Ice and lakes

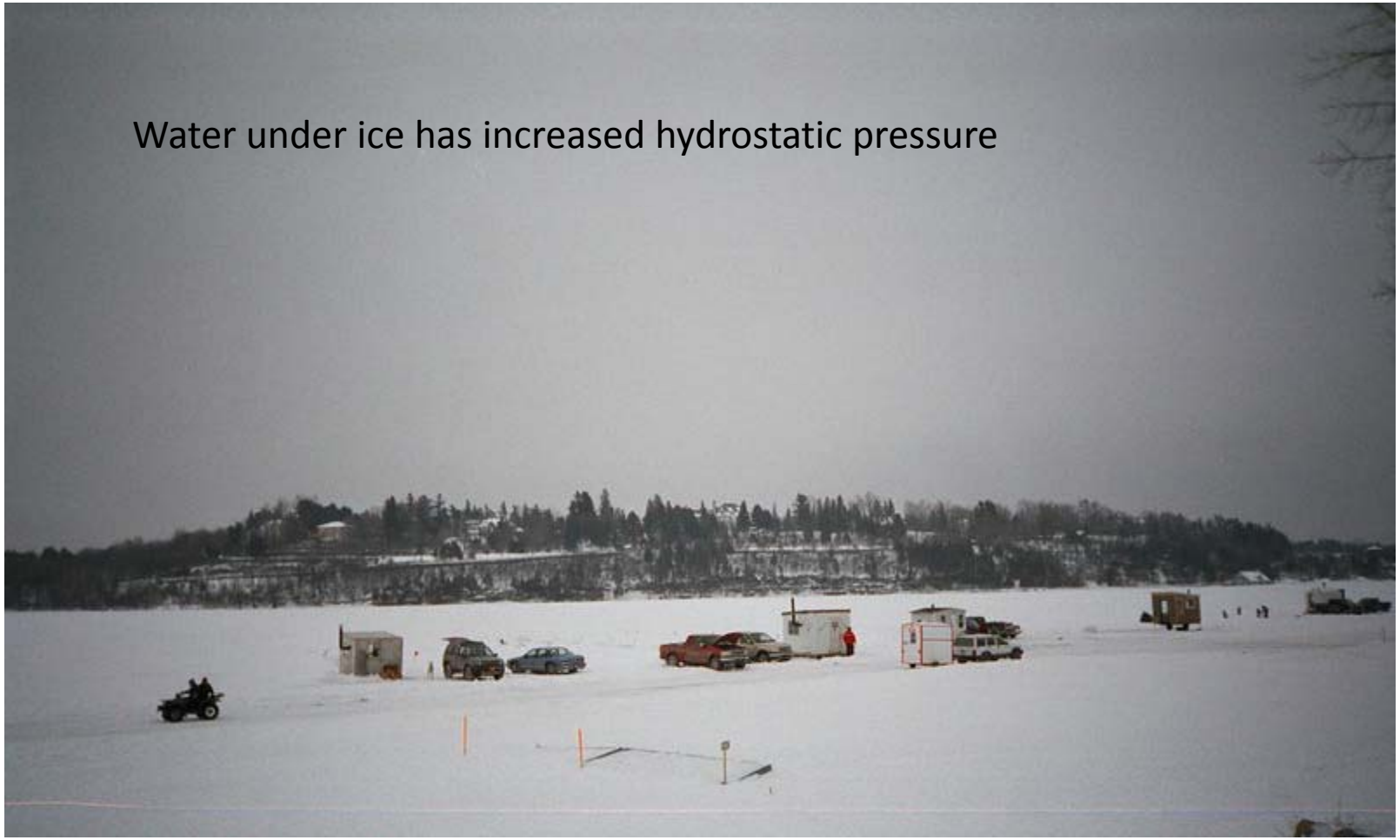
- Ice is becoming a rare commodity
  - Magnuson et al. 2000. Historical trends in lake and river ice cover in the northern hemisphere
  - Freeze and breakup times of ice
    - Ice cover shorter over the past 150 years

Ice & snow cover important

- Affects local & perhaps global climate
- Aethstetic value
- Internal dynamics of lakes and rivers
  - Depends on season interacting with ice formation

Ice cover

- Black ice (clear + strong)
  - Forms under calm conditions, < 0^{o}C
  - Grows toward lake bottom
- White ice (opaque + weak)
  - Snow cover on black ice...heavy
  - Cracks black ice
  - Slush forms and freezes


Water under ice has increased hydrostatic pressure

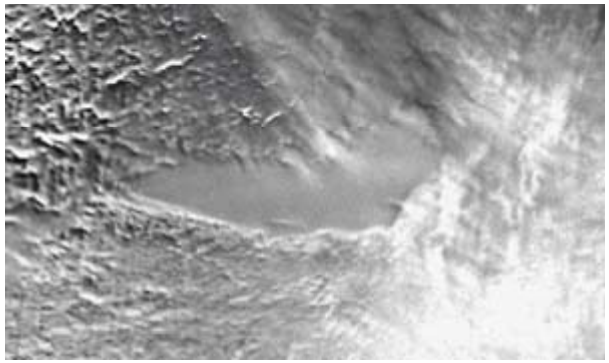
Ice cover

- Ice is a lid on the lake … reduces exchange of materials
- Causes gases and ions to freeze out
- Reduces light
  - Black ice 20% reduction
  - White ice w/ snow cover 99% reduction

Ice cover

- Ice reduces water circulation (so amictic is probably not precise)
- Circulation occurs but very slowly
  - Na tracer
  - Sediment (5^{o}C) warms water and it rises, reaches the ice surface, cools and sinks…

Lake Vostok



Antarctica

- liquid water below 3600 m of ice
- water at least 400,000 years old
- life likely present due to mixing

Cryobots

- melt surface ice
- “sink” down
- deploy a probe into water