Estimating zebra mussels densities using distance sampling

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Background

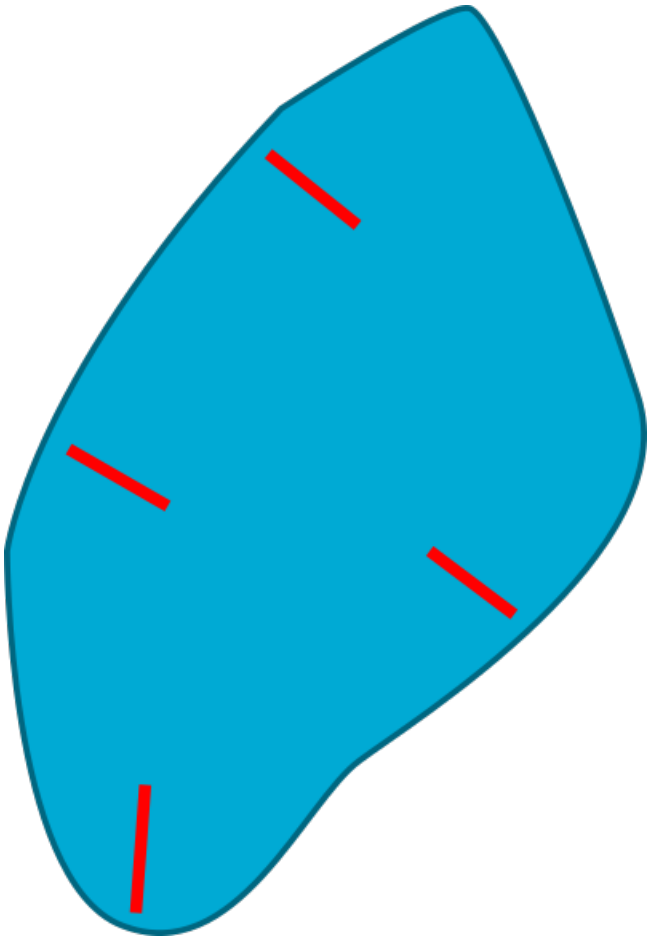
photo: Naomi Blinick

Reliably count zebra mussels at low densities

photo: Naomi Blinick

- Assess control efficacy
- Determine conditions that promote growth

Benefits of using a formal survey design

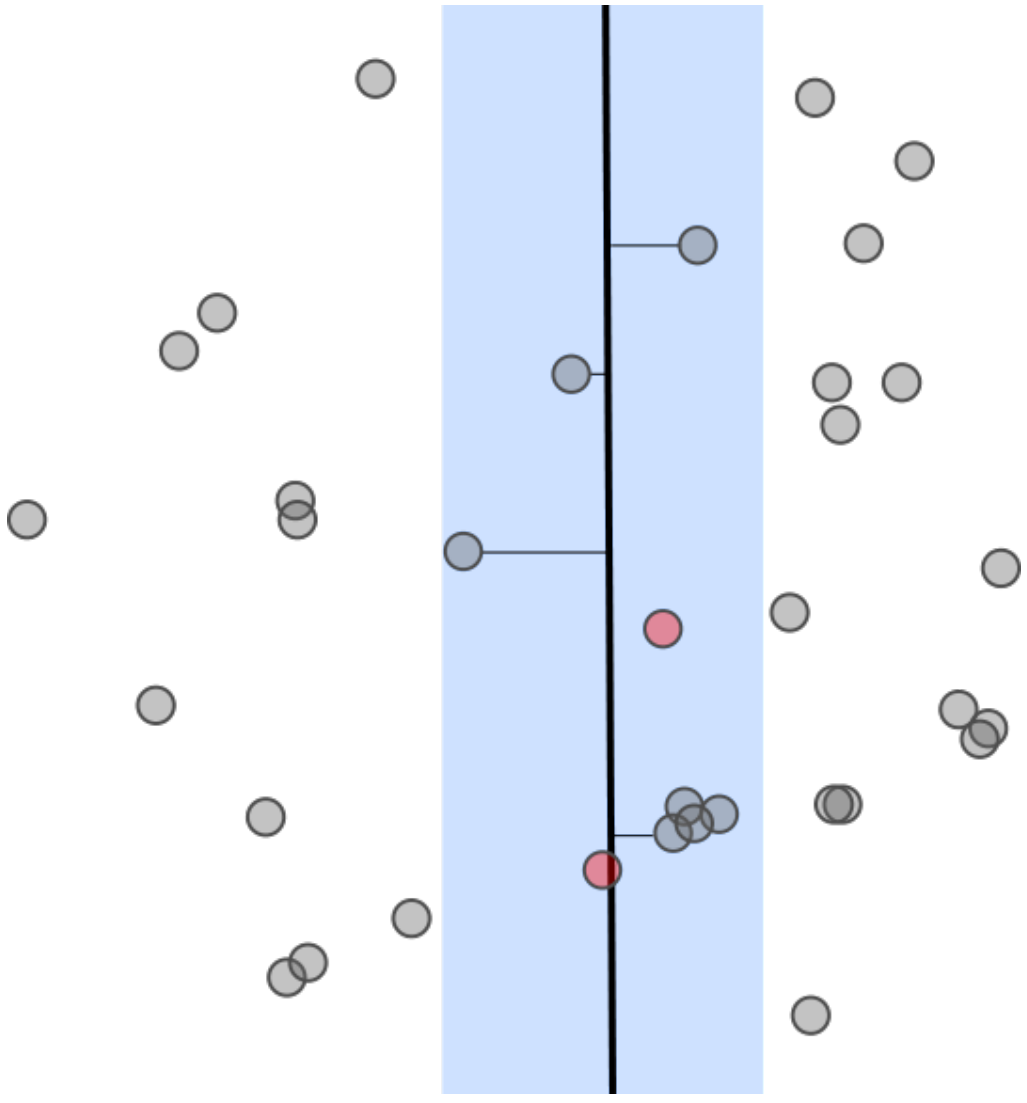


- Ensure sample is representative of the population
- Control the amount of area surveyed
  - Determine **uncertainty** in density

