Estimating zebra mussels densities using distance sampling

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10/16/2018

Background

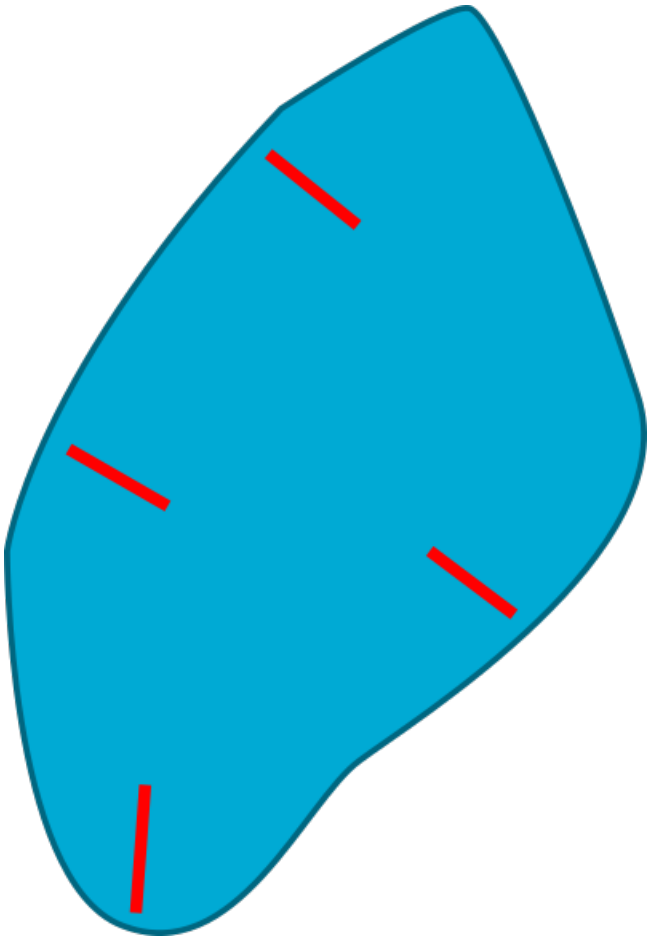
photo: Naomi Blinick

Reliably count zebra mussels at low density

photo: Naomi Blinick

- Assess control efficacy
- Determine conditions that promote growth

Benefits of using a formal survey design

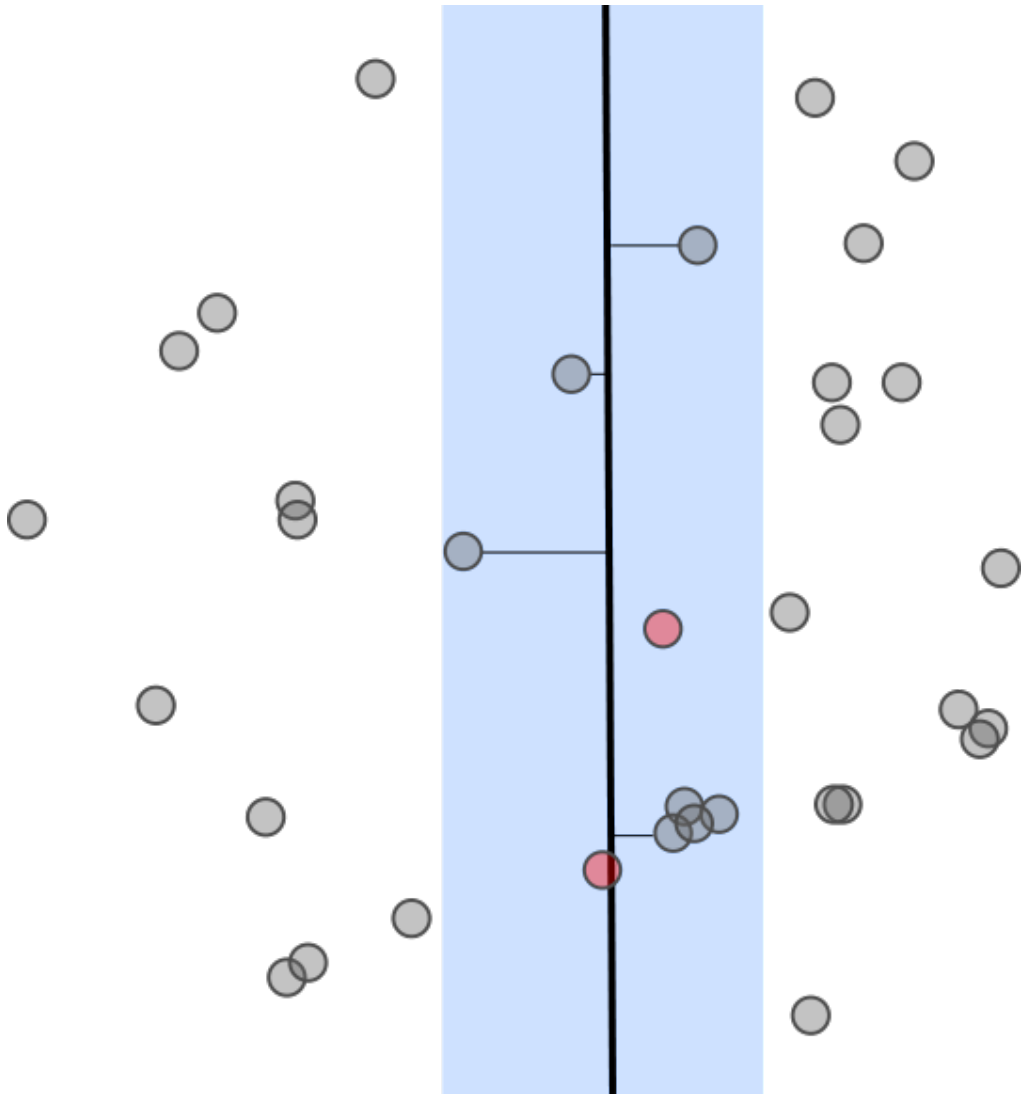


- Control the amount of area surveyed
  - Determine **uncertainty** in density
- Determine conditions that promote growth

