

Estimating zebra mussels densities using distance sampling

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Background



photo: Naomi Blinick

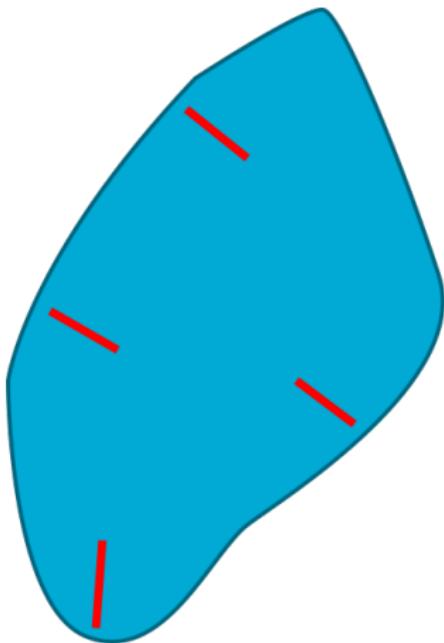
Reliably count zebra mussels at low densities



- ▶ Assess control efficacy
- ▶ Determine conditions that promote growth

photo: Naomi Blinick

Benefits of using a formal survey design



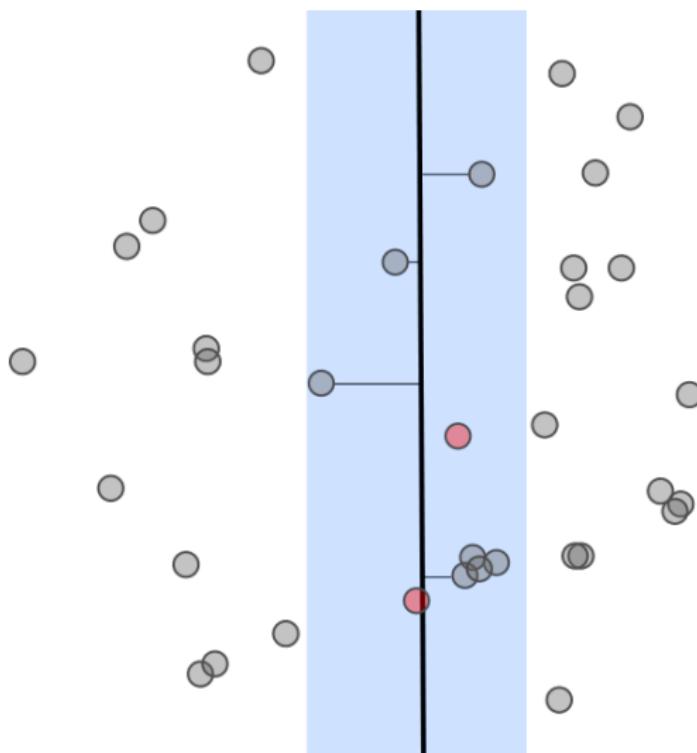
- ▶ Ensure sample is representative of the population
- ▶ Control the amount of area surveyed
 - ▶ Determine **uncertainty** in density

