Acoustic Size Spectra of Fishes:

variation within a hydropower reservoir

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Outline

- Background & Introduction
- Size spectra in Lac du Bonnet
- Monitoring fish communities
- Conclusion

Project Background

Objective Contribute to the development of hydroacoustic methods for ecological monitoring in lakes and reservoirs

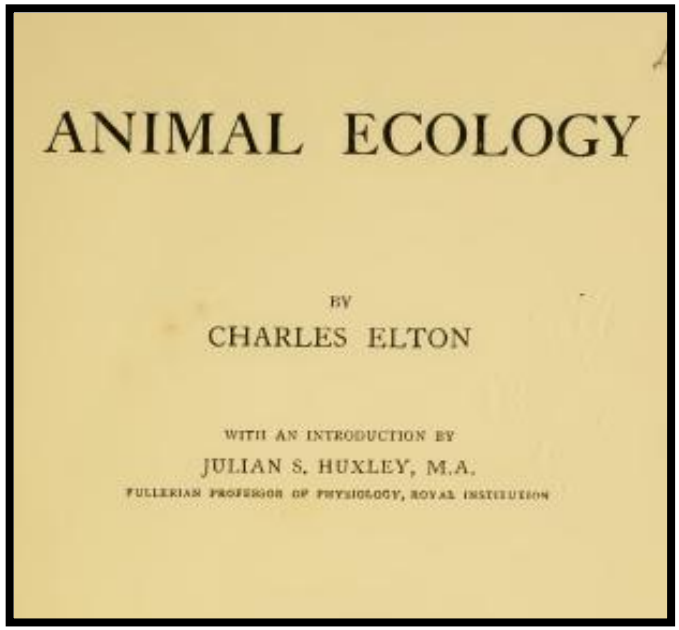
http://www.hydro.mb.ca/corporate/facilities/gi_the_winnipeg_river.shtml

WHY A SIZE-BASED APPROACH?

"**Body size** influences many processes: ranging from individual biological rates up to the structure of food webs"

Blanchard, 2011

Size Spectra


ANIMAL ECOLOGY

BY

CHARLES ELTON

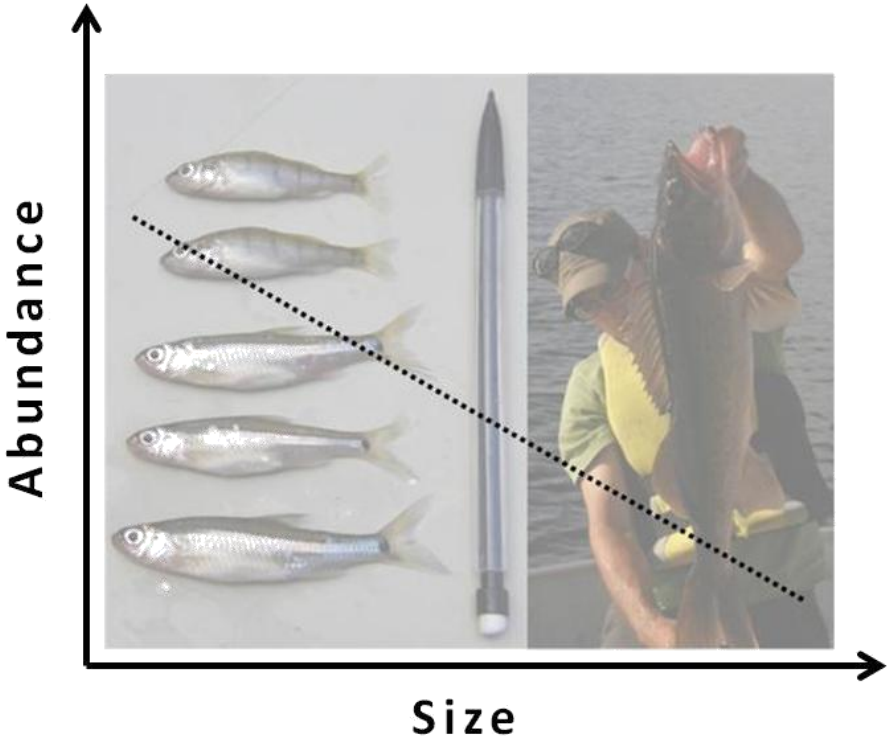
WITH AN INTRODUCTION BY

JULIAN S. HUXLEY, M.A.

FULLERIAN PROFESSOR OF PHYSIOLOGY, ROYAL INSTITUTION

"the smaller an animal the commoner it is on the whole"