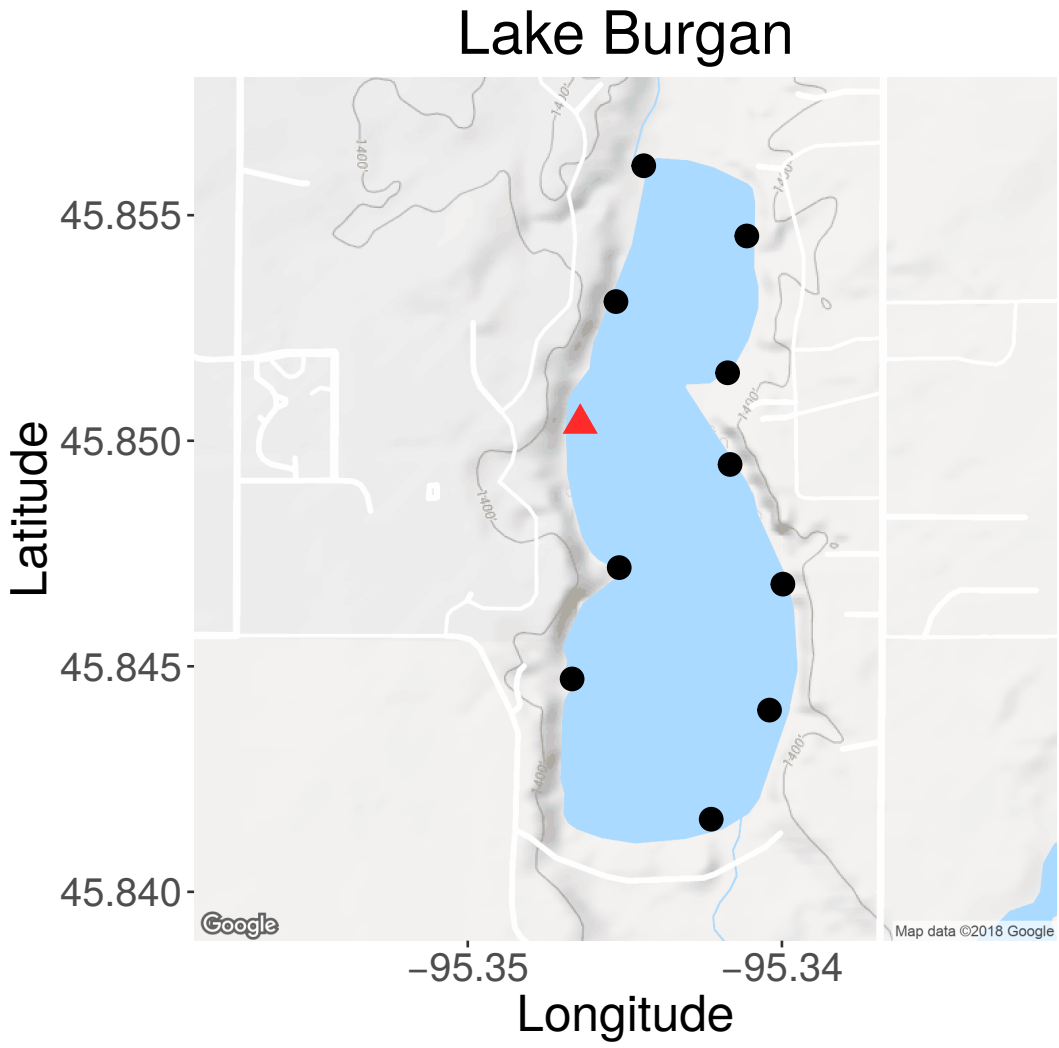
Distance sampling

image: Thomas Ostendorf

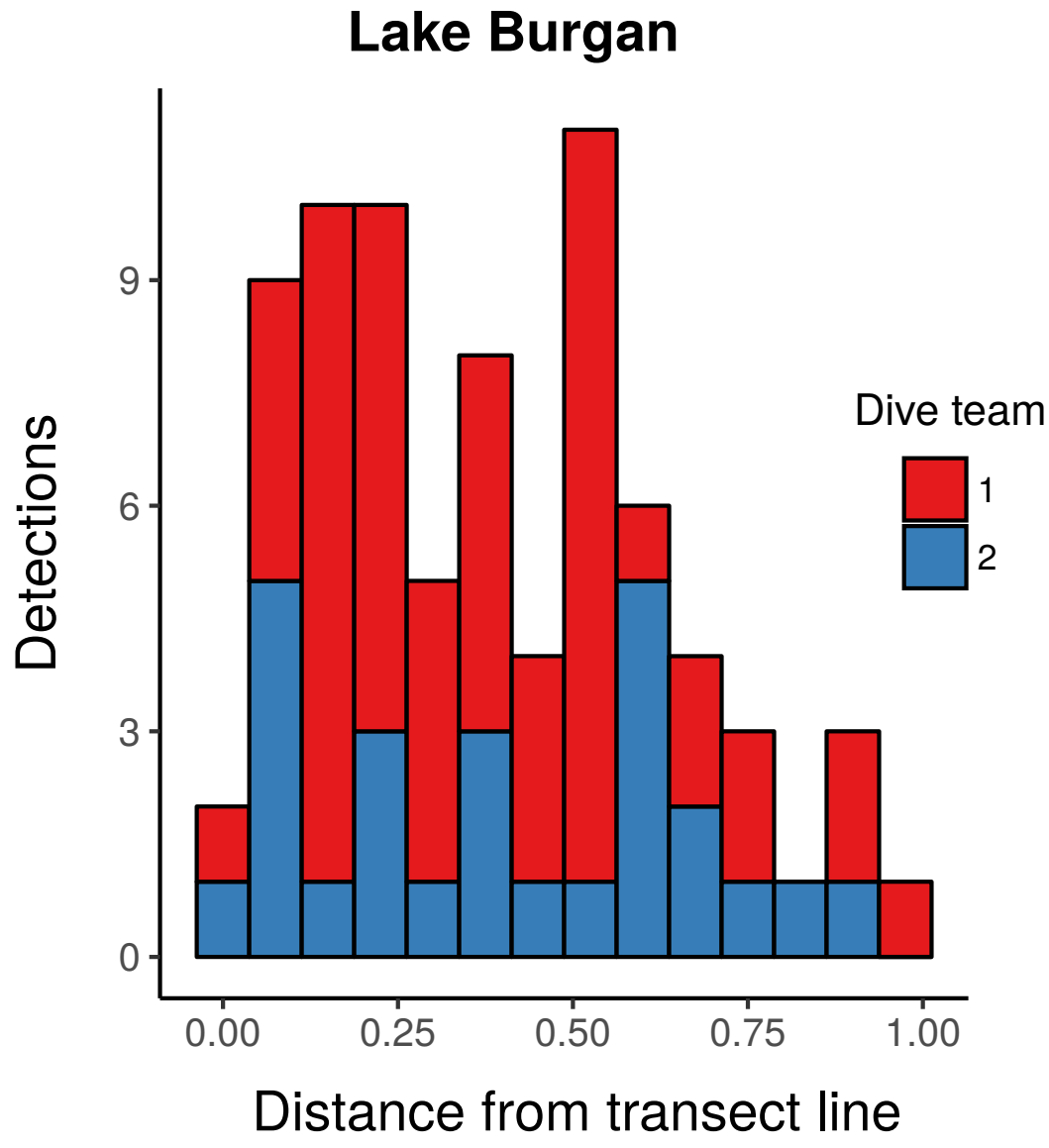
An approach for low and intermediate densities



Lake survey: summer 2017



Distance and detectability



The payoff

X: is the number of zebra mussels detected

A: is the amount 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?

