Marine Institute

Centre for Fisheries Ecosystems Research

CFER

Productivity of freshwater ecosystems: an acoustics approach

Hydronet Annual Meeting, 2012

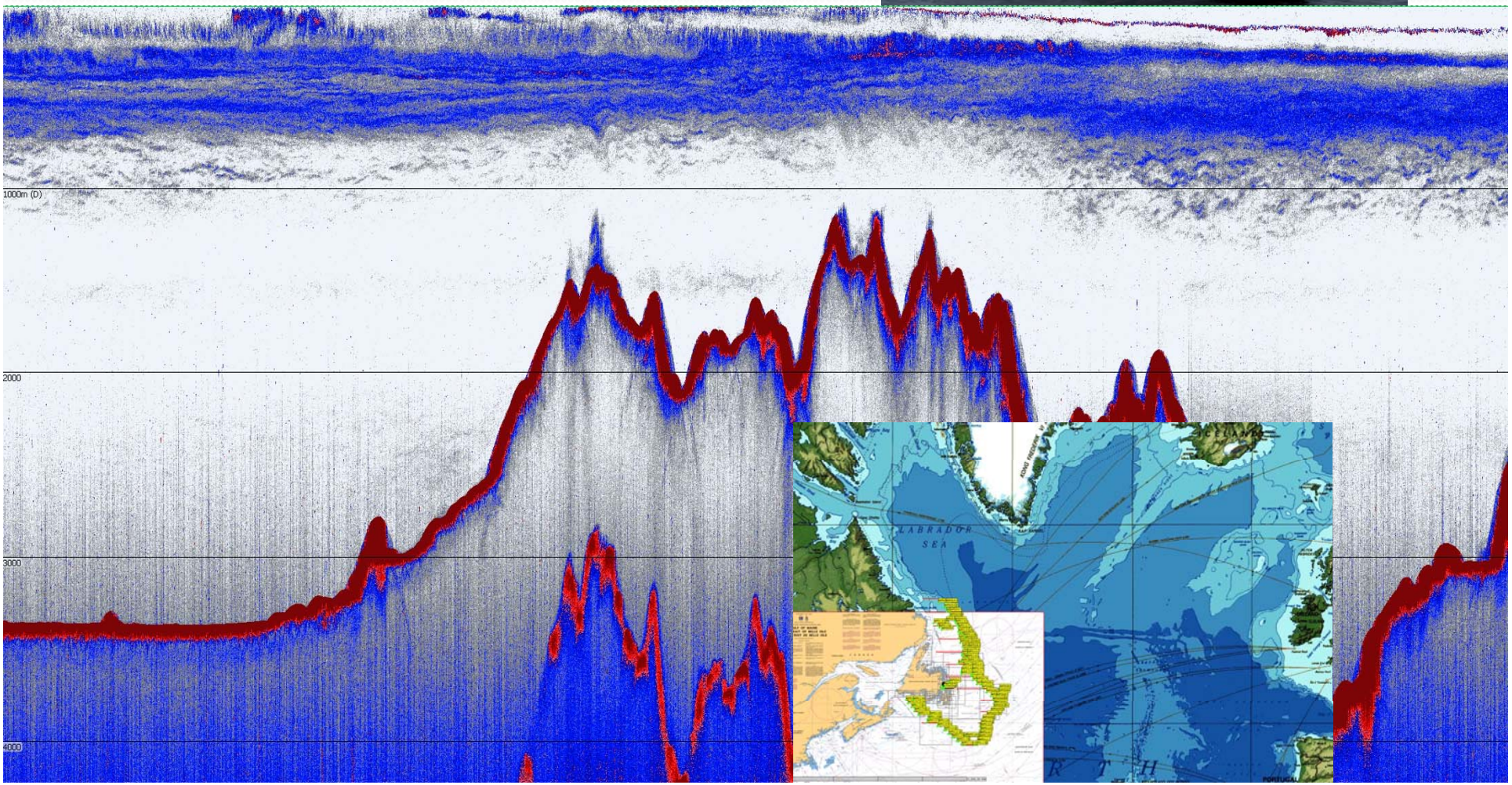
George Rose, Laura Wheeland, Riley Pollom