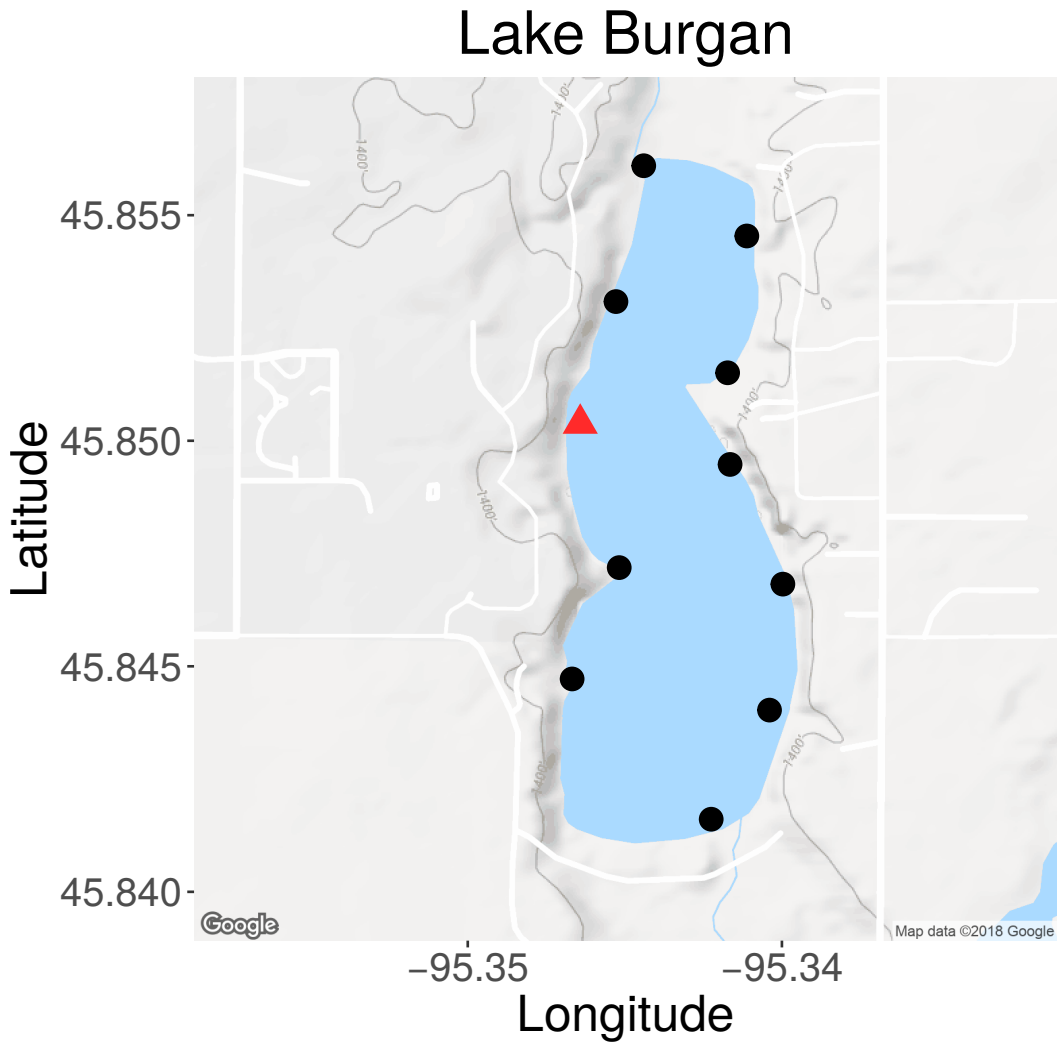
Distance sampling

image: Thomas Ostendorf

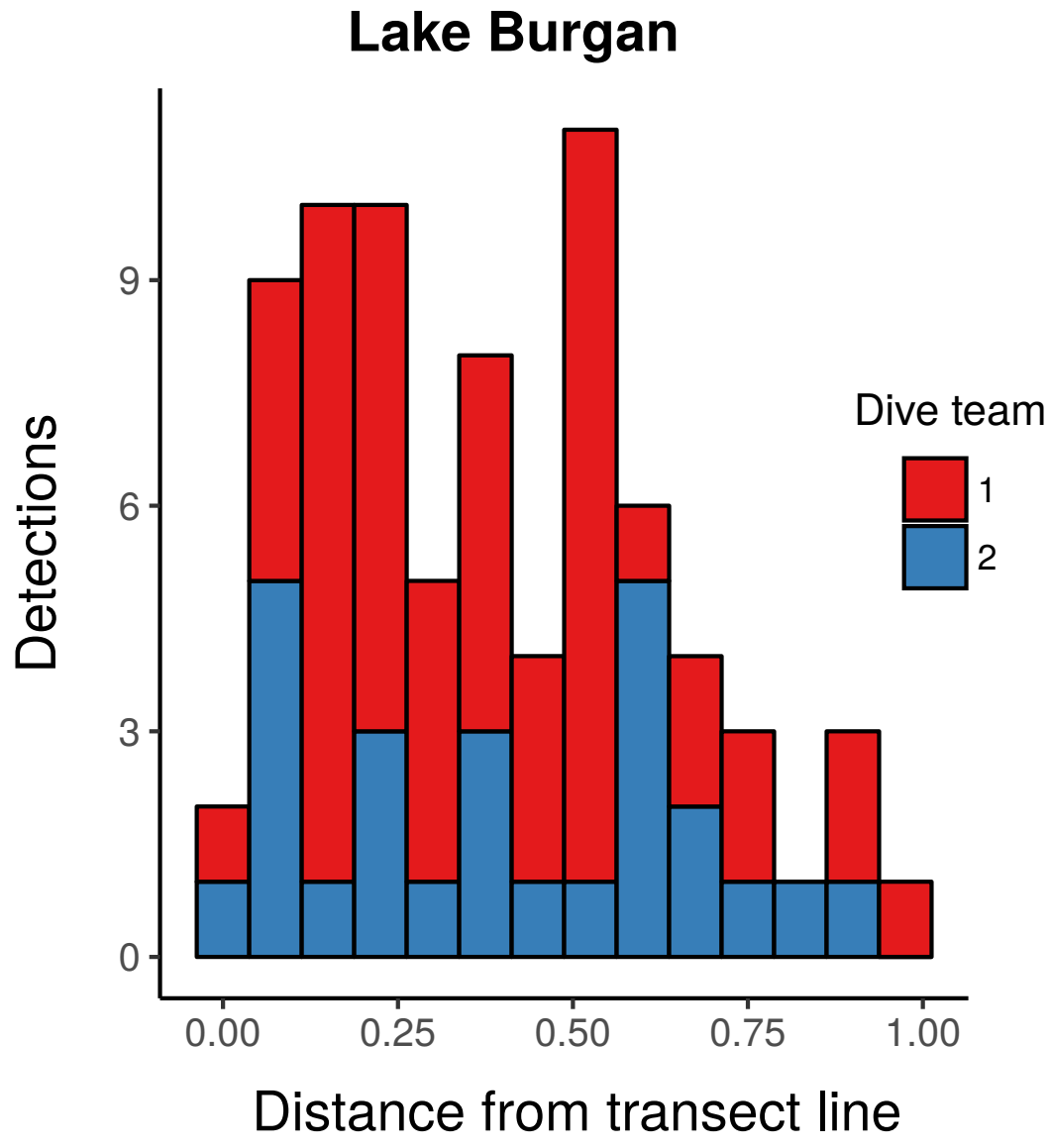
An approach for low and intermediate densities