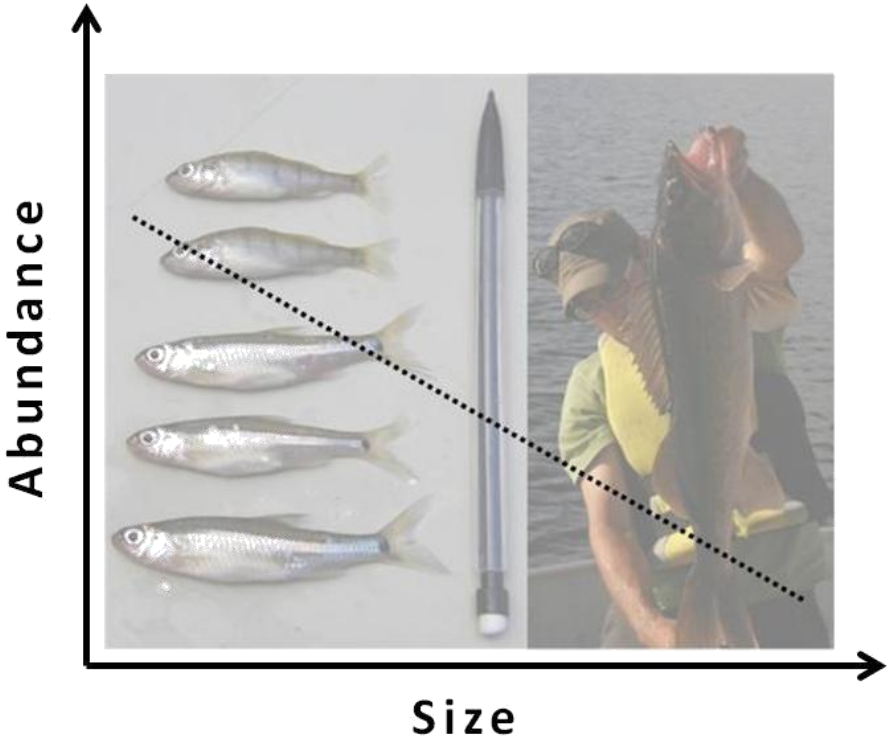
Elton, 1927



Size Spectra

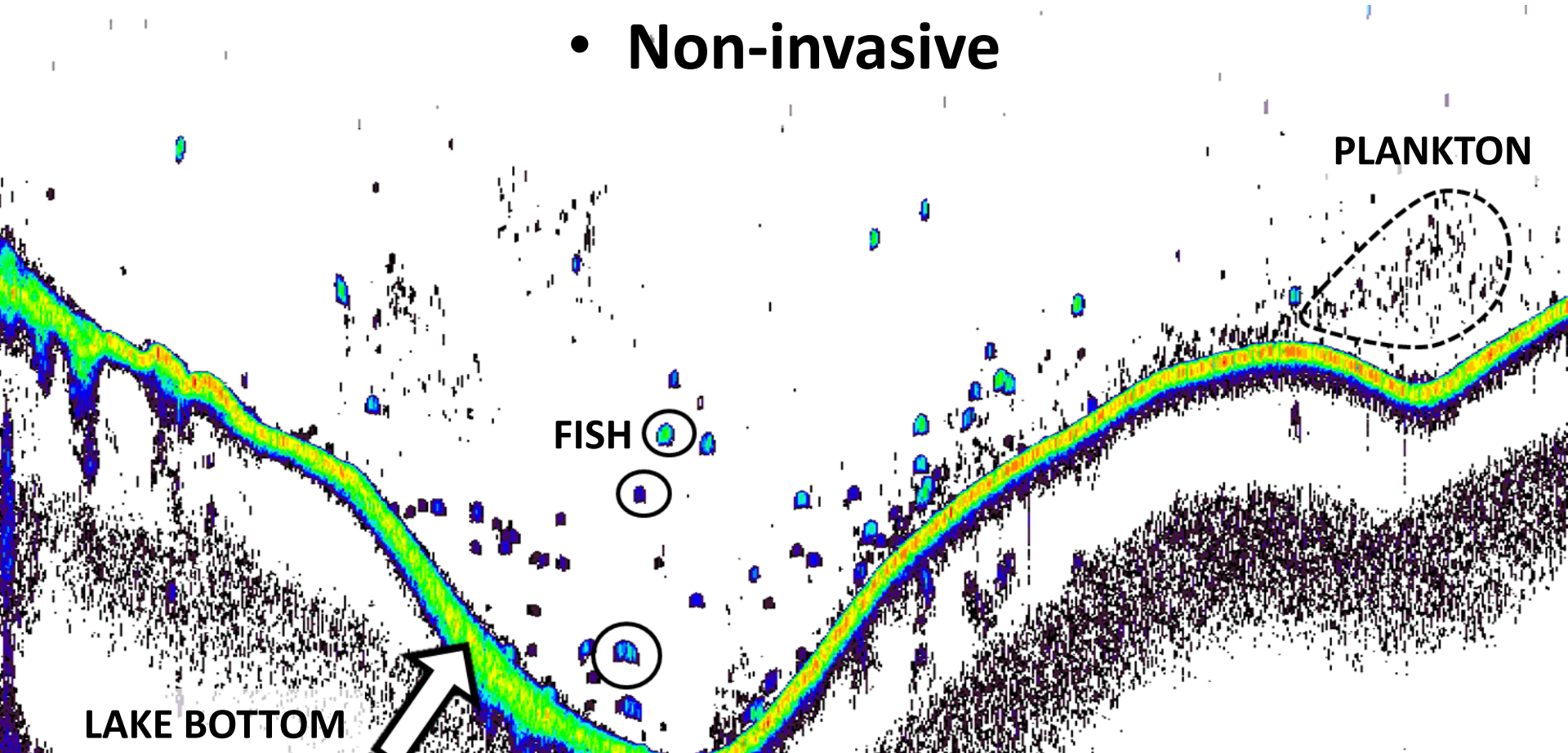
- Indicators of community abundance & size structure