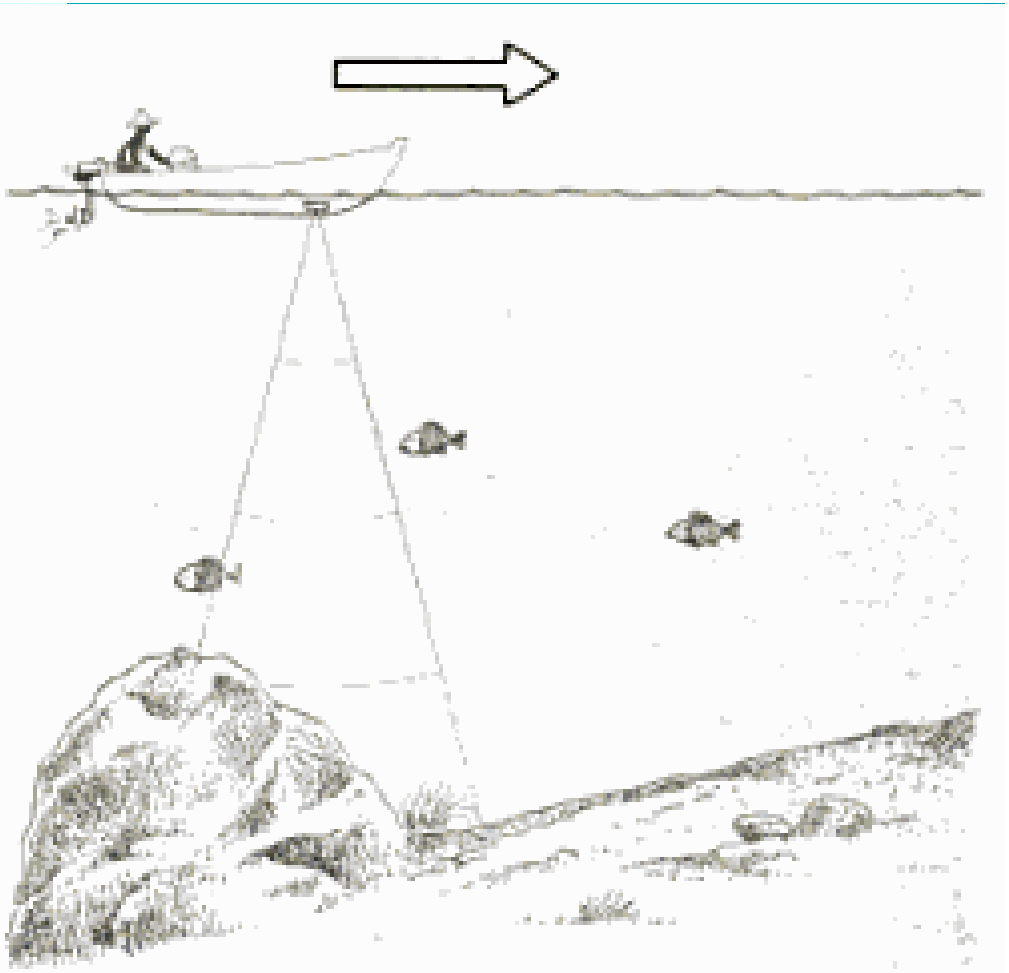
NSERC HydroNet CRSNG

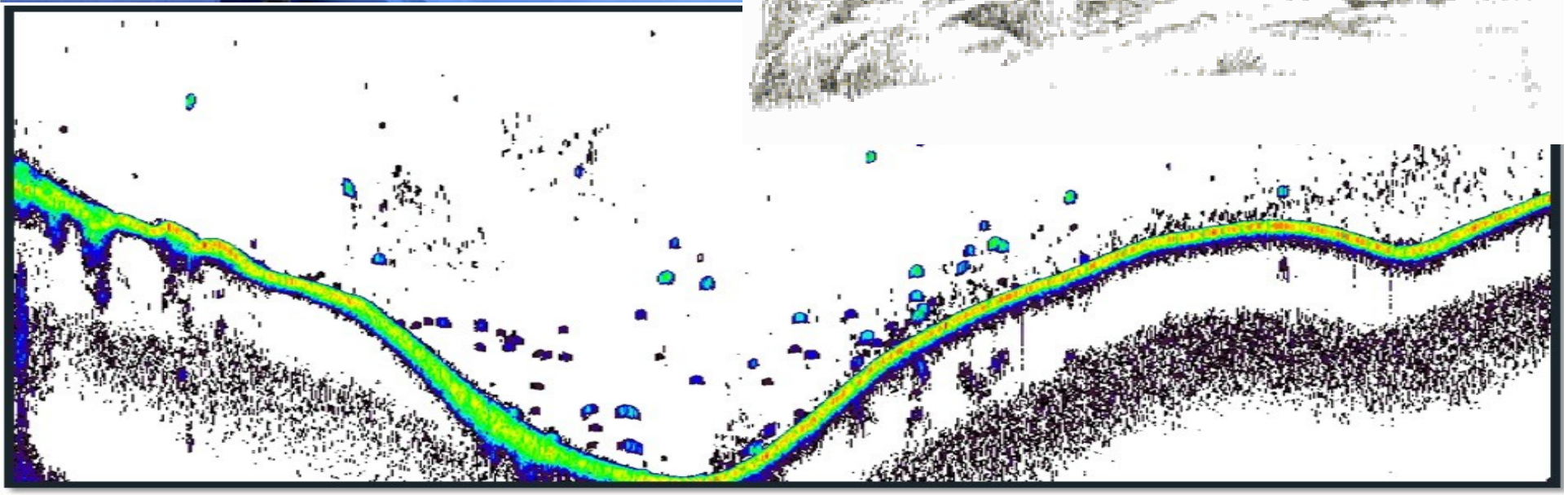
MARINE INSTITUTE

MEMORIAL UNIVERSITY

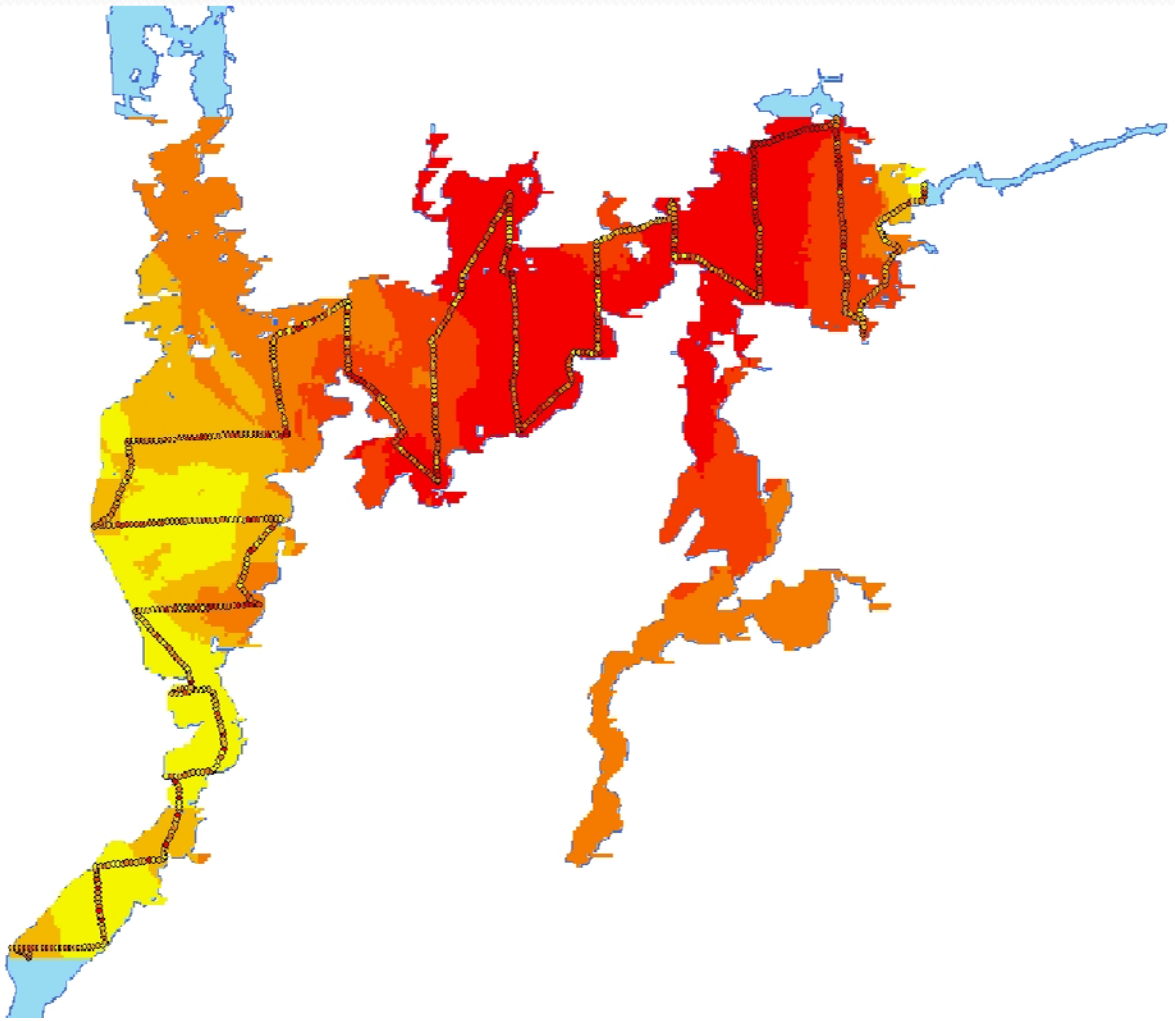
Scaling down

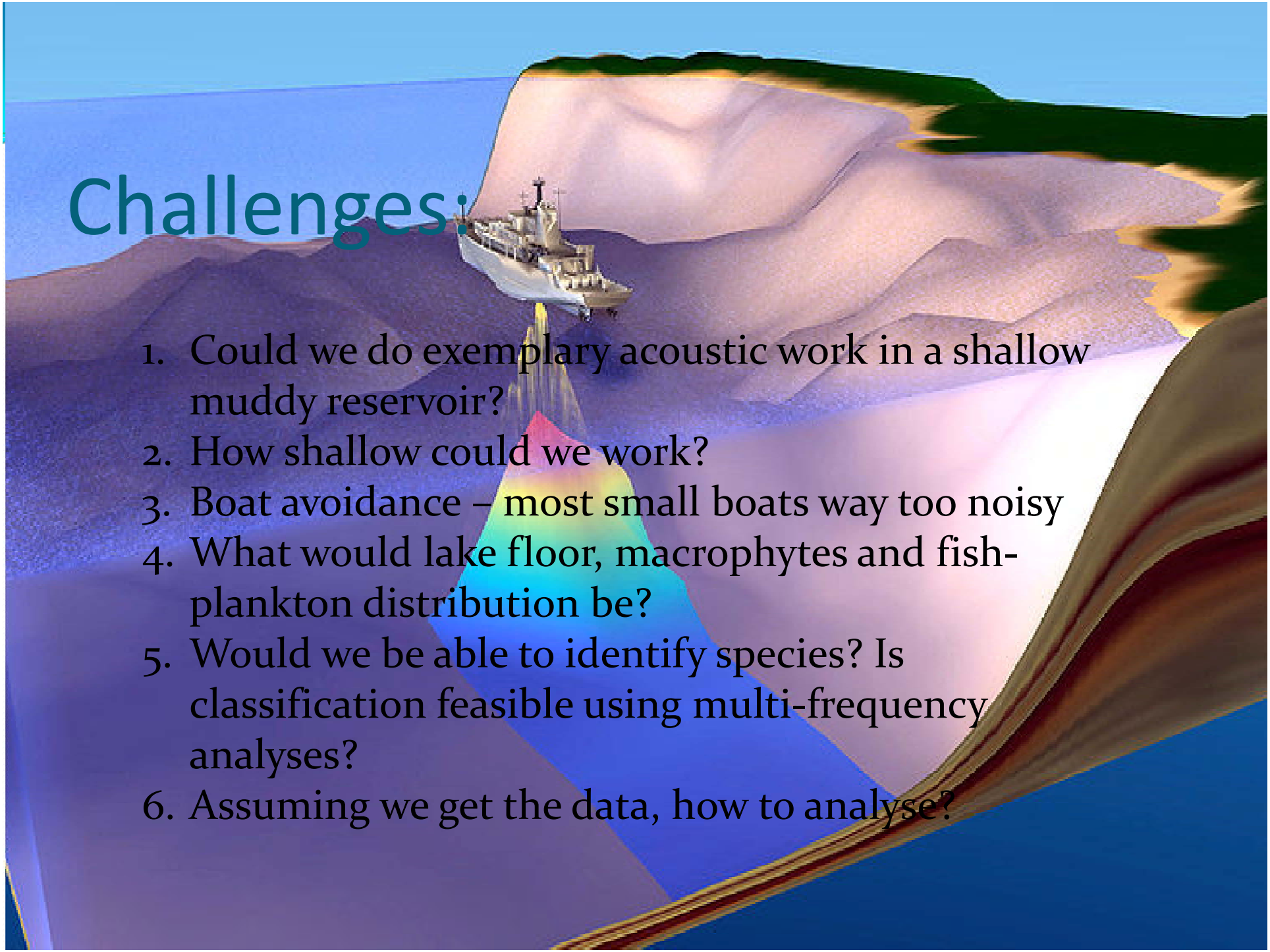






Objectives: hi-res maps





Challenges:

1. Could we do exemplary acoustic work in a shallow muddy reservoir?
2. How shallow could we work?
3. Boat avoidance – most small boats way too noisy