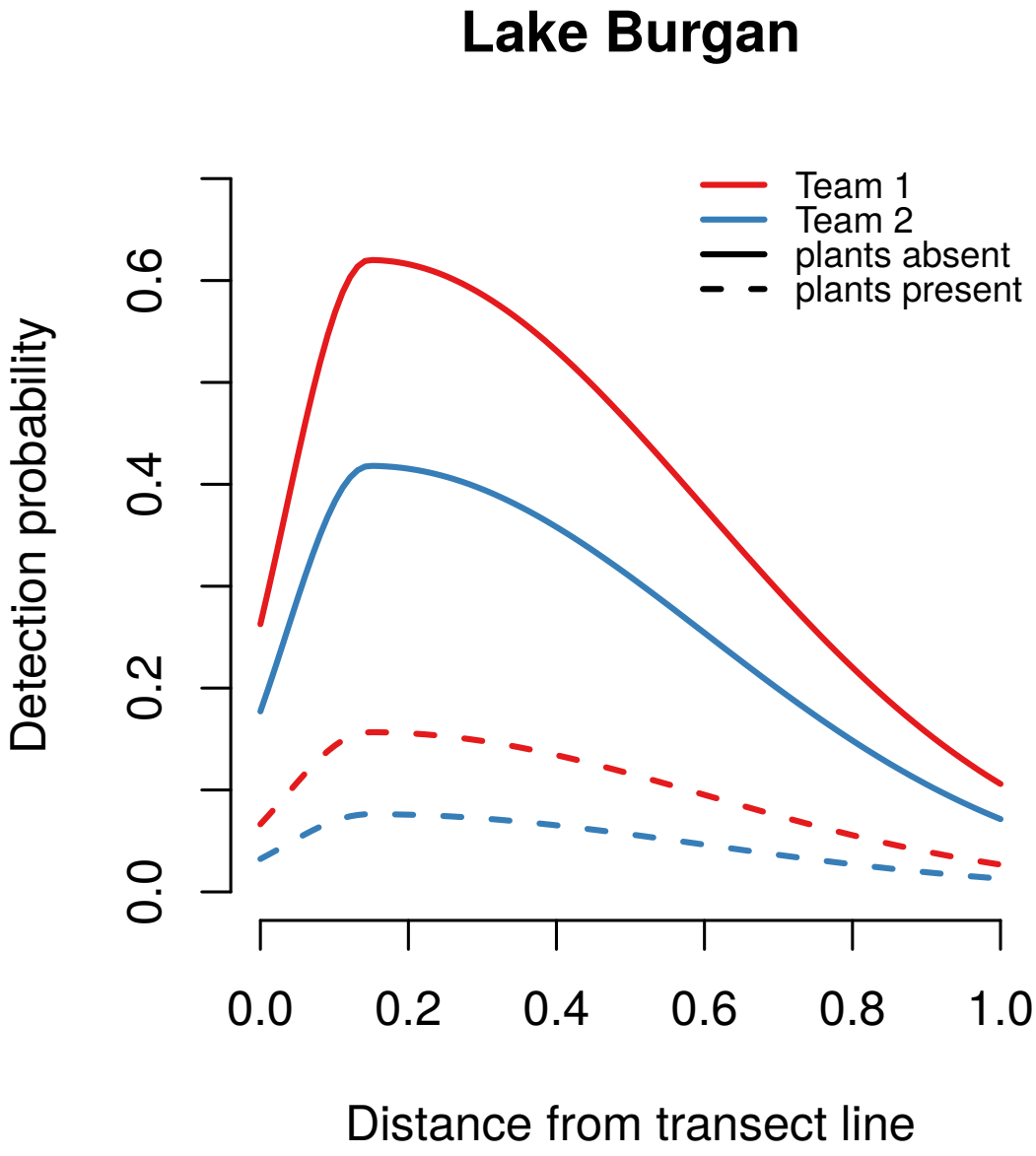
Lake survey: summer 2017



Distance and detectability



Estimated detection function



The payoff

X: is the number of zebra mussels detected

A: is the amount of are surveyed

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

- Observed density: $\frac{X}{A} = 0.08$
- Estimated density: $\frac{X}{P\,A} = 0.25$ (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?