- Typically from catch data

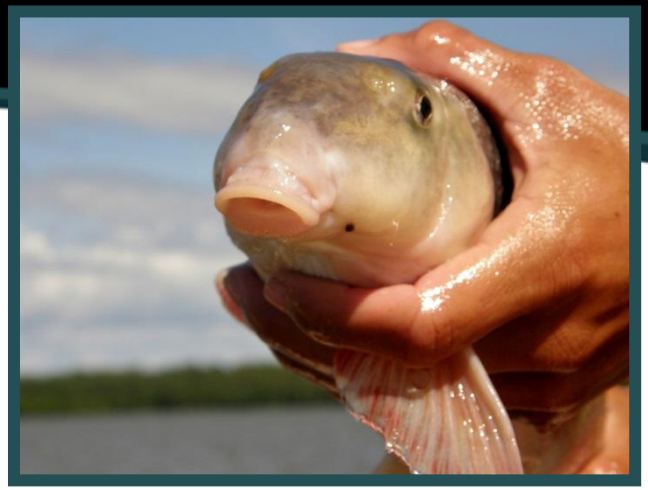


Benefits of an acoustic method

- Efficient data collection
- Not size selective
- Non-invasive



QUESTIONS

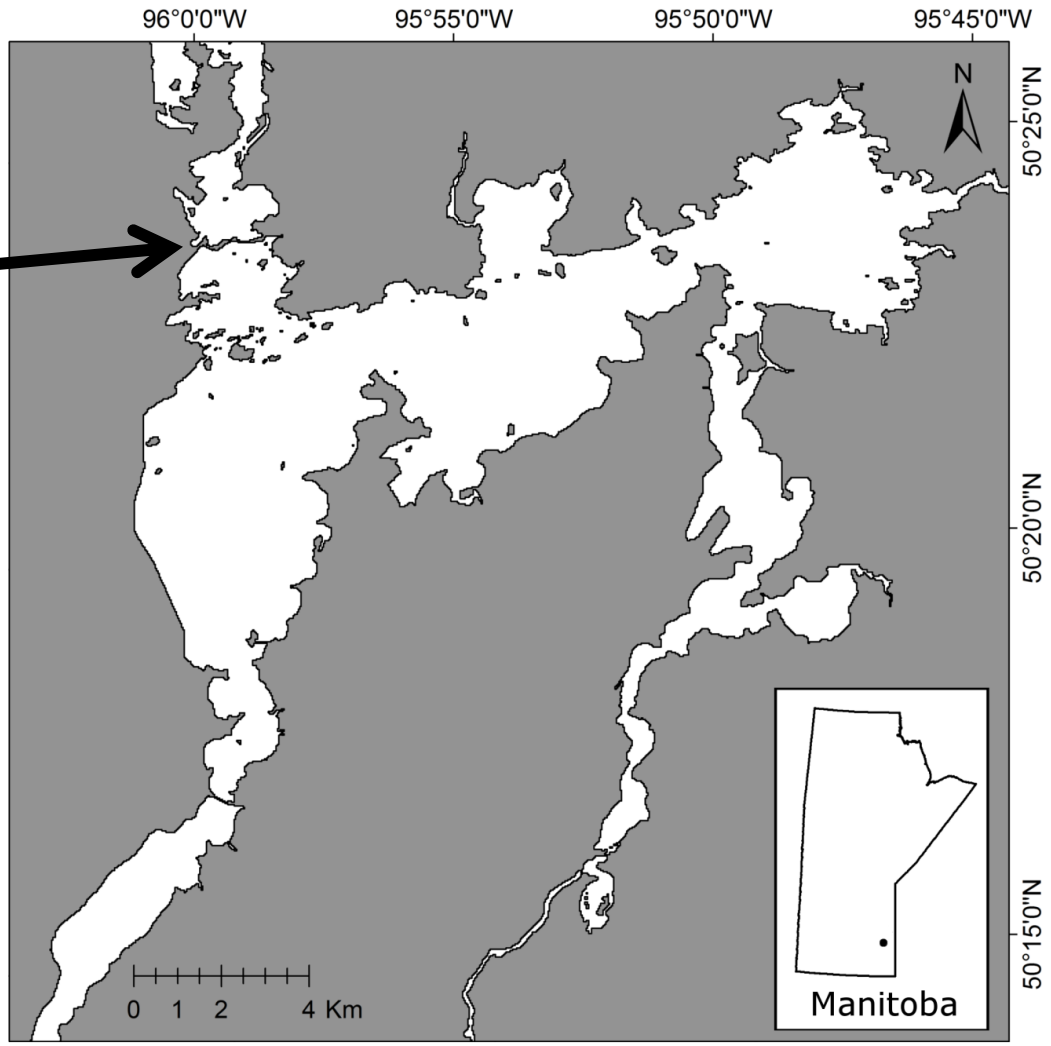


