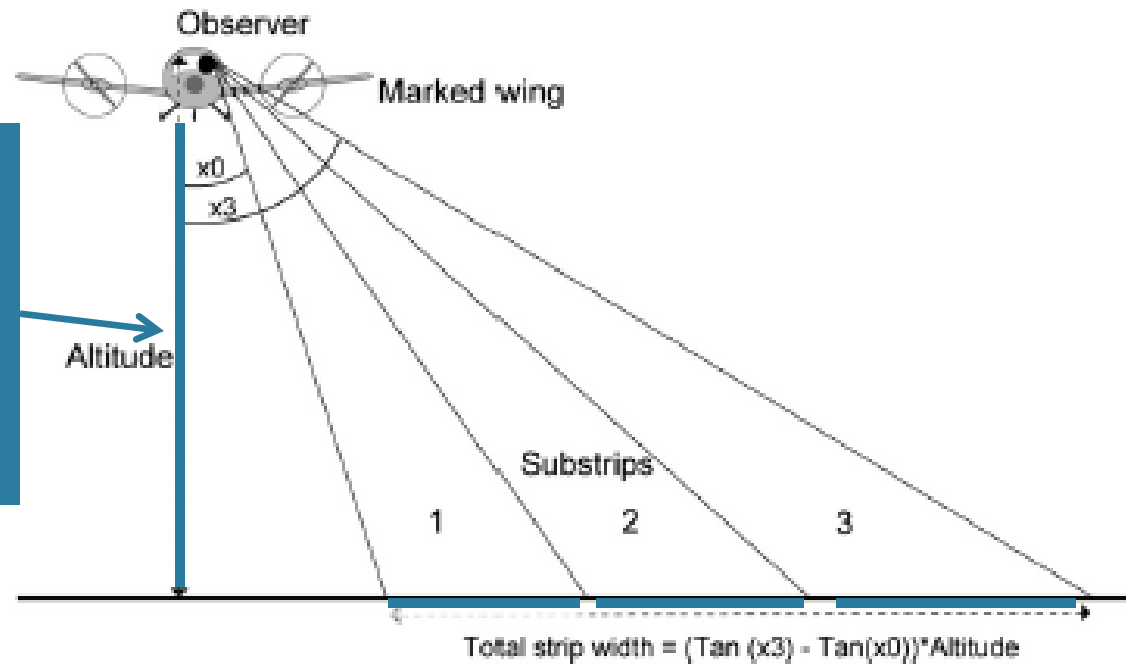


Transect Type:
•Line vs. Strip

Aerial Survey Techniques

Altitude:

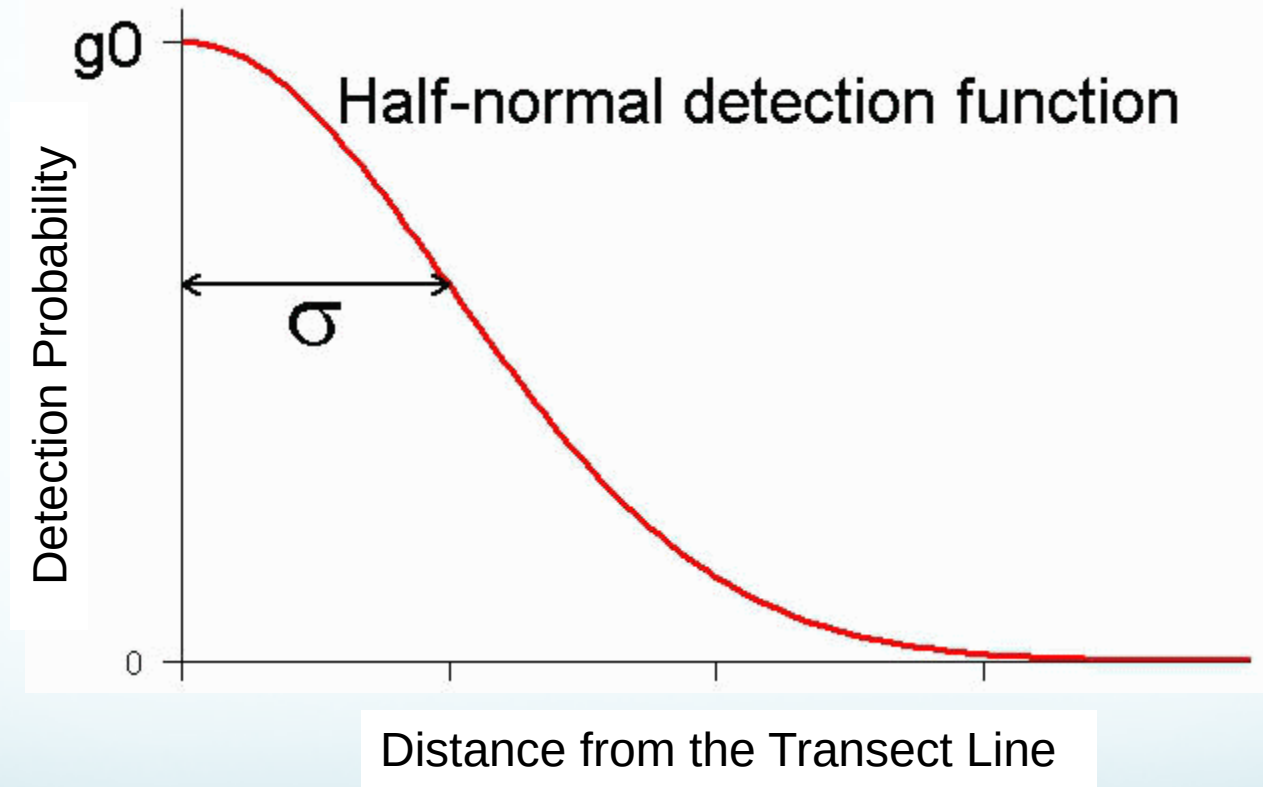
- Influences detection and identification rates of animals
- Also influences area of substrips