4. What would lake floor, macrophytes and fish-plankton distribution be?
5. Would we be able to identify species? Is classification feasible using multi-frequency analyses?
6. Assuming we get the data, how to analyse?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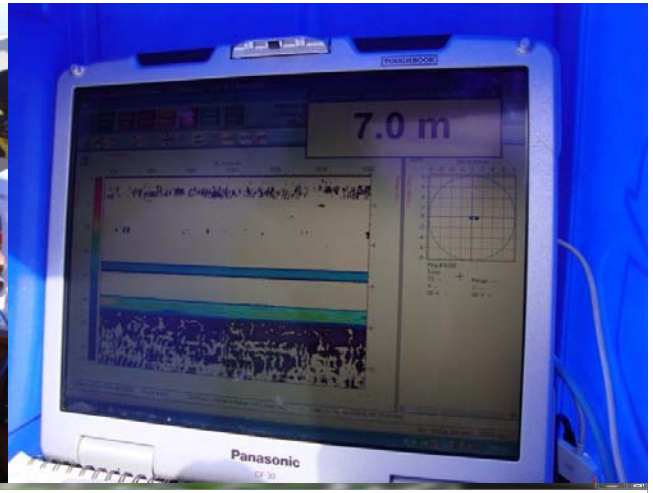
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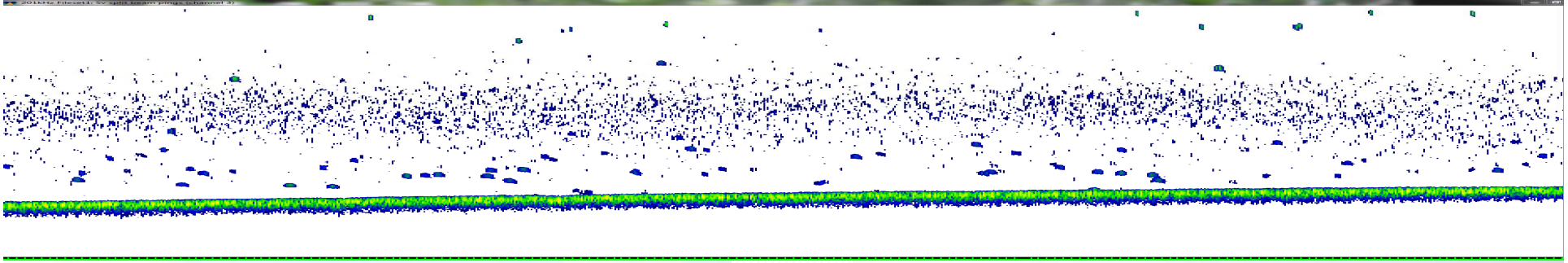