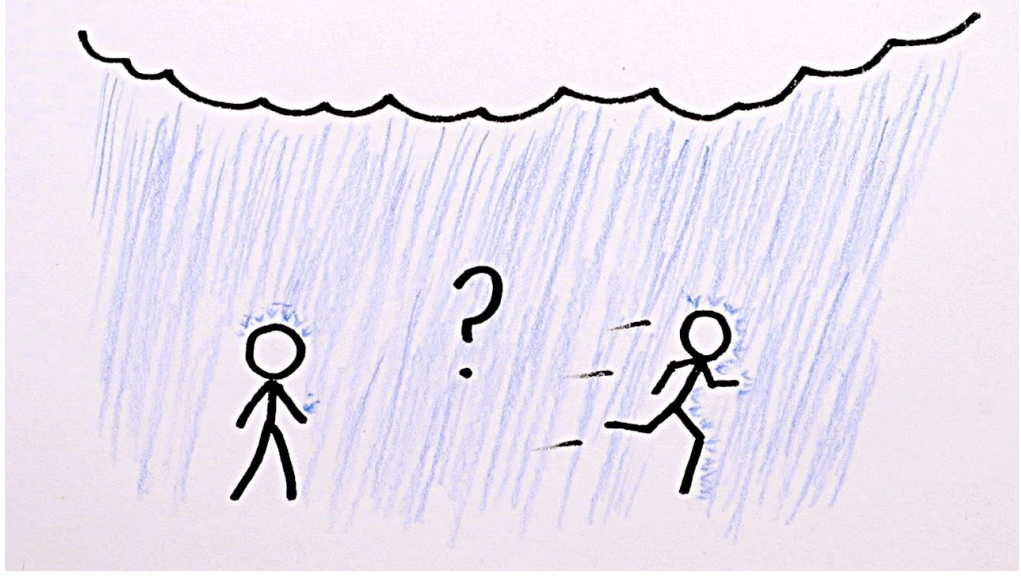
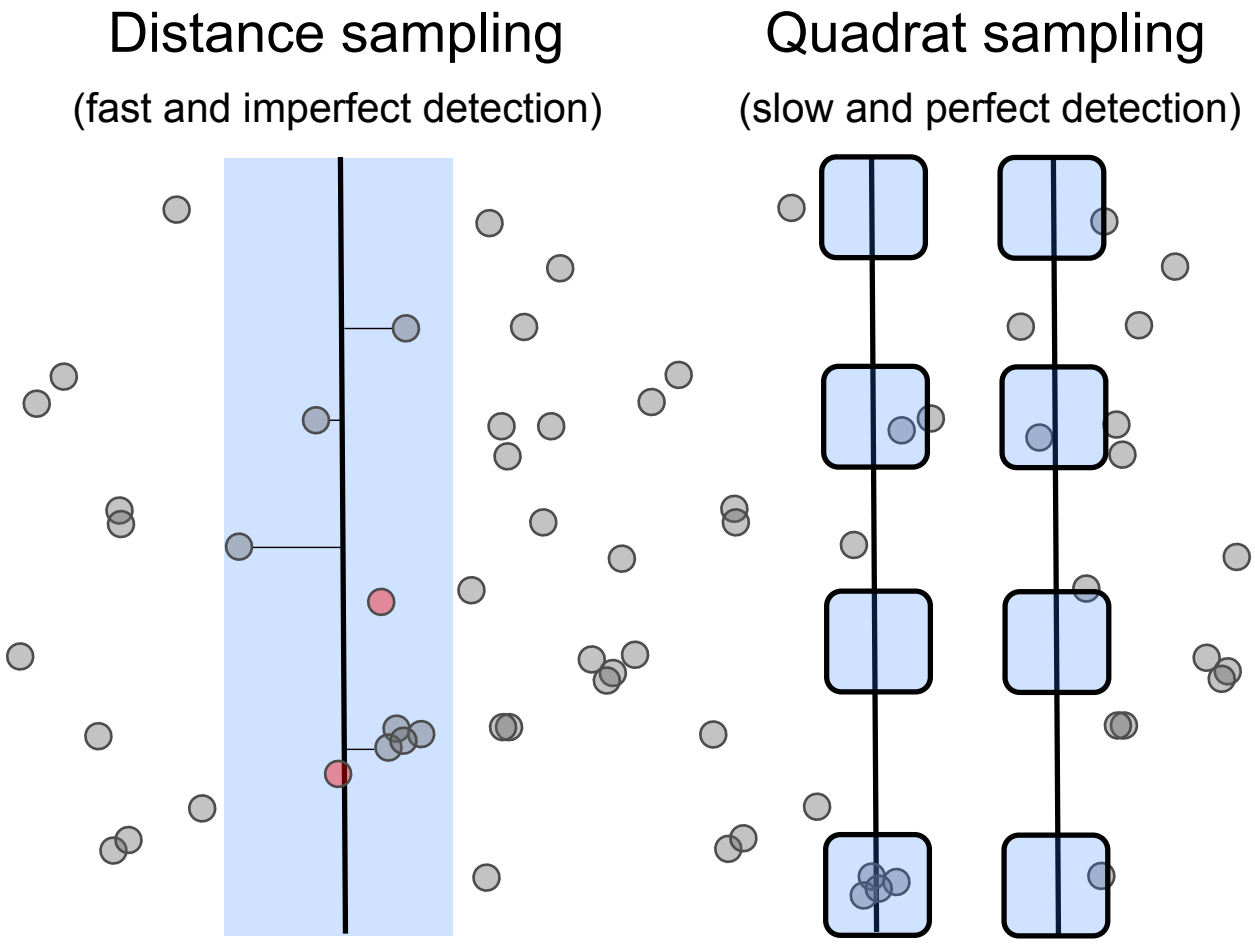