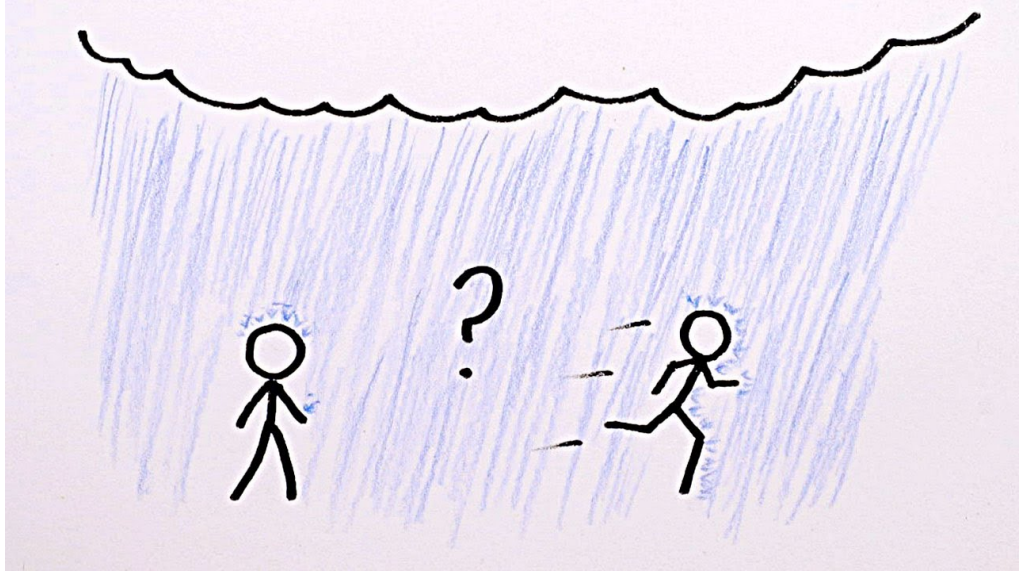
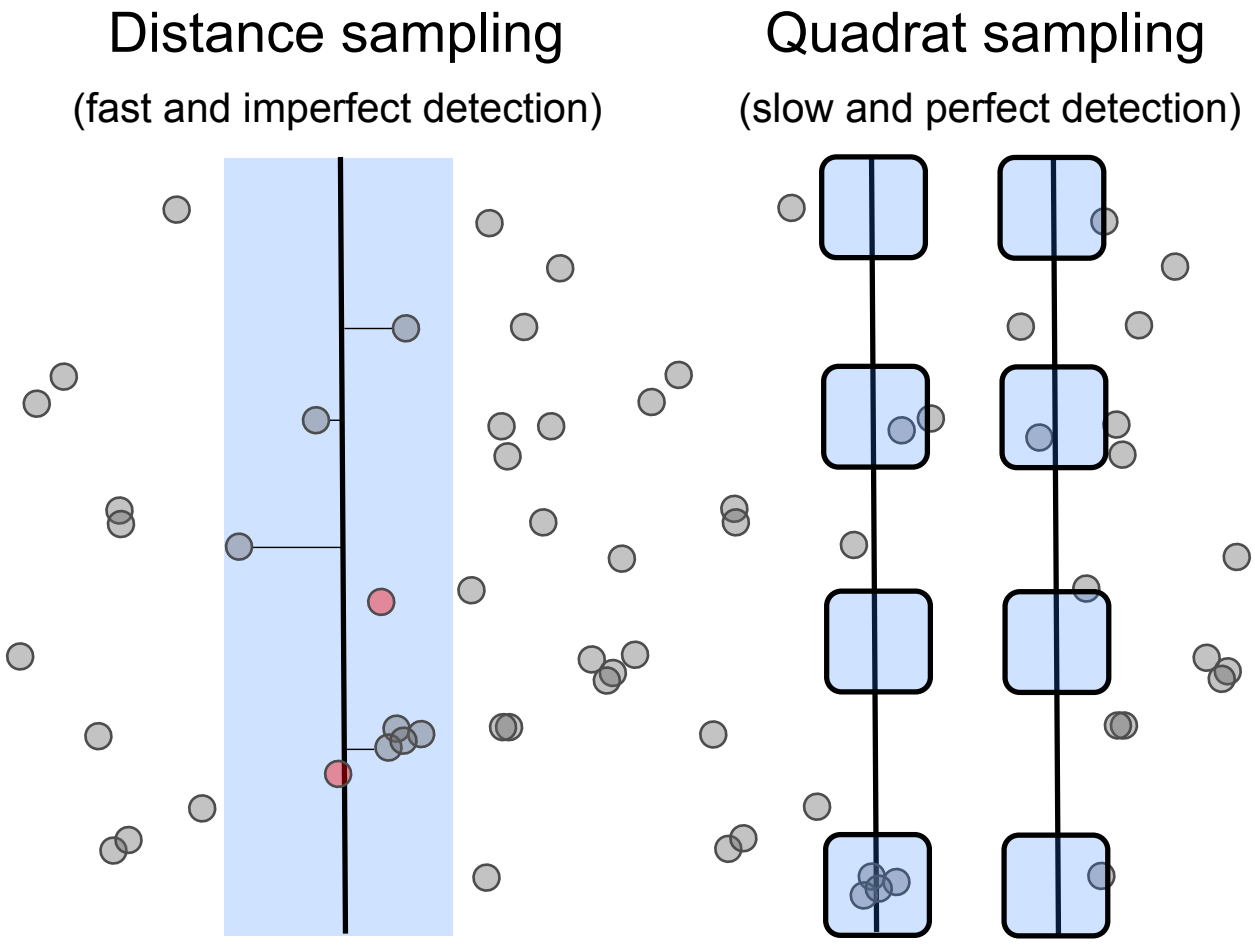