1. Can we form size spectra from acoustic survey data?

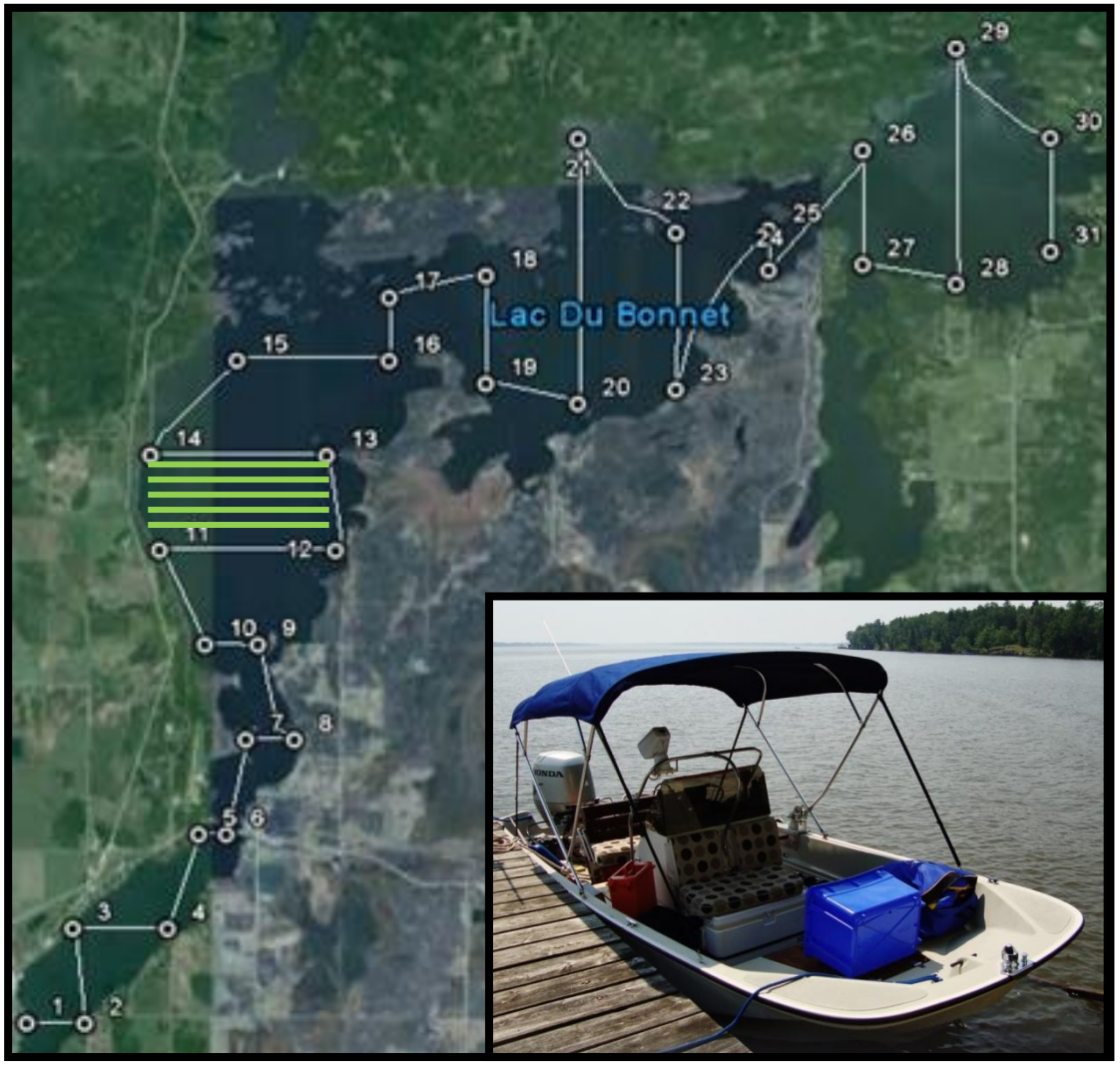
If so,

2. How do spectra characteristics vary among habitats within a reservoir?

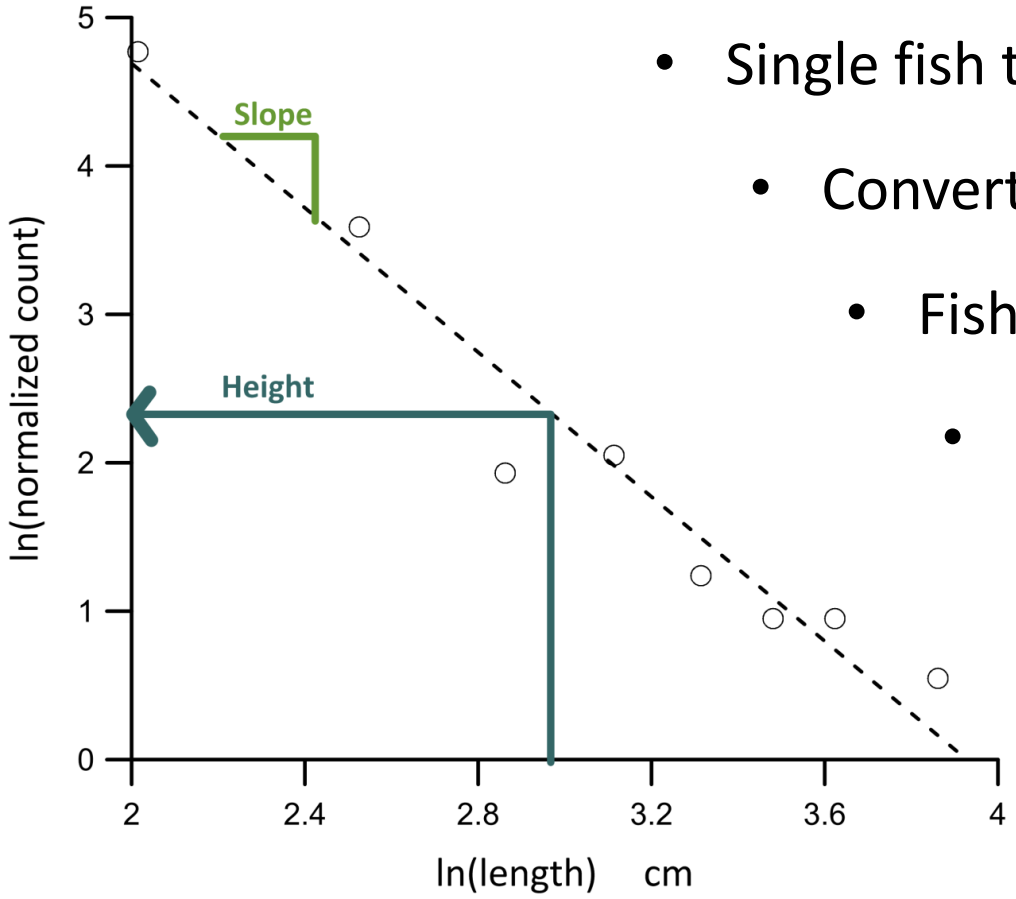
Lac du Bonnet



METHODS [Acoustics & ground truthing]