Distance sampling

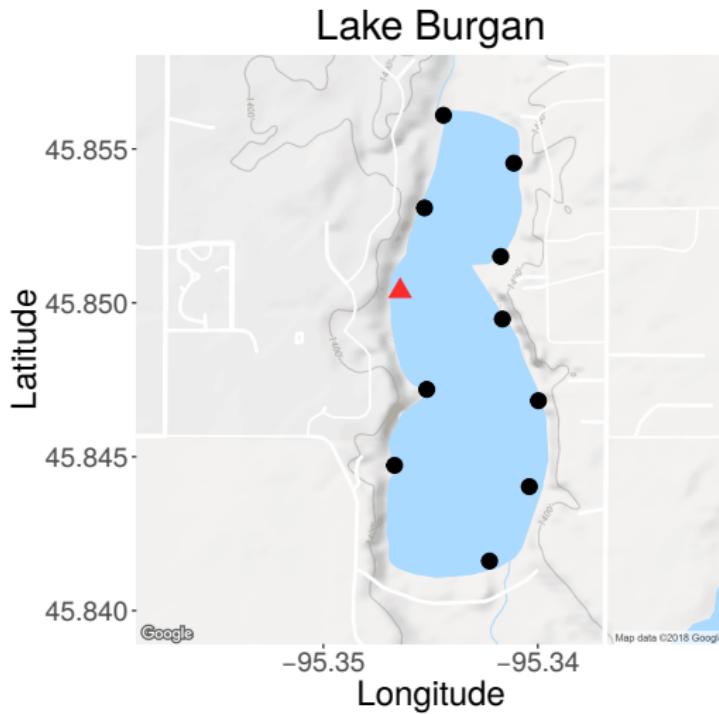


image: Thomas Ostendorf

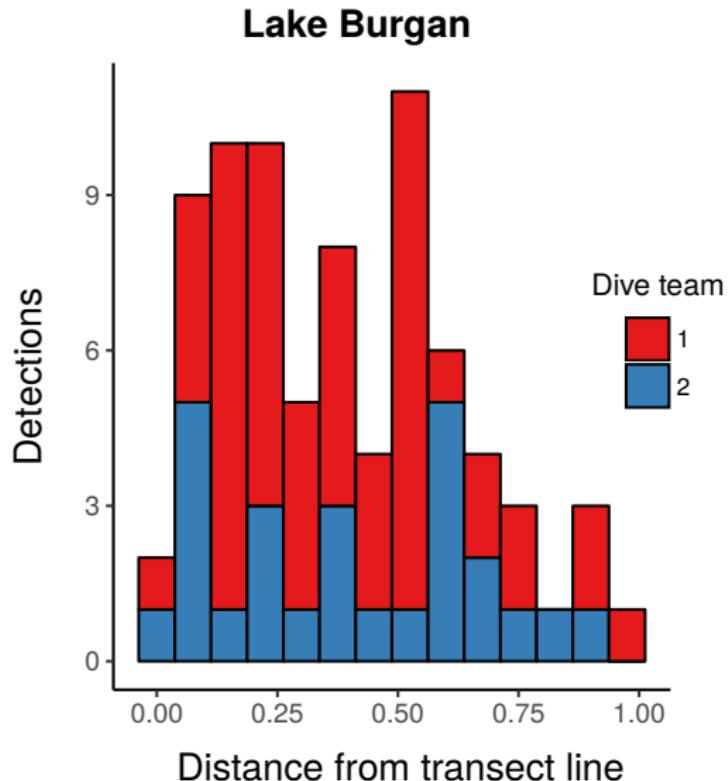
An approach for low and intermediate densities



Lake survey: summer 2017



Distance and detectability



The payoff

X : is the number of zebra mussels detected

A : is the amount are surveyed

P : is the detection probability of detecting a zebra mussel
($P = 0.60$)

- ▶ Observed density: $\frac{X}{A} = 0.08$
- ▶ Estimated density: $\frac{X}{PA} = 0.25$ (SE = 0.09)

Investigating survey tradeoffs



image: Thomas Ostendorf

The fast/slow tradeoff

Should we go fast and cover lots of area, but maybe miss some mussels?

or

Should we go slow and detect everything, but cover less area?