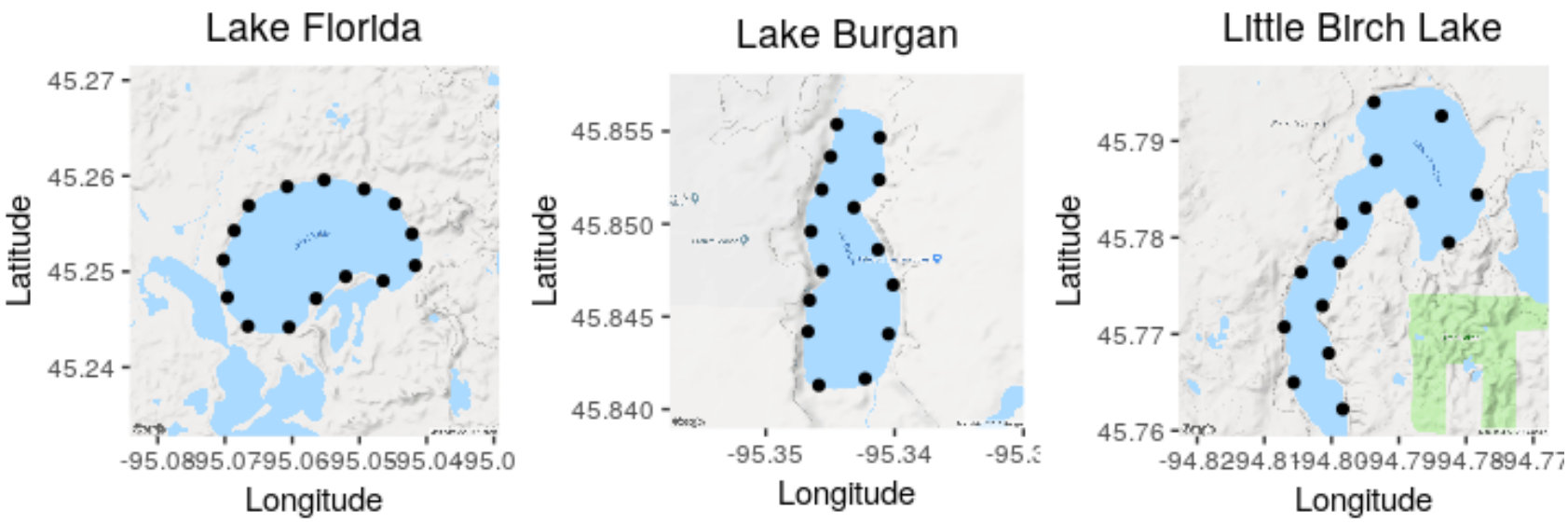