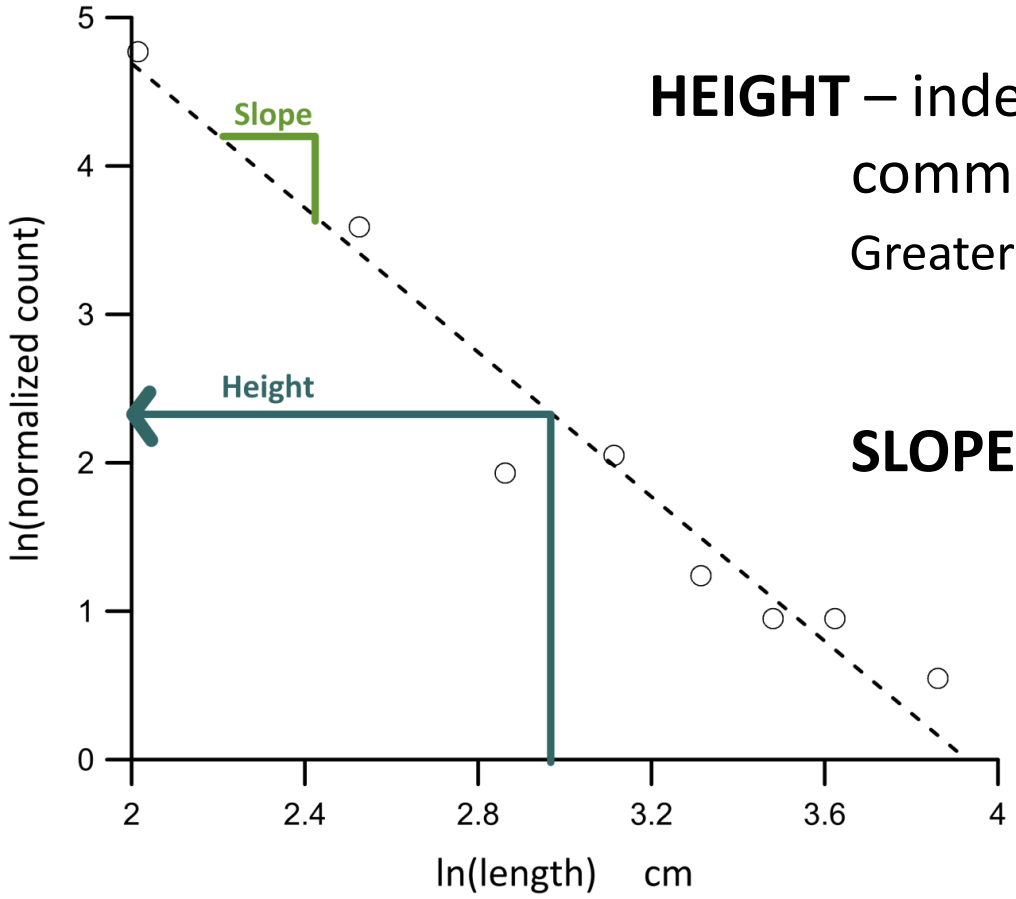


METHODS [Building size spectra]



- Single fish targets
  - Convert acoustic size (TS) to length
    - Fish ≈ 5-50 cm, 5 cm bins
      - Normalize for volume sampled
        - ln(length) x ln(count)

METHODS [Building size spectra]