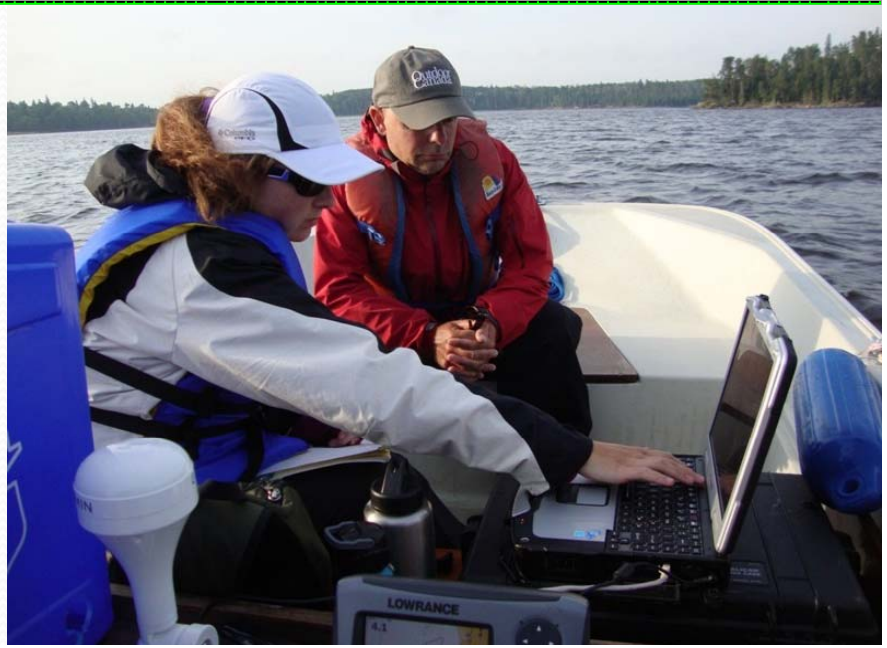
LOWRANCE


Lac Du Bonnet
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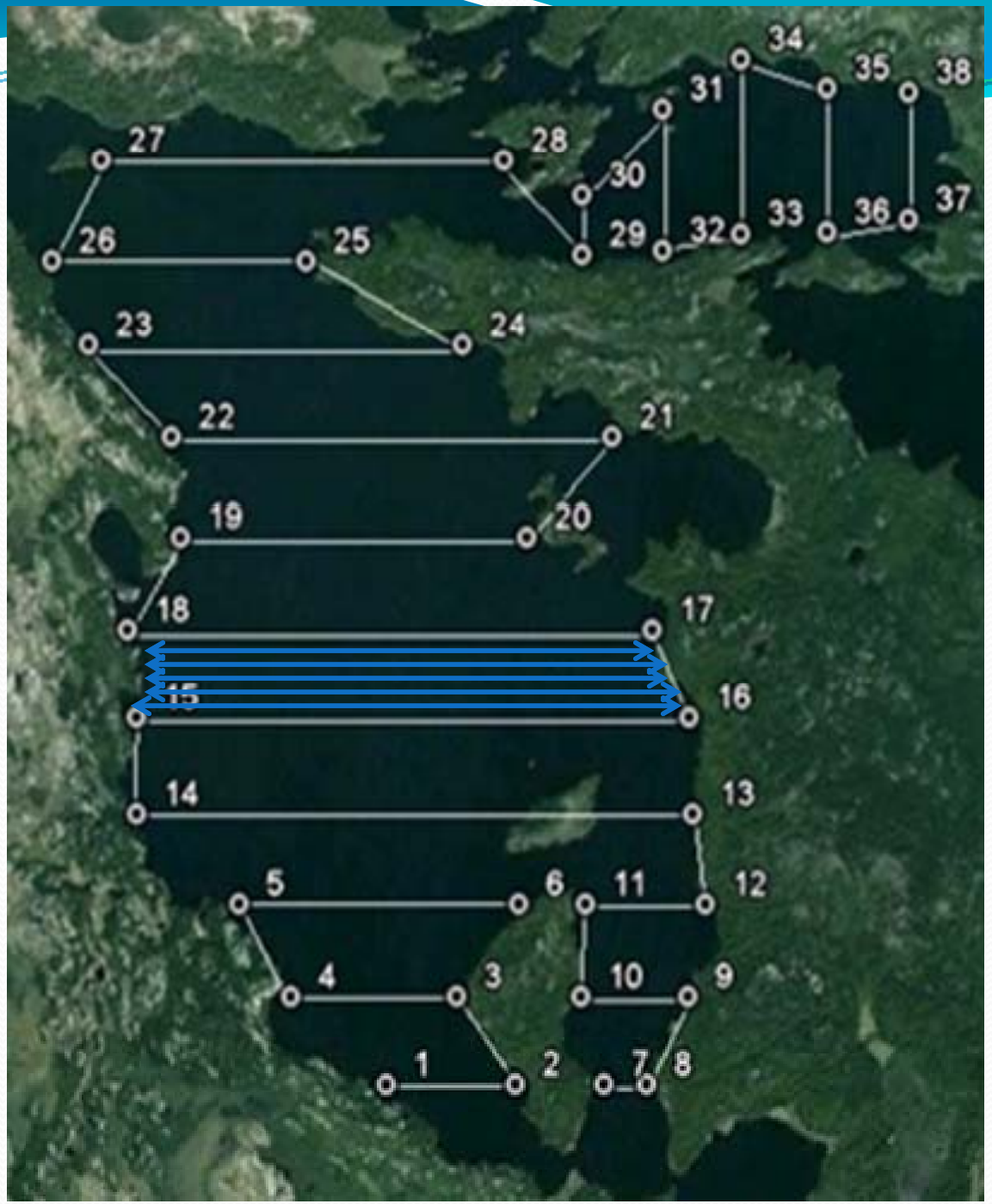