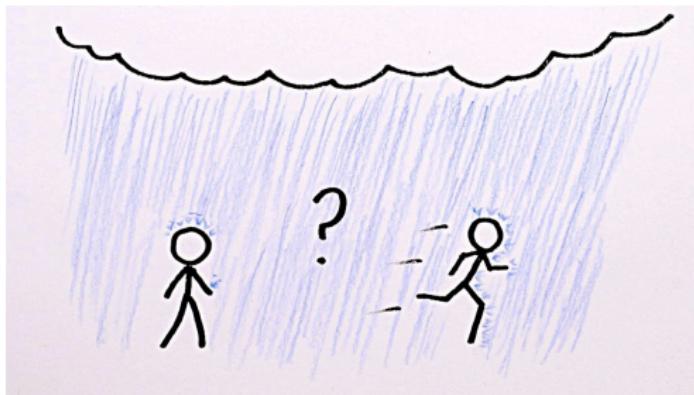
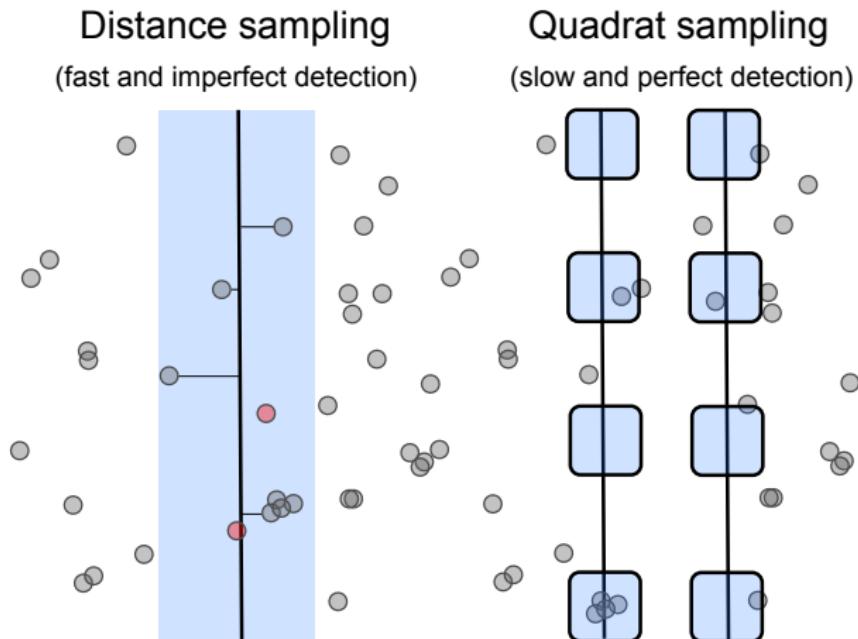
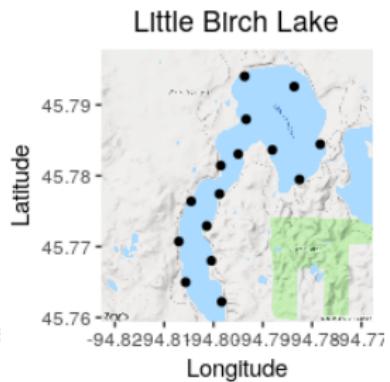
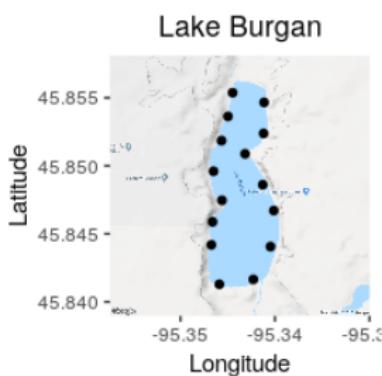
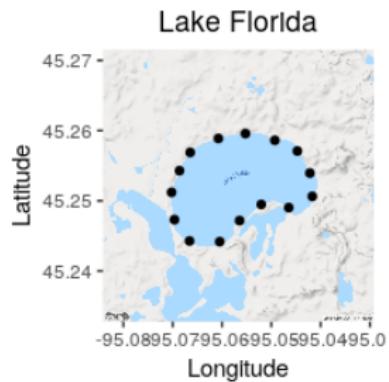


image: minutephysics(youtube.com)