HEIGHT – index of overall community abundance

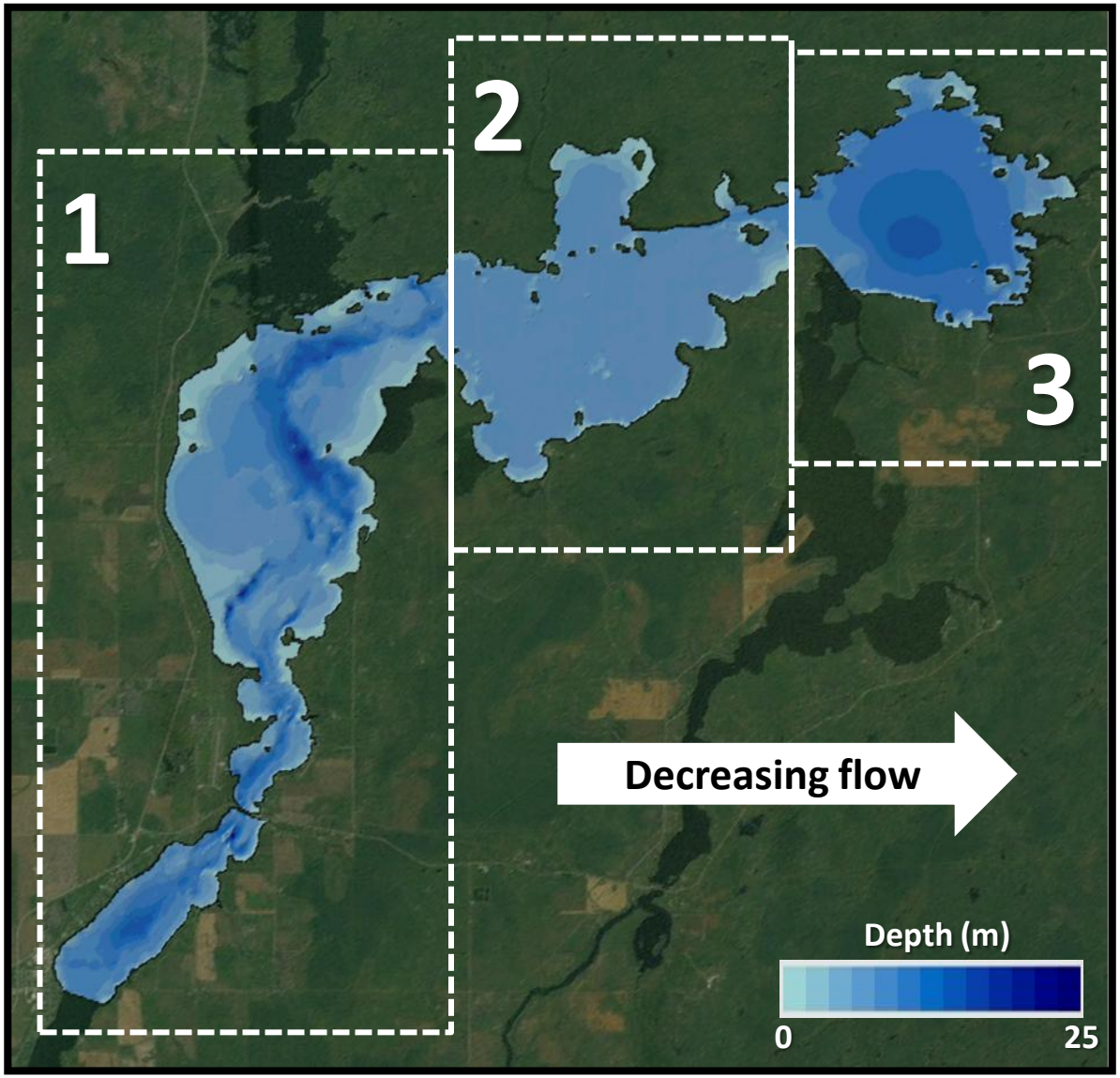
Greater height = more fish

SLOPE – relative abundance by size

steep (more negative): skewed towards small fish

shallow (less negative): more equal size distribution

Defining Habitat Areas: mesoscale

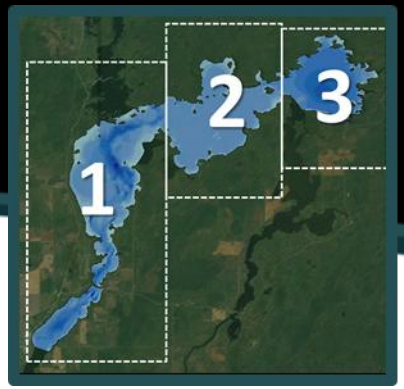


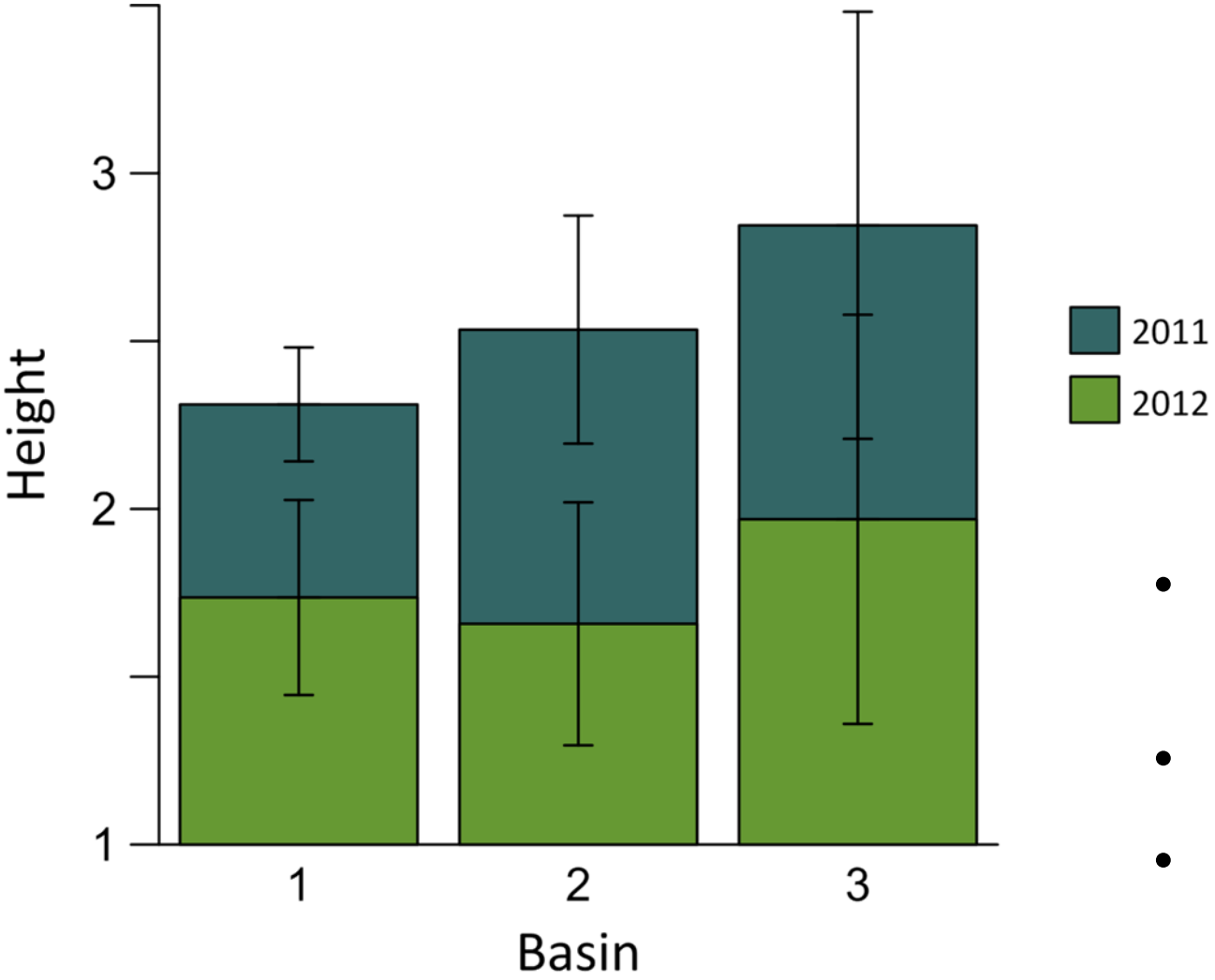
Basin 1
Mean depth = 7.4m
Max depth = 25m
Mud, Sand, Rock