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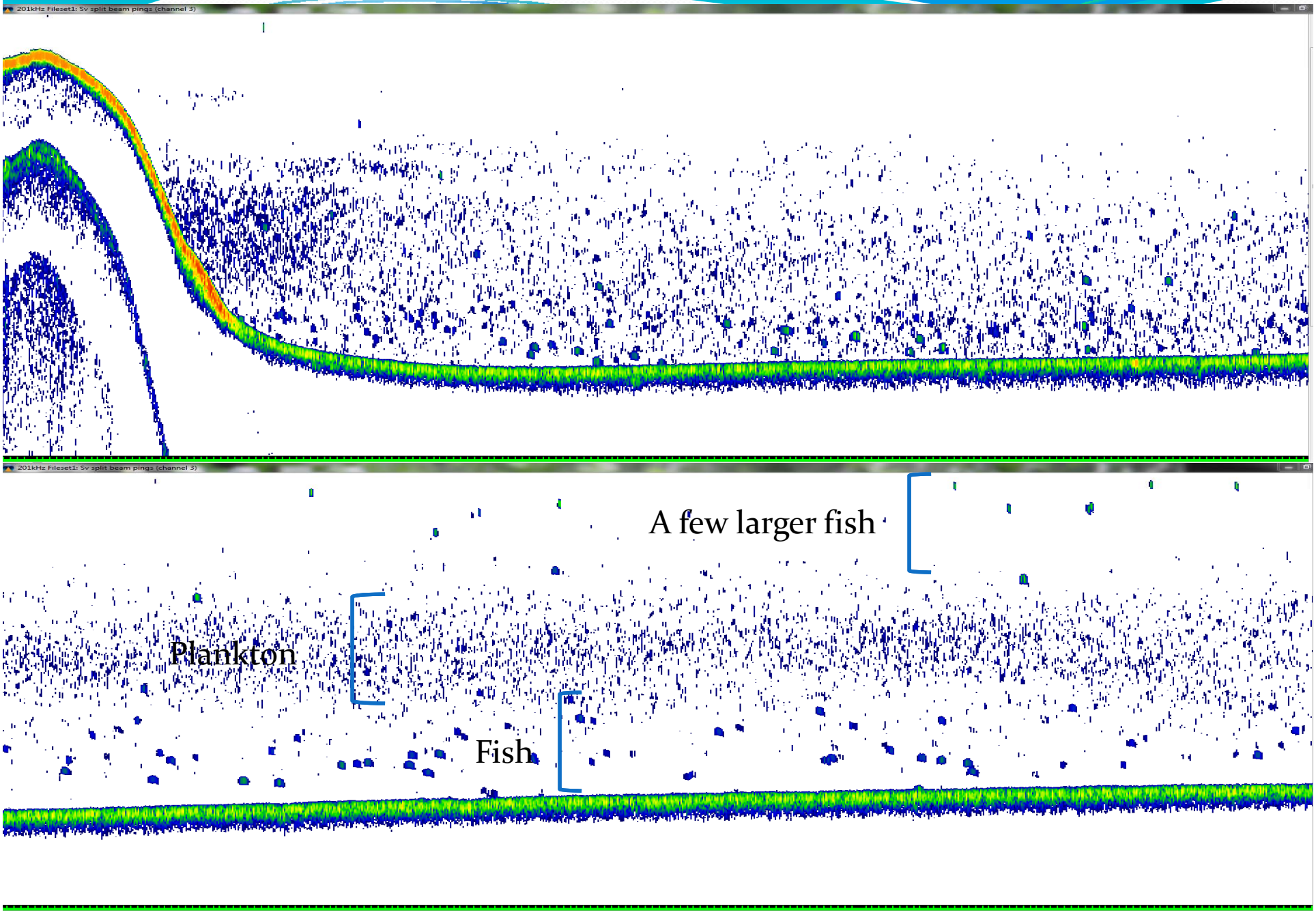
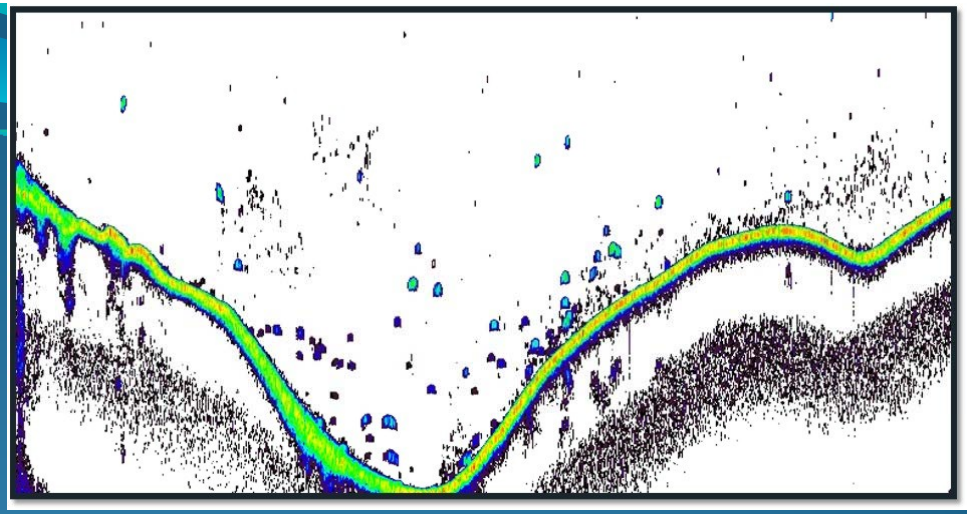
Plankton and single fish targets