Controlling effort through design

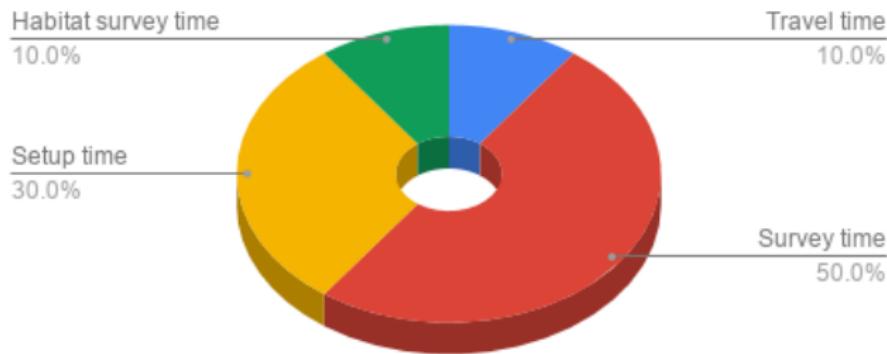


Lake surveys: summer 2018

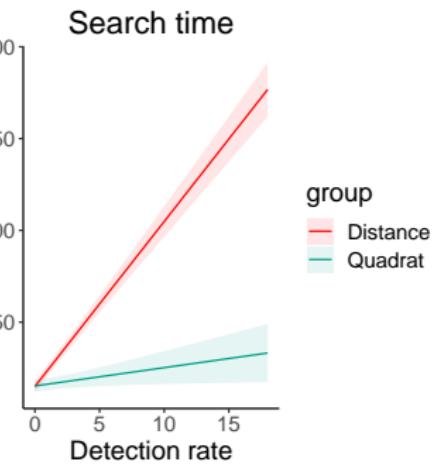
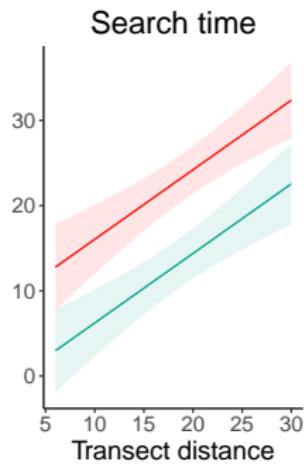
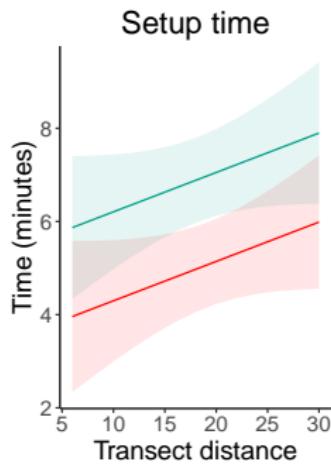


Time budget approach

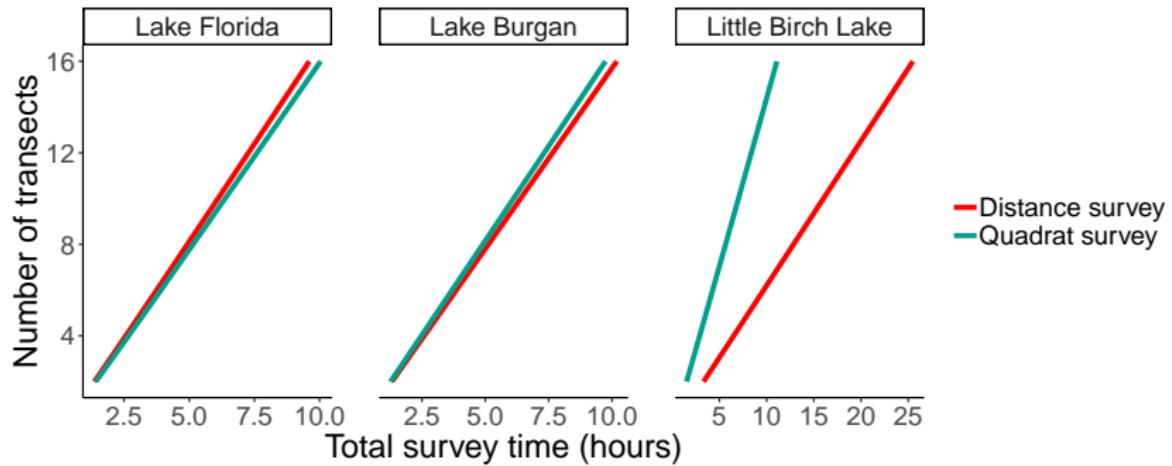
- ▶ Time to **setup** each transect
- ▶ Time to conduct each **survey**
- ▶ Time to **move** between transects