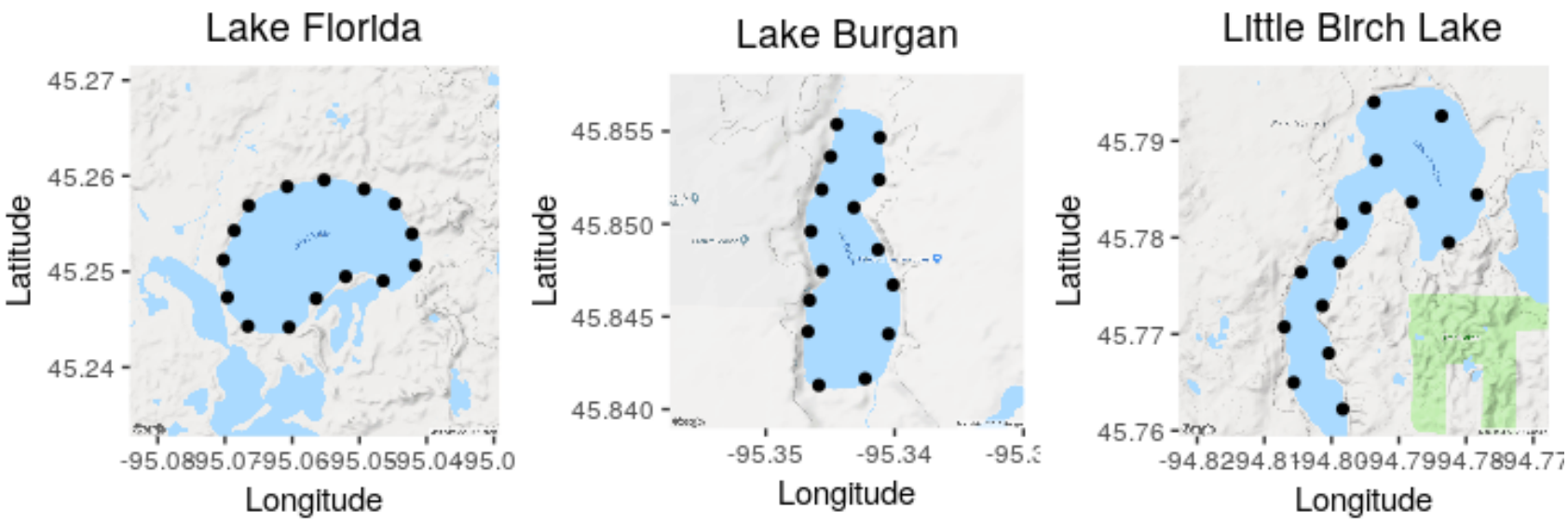


image: minutephysics(youtube.com)