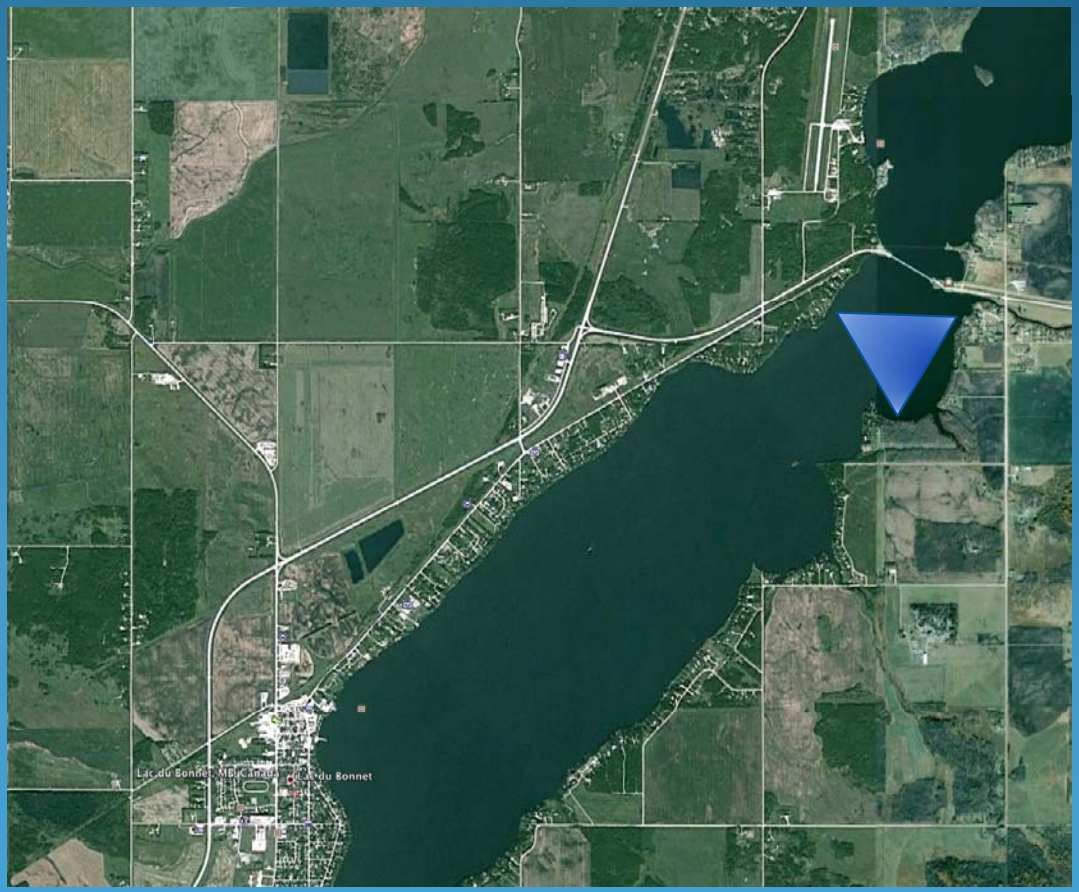
Achieved to date

- Acoustic system working OK, will produce:
  - Bathymetry map
  - Habitat map
  - Macrophyte map
  - Fish-plankton map
- Boat avoidance experiments

New idea (1)

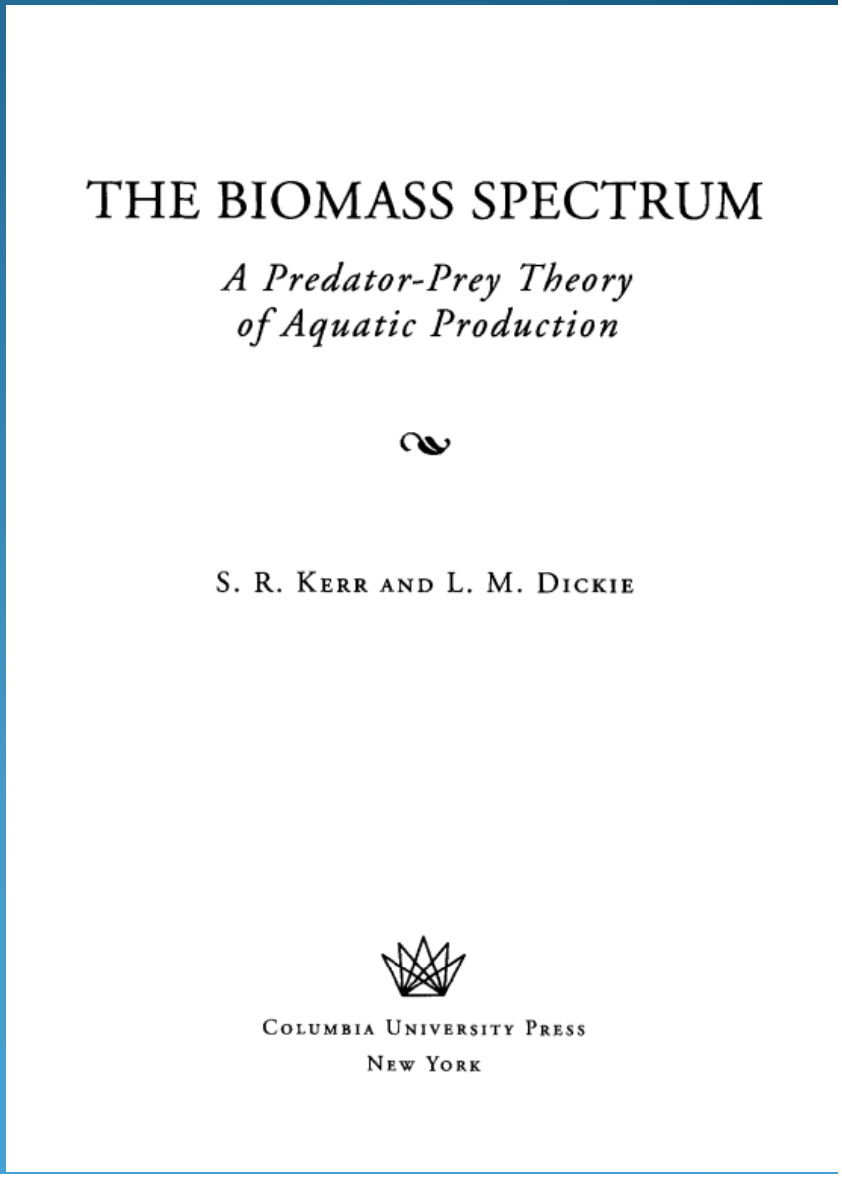


1. Using VRAP telemetry (sturgeon)
2. Continuous tracking of individual fish over months
3. Would enable direct and real-time assessments of fish avoidance