Basin 2
Mean depth = 6.6m
Max depth = 13m
Mud, Rock
2 Large bays

Basin 3
Mean depth = 9.9m
Max depth = 15m
Mud, Rock

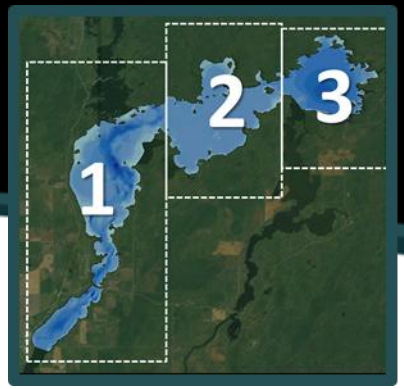
Height [Fish community abundance]

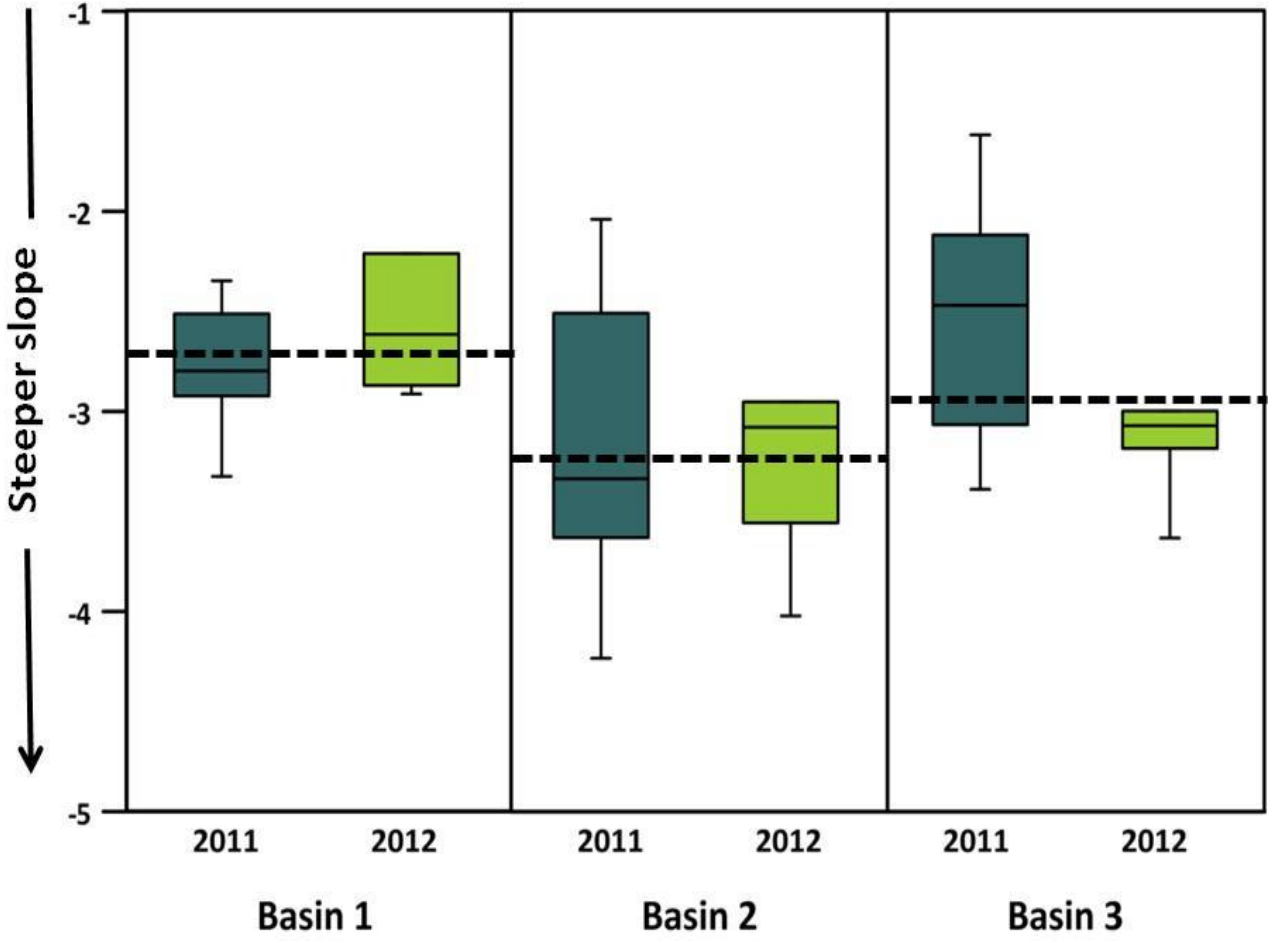




- Increased away from channel
- 2011 > 2012
- Decreased across the season

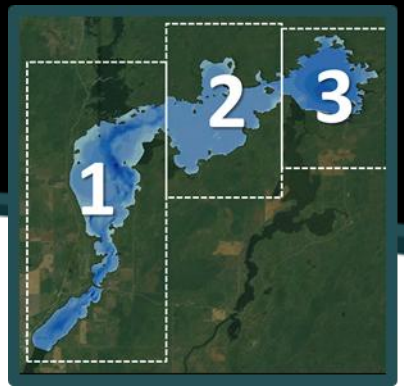
SLOPE [Relative abundance by size]