Controlling effort through design

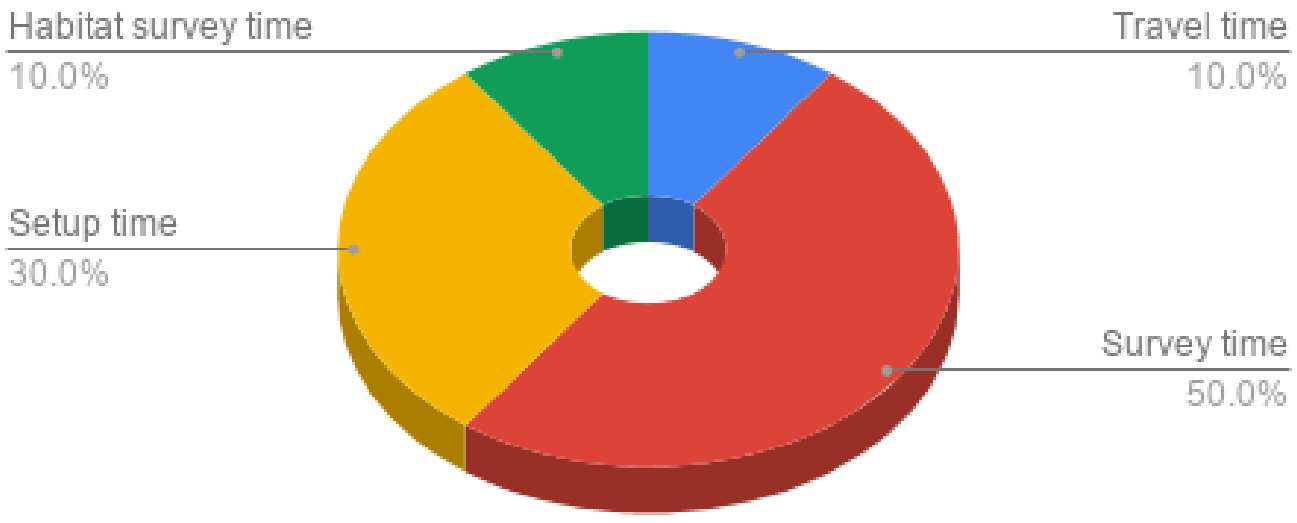


Lake surveys: summer 2018

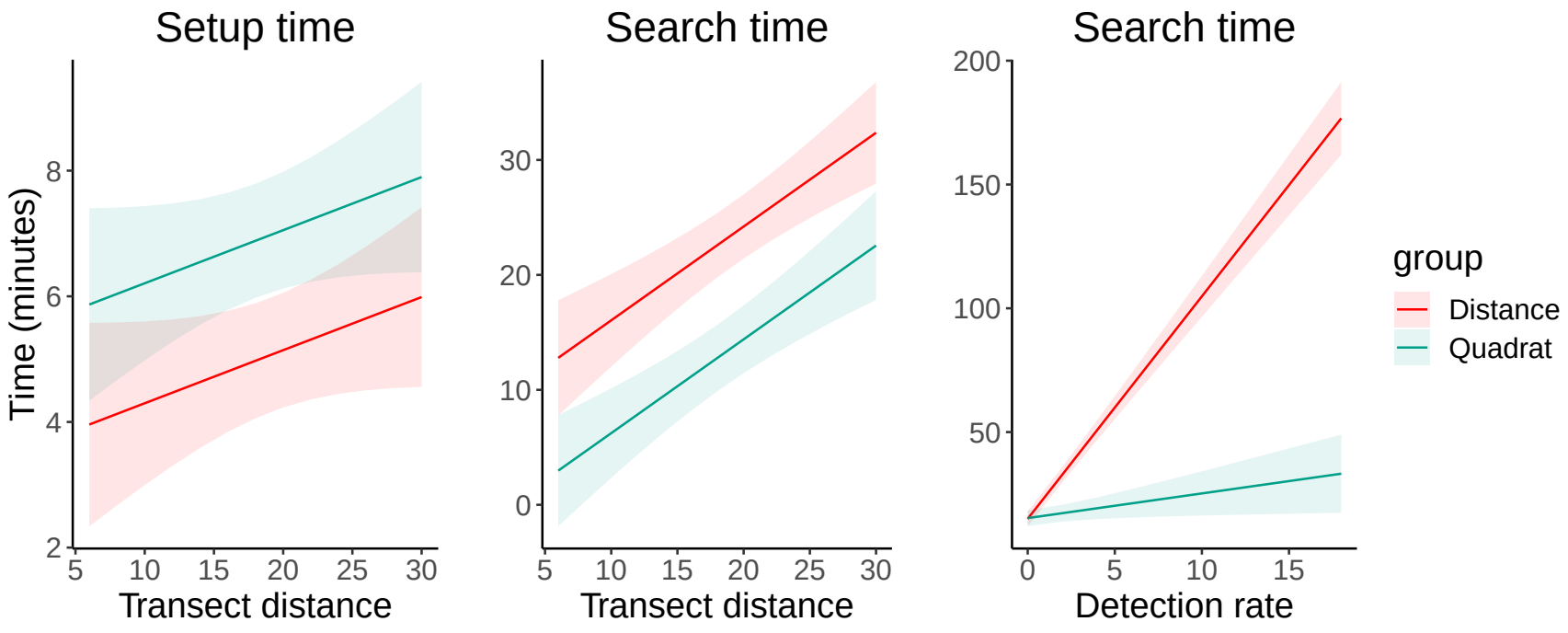


Time budget approach