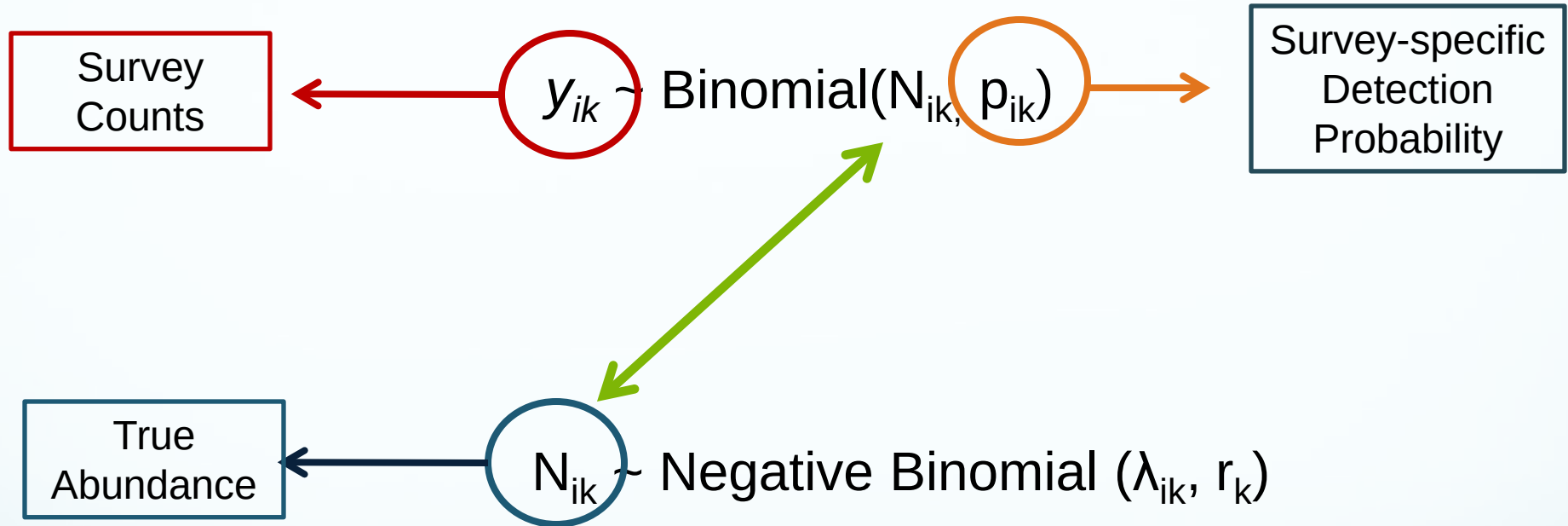
Our Initial Objective

- To find a way to combine aerial surveys together into a single modeling framework to improve estimates of detectability and abundance (or density) across all surveys
 - Make efficient use of data and improve model predictability
 - Surveys with less data used for detectability estimation (distance classification) can potentially use data from other surveys to provide more accurate abundance estimates
- **But how would that work exactly?**

Detection Functions



Hierarchical Distance Sampling Approach



i =transects
 k =surveys

Combining Surveys

- Some Potential Options for Estimating Sigma:
 1. Model sigma as constant across all surveys for a particular species
 2. Model sigma as a fixed effect by survey for a particular species
 3. Model sigma such that each survey is a realization of a region-wide random effect

Challenges

- Parameterizing these models can be difficult
 - Different data collection methods
 - Sparse data in some areas
 - Skew in the counts
 - May need more flexible distributions or models to address large counts and zeroes
 - Correlation in the counts
 - Include explicit spatial correlation in models of abundance
- How many species can we model this way?