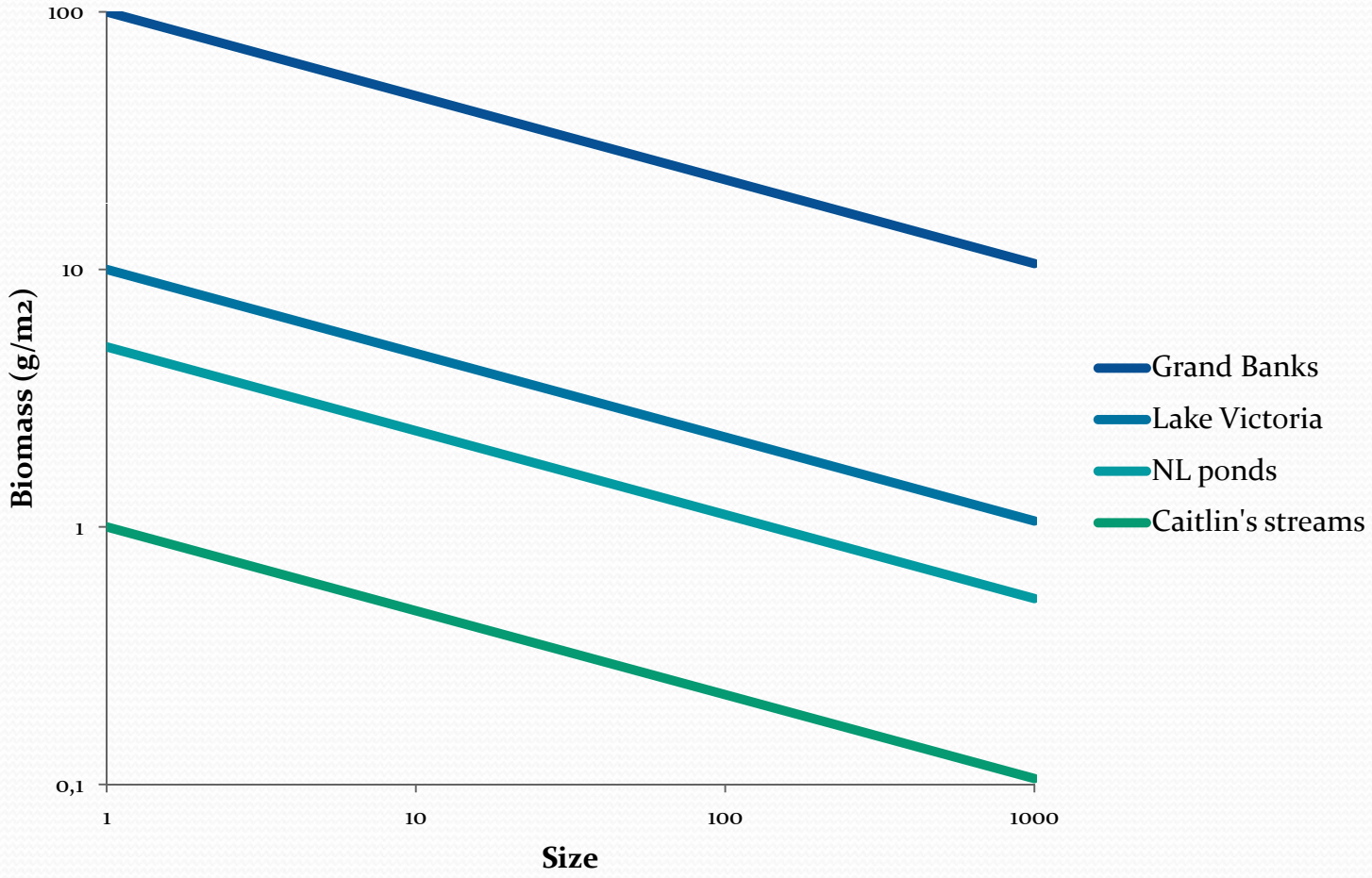


New idea (2)

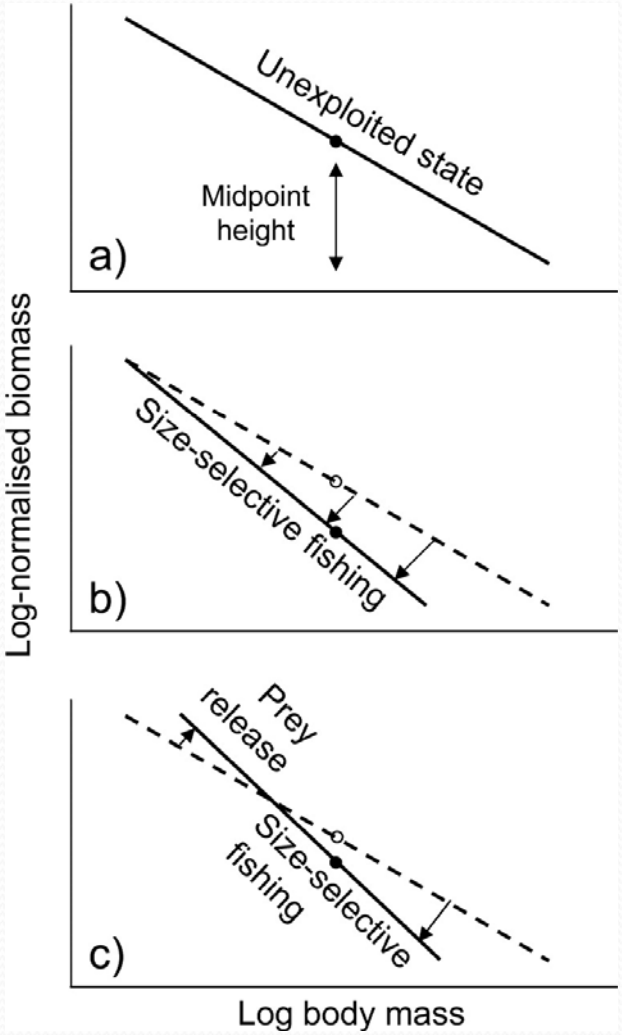
1. Using size frequency acoustic data to assess biomass spectra
2. Theory based on work of Dickey, Sheldon, Kerr for marine ecosystems
3. Mostly single targets so ideal for these types of analyses
4. Does not require species ID
5. Expectation of exponential decline curve of size-frequency, with intercept and slope indications of productivity-mortality



Biomass spectra theory



How the size spectra from (a) an unexploited community, (b) alters as a result of size-selective fishing, and (c) potential prey release.