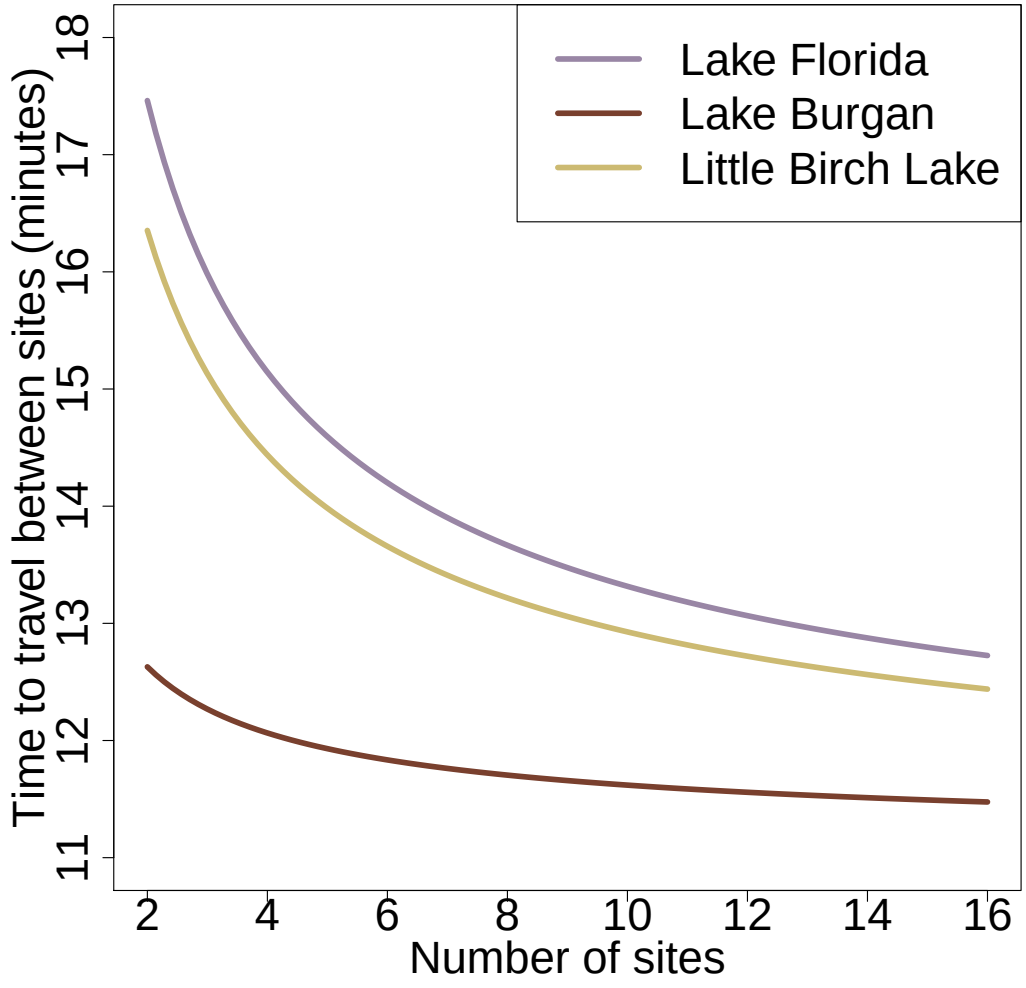
- Time to **setup** each transect
- Time to conduct each **survey**
- Time to **move** between transects