image: minutephysics(youtube.com)

Controlling effort through design

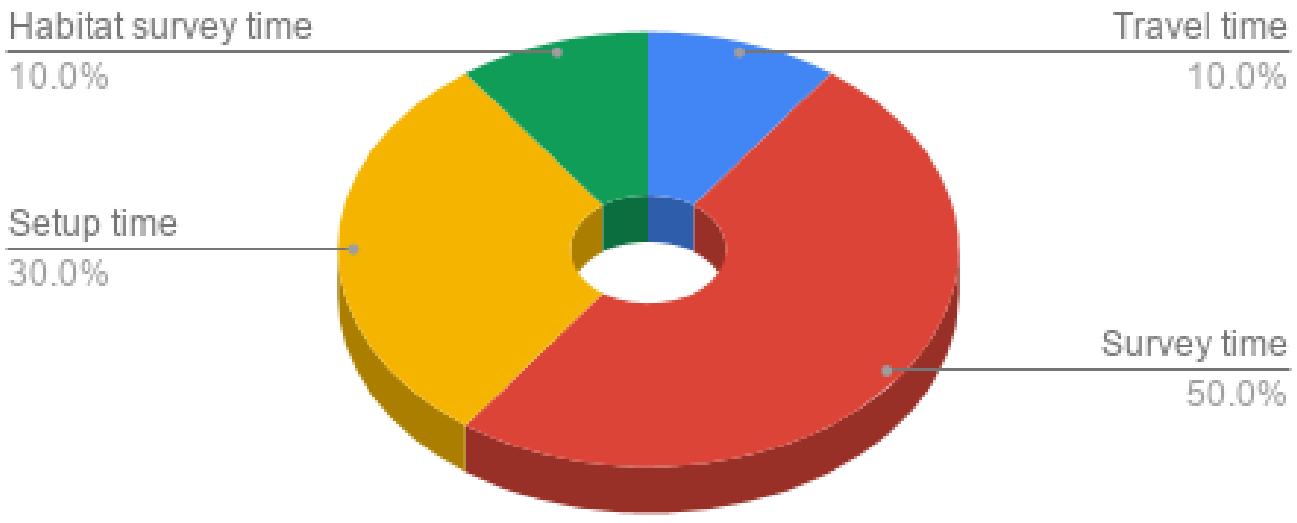


Lake surveys: summer 2018

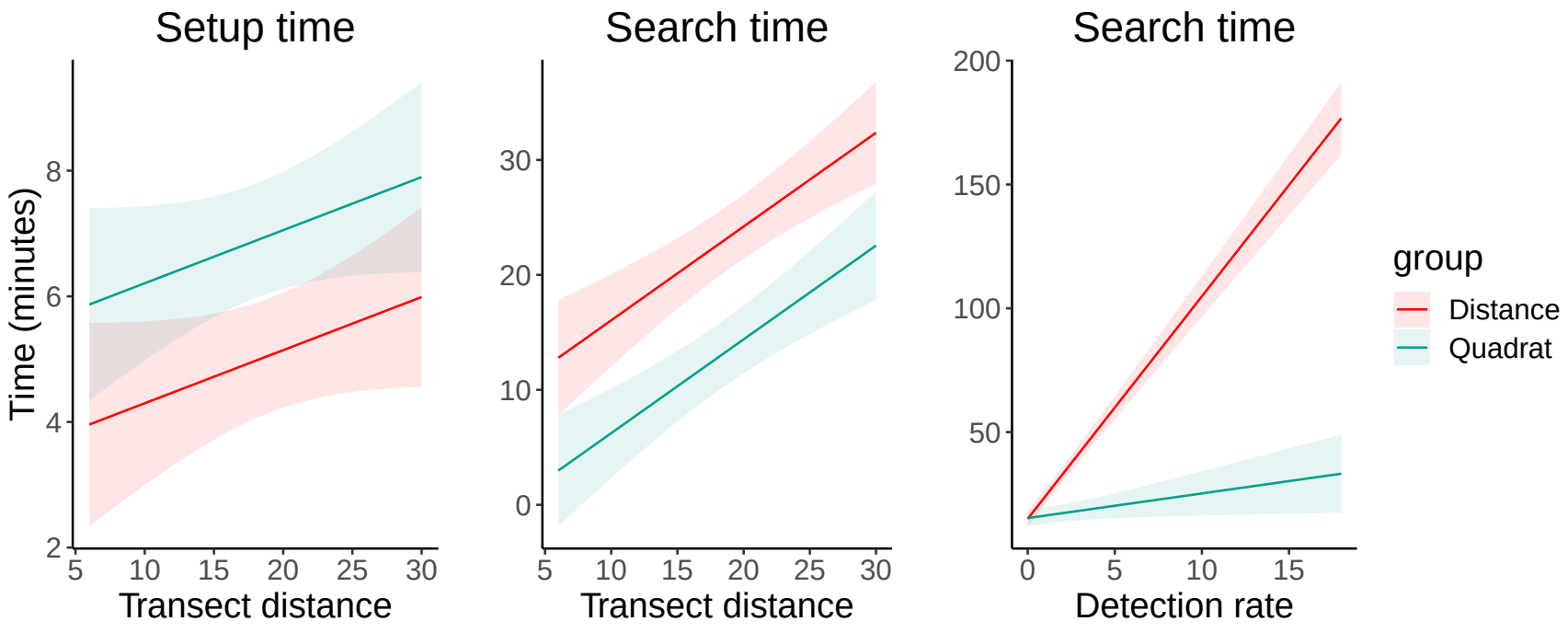