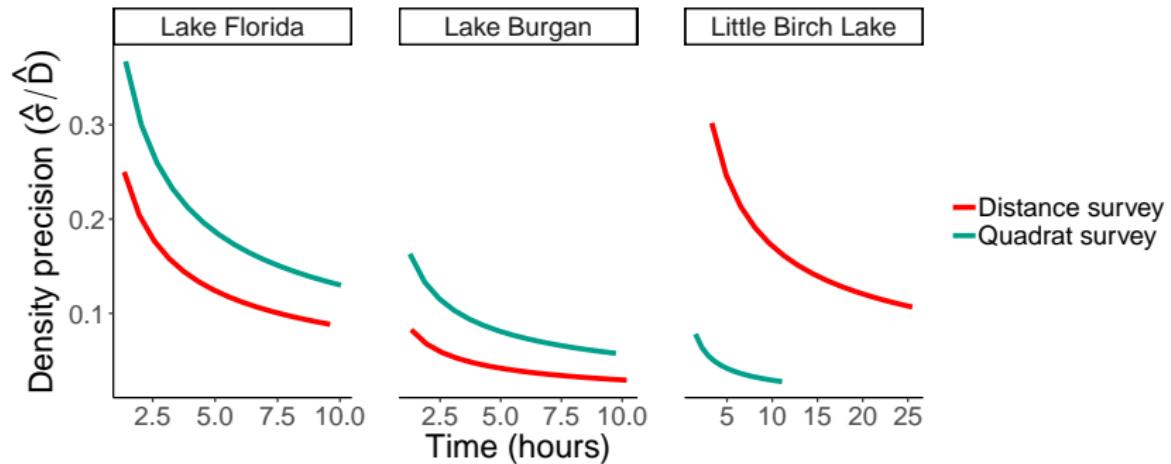
Time to perform transect setup & search



Number of transects that can be completed



Impacts of the time budget on estimates



Conclusions

- ▶ **Distance sampling** is an attractive approach at low-densities
 - ▶ Requires two observers
- ▶ At higher densities **quadrat surveys** are more efficient
- ▶ Still working on exploring how survey area and efficiency trade off more generally

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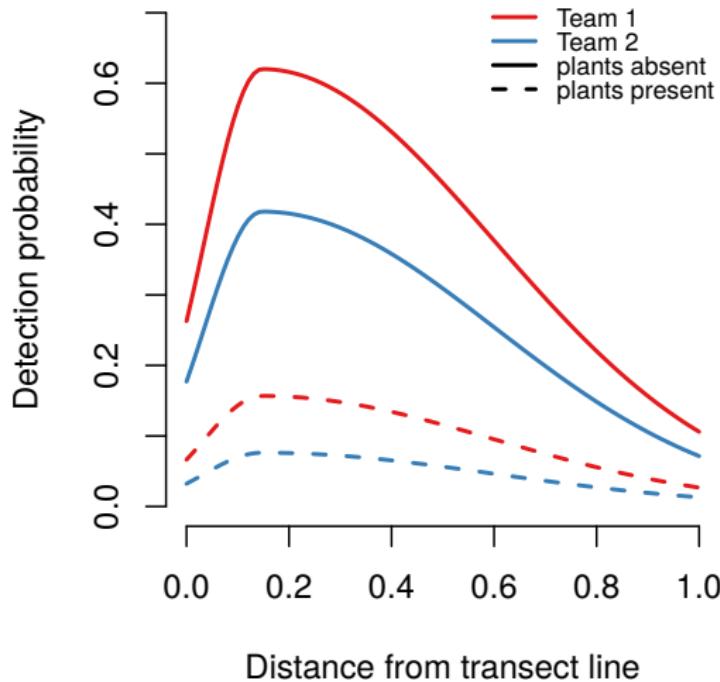
Tom Jones



- ▶ Contact me: Jake Ferguson (jakeferg@umn.edu)

Estimated detection function

Lake Burgan



Time it takes to move between transects