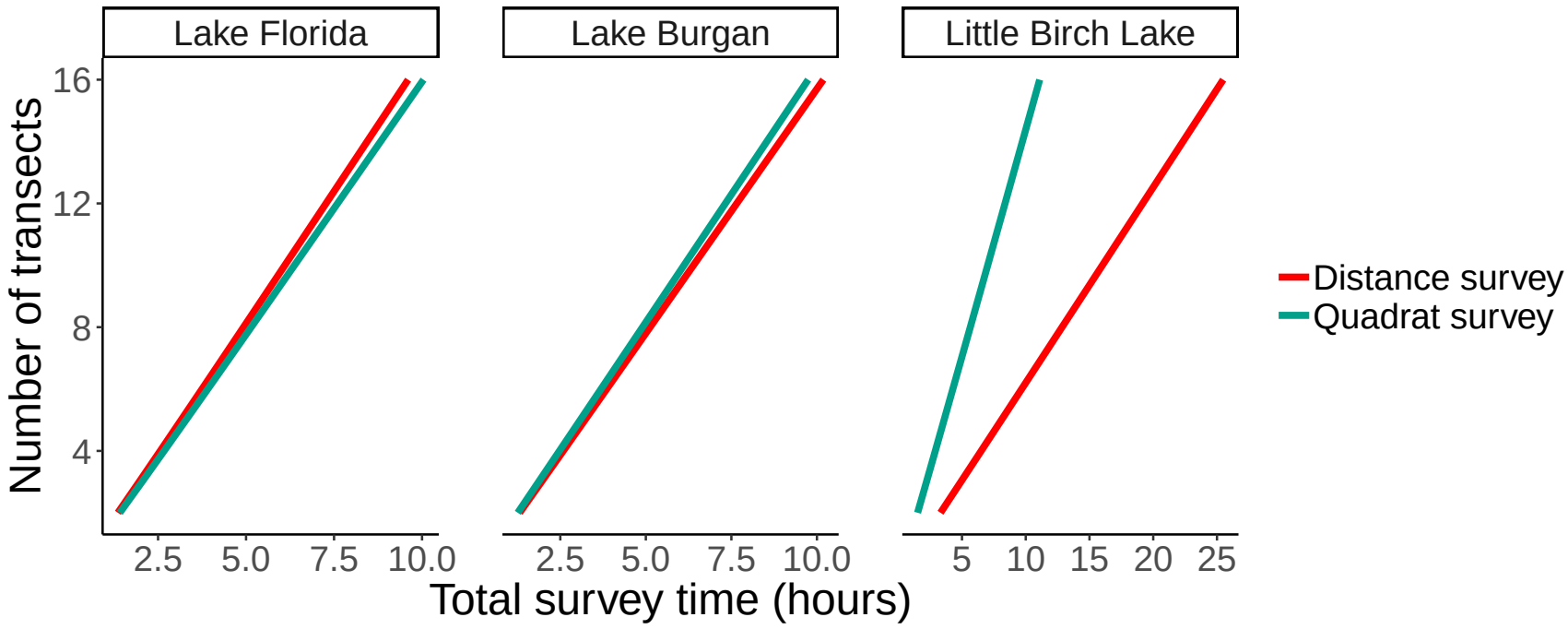
Time to perform transect setup & search



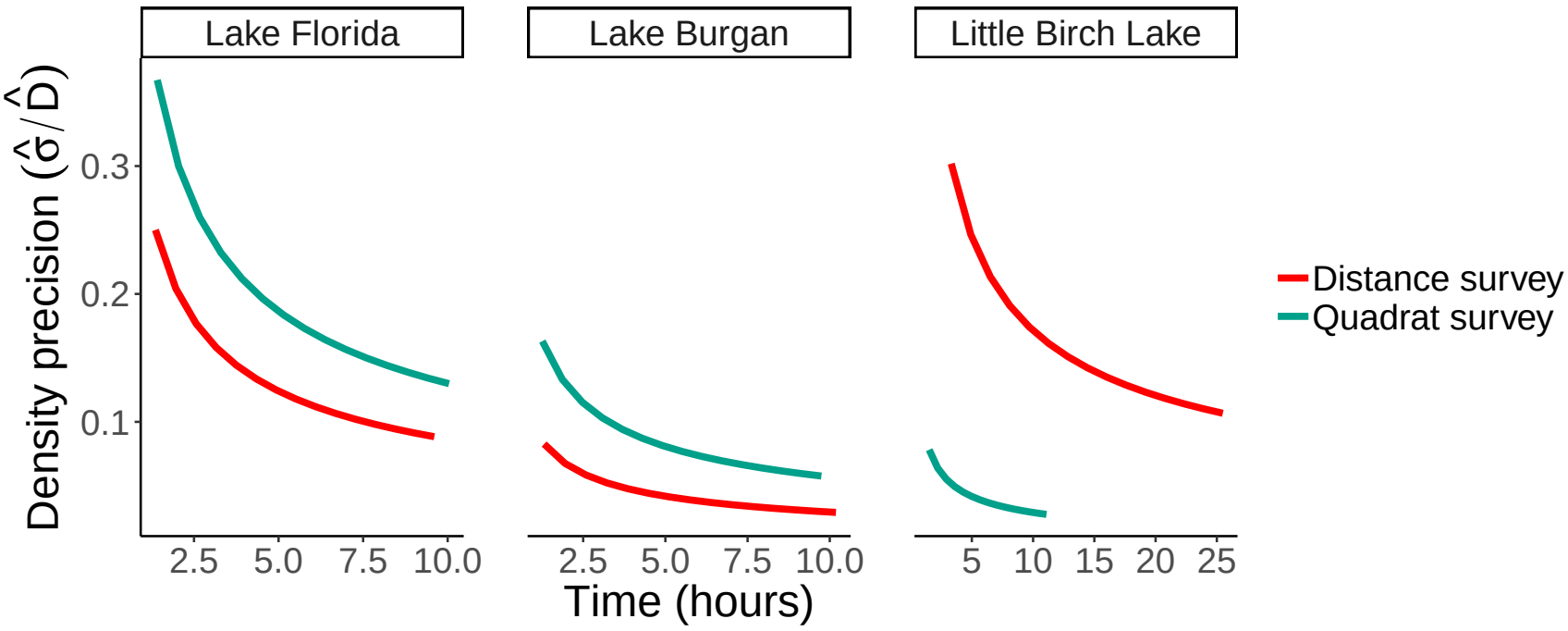
Time it takes to move between transects



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

Acknowledgements

Naomi Blinick
Leslie Schroeder
Sarah Baker
Aislyn Keyes
Austin Hilding
Thomas Ostendorf
Kylie Cattoor
Keegan Lund

John Fieberg
Michael McCartney
Steve McComas
Rich Rezanka
Tom Jones

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

MINNESOTA AQUATIC INVASIVE SPECIES RESEARCH CENTER
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