Sweeting C J et al. ICES J. Mar. Sci. 2009;66:195-202

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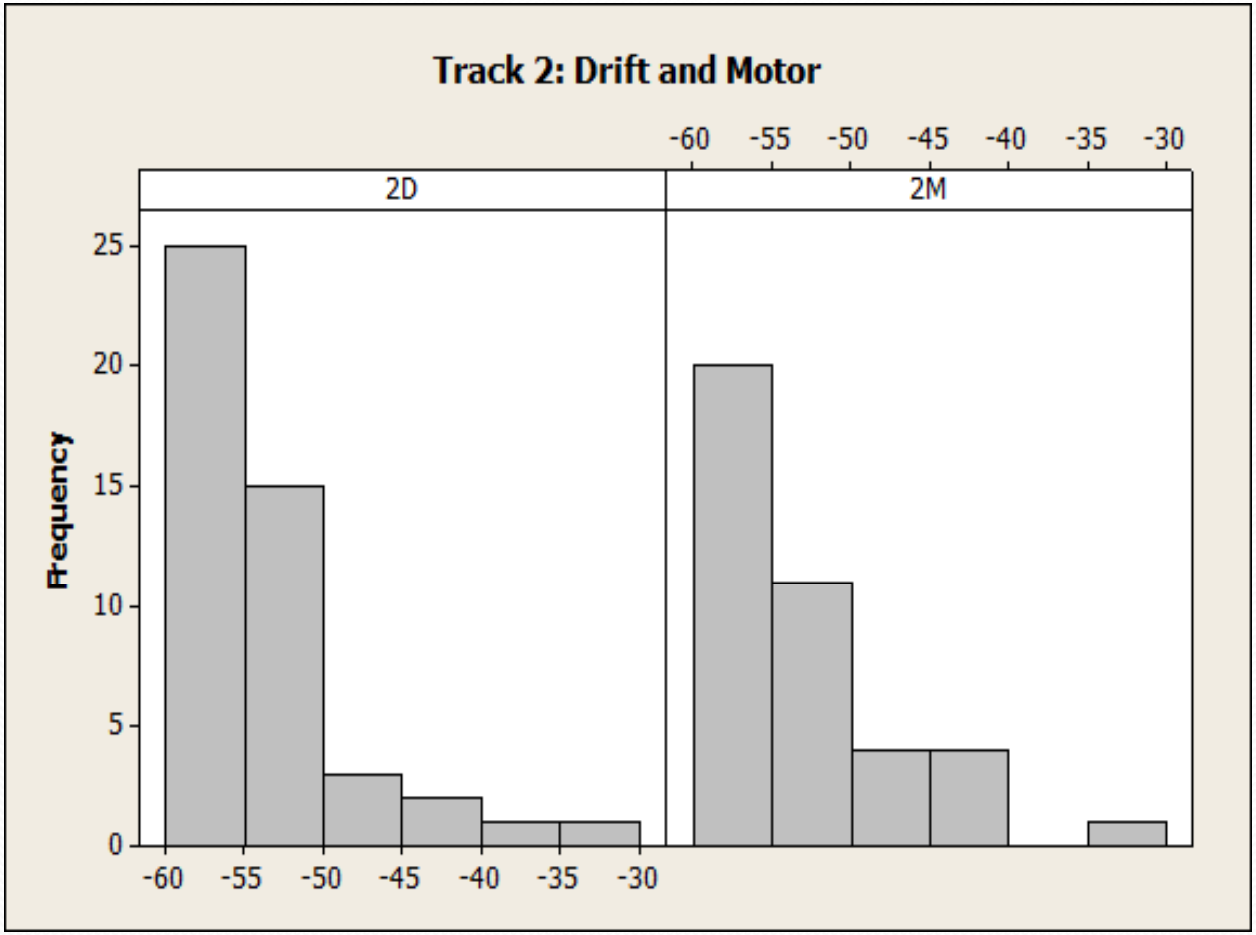
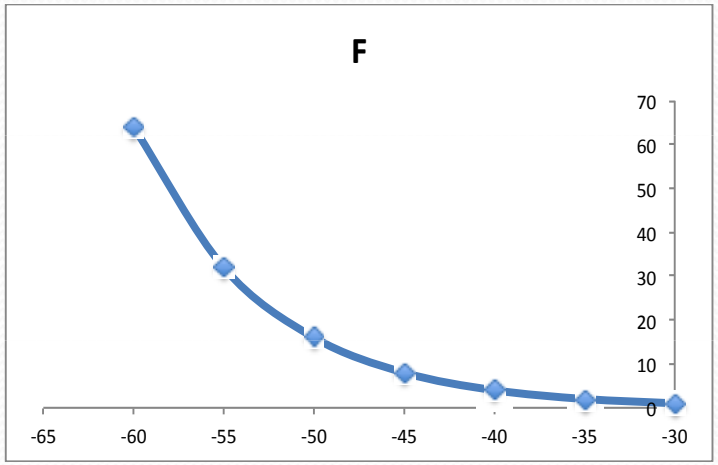
Some data from LdB



Modeling to come:

- Correct Freq for: #hits per target over TS range
- Correct Freq for: Total Sa/Σ BXS over TS range (for missed targets)
- Convert Freq to Biomass
- Convert TS to Length



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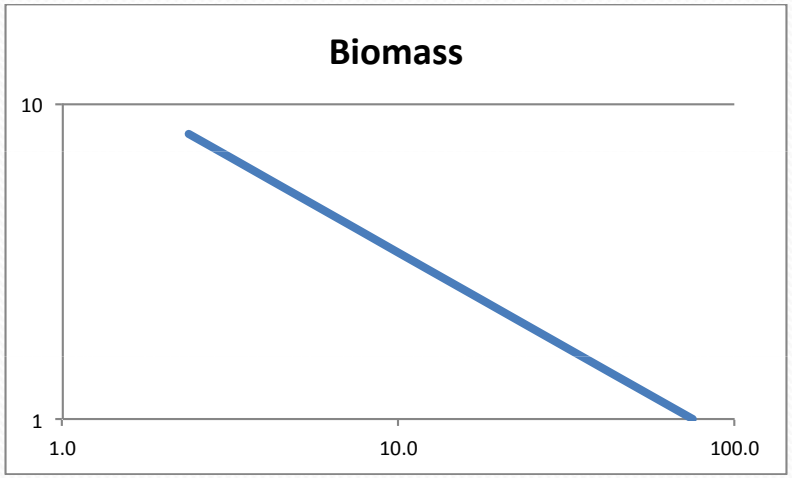

Next:

Season 2 at Lac du Bonnet (more data)

Refinement of acoustic methods

- **Maps of bathymetry, habitat, macrophytes, fish, plankton**
- **Boat avoidance analyses**
- **Biomass spectra analyses**
- **Can functional groups be derived from acoustic size and multi-frequency target classification**

Comparisons with traditional techniques (Boisclair group)

Thanks to:

- Manitoba Hydro (Joel and Gary)
- Manitoba Conservation (Doug)
- Ed Stern, CFER
- UdeM team Boisclair