Time budget approach

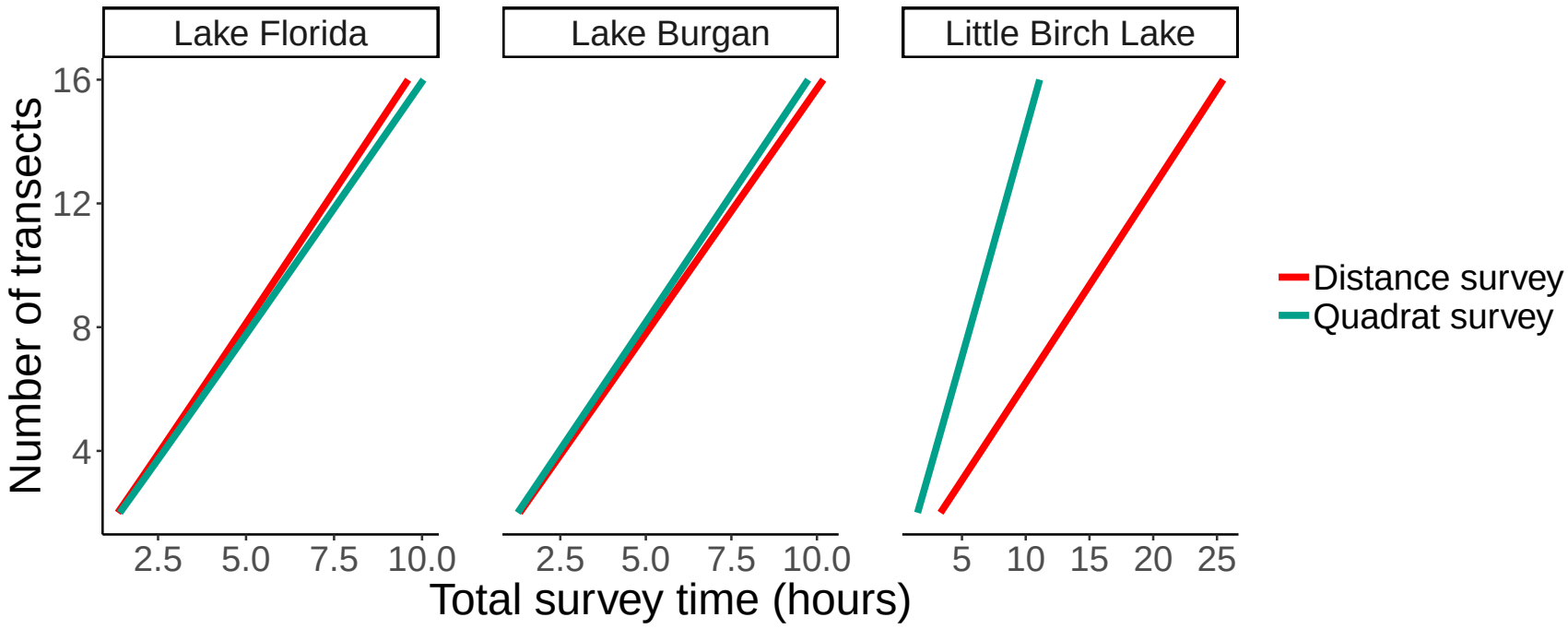
- Time to **setup** each transect
- Time to conduct each **survey**
- Time to **move** between transects