- Steepest in Basin 2
- Consistent between years (*usually*)
- Flattened out across season (*usually*)

LdB Spectra Summary



Basin 1

- Lowest height
- Shallow slopes

High flow, low plankton, deep

Basin 2

- Moderate height
- Steepest slopes

Low flow, large bays, shallow

Basin 3

- Greatest heights
- Slope varied

Low flow, high plankton, deep

Size Spectra as a monitoring tool

Habitat use:

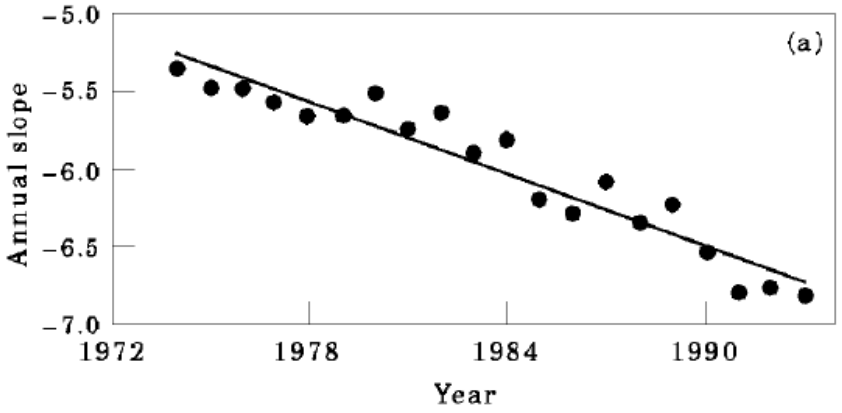
Increased **height** = more fish

Increased **slope** = important for juvenile and small fishes

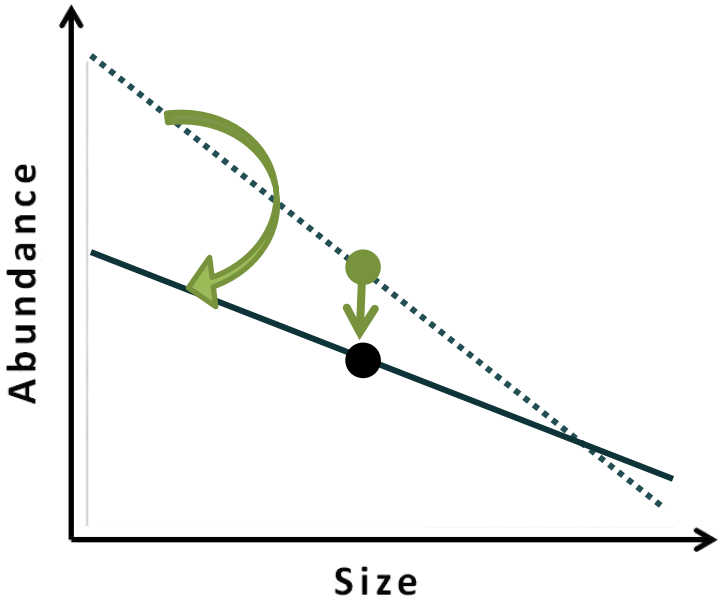
Size Spectra as a monitoring tool

Long term monitoring:

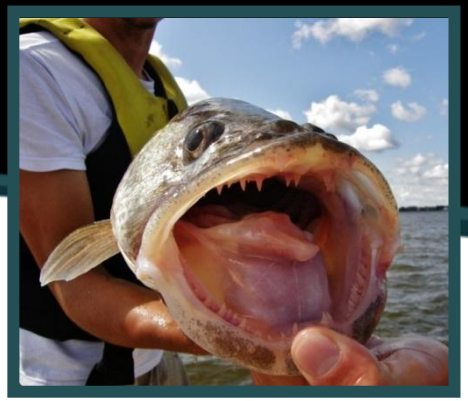
Track changes in slope and height



Rice & Gislason 1996

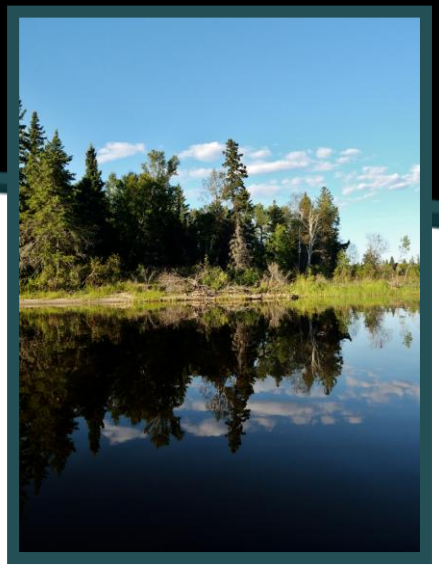


Conclusions



- **Length-frequency spectra can be derived from acoustic survey data**
- **Consistency in survey route and timing is important for making comparisons**
- **Potentially useful tool for efficient, cost effective, and non-invasive monitoring of fish community abundance and structure**

Acknowledgements



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