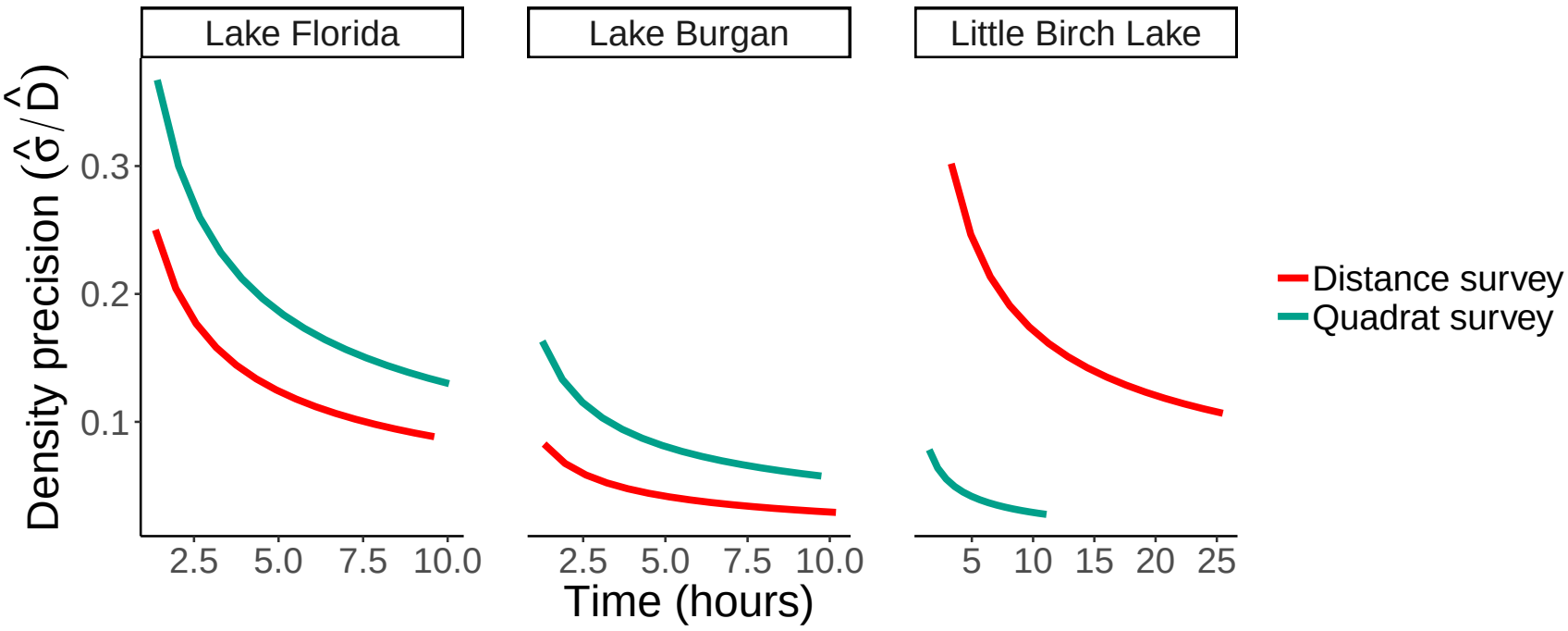
Time to perform transect setup & search



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

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Driven to Discover℠

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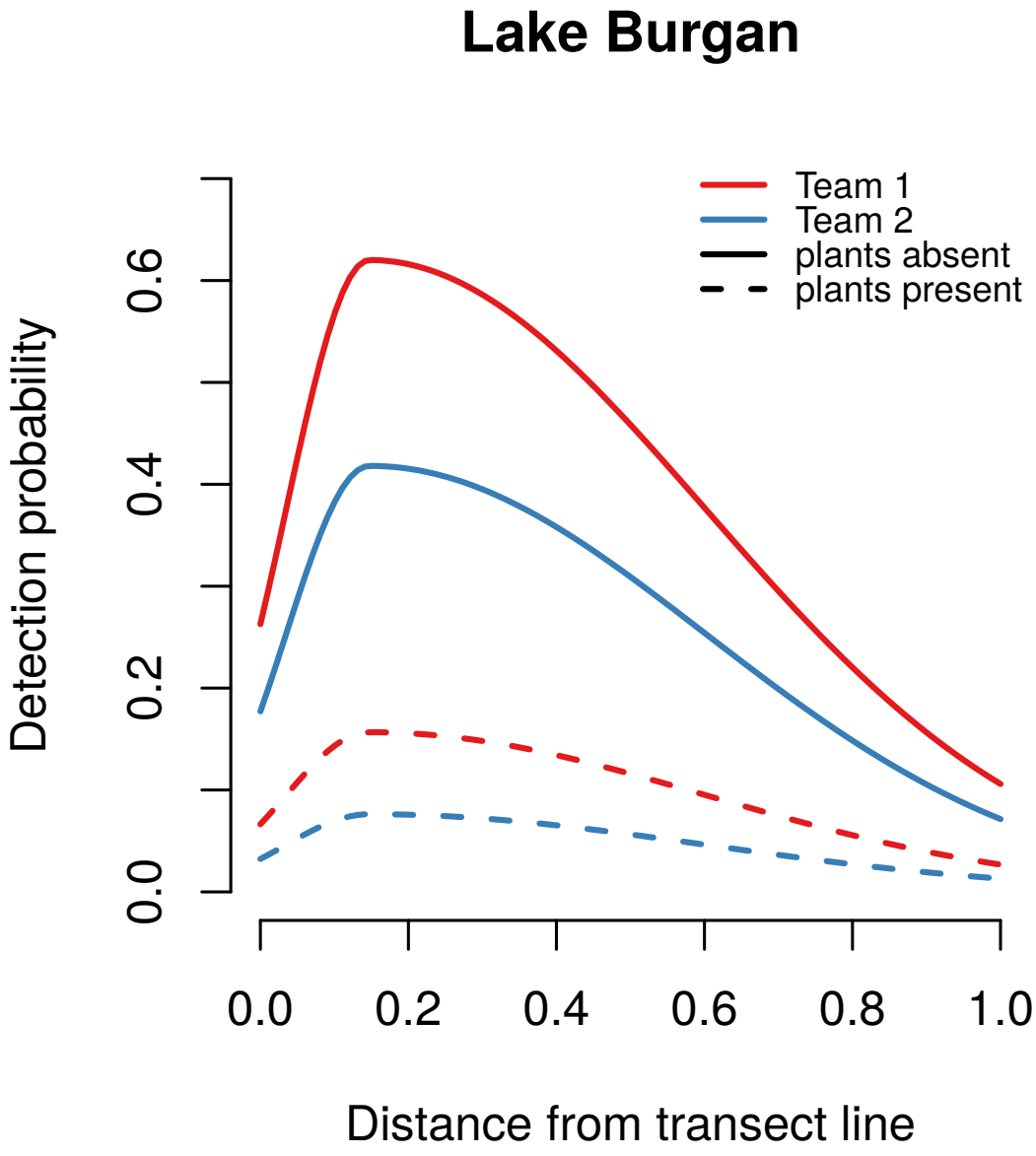
Estimated detection function



Time it takes to move between transects