Methods for monitoring polar bears

- There are trade-offs among techniques! Considerations for selecting a method might include:
  - Management objectives
  - Information needs
  - Availability of resources
  - Logistical constraints
  - Social acceptability
  - Time frame
- Options: physical capture, **aerial surveys, genetic mark-recapture, remote sensing**
  - All ‘alternative’ methods provide less detailed information than capture-based programs!

Aerial Surveys: What information can we get?

- Snapshot estimate of abundance:
  - How many bears are in the study area during the survey
- Some basic information on reproduction:
  - Litter sizes
  - Proportion of cubs / yearlings in the sample
- Distribution of bears across the landscape due to
  - Systematic surveying
  - Comprehensive sampling of the population

Aerial Surveys: What information don’t we get?

- Estimates of survival
- Information on age structure
- Quantitative information on body condition
- Only limited data on recruitment
- Population growth: repeated surveys are required

Large-Scale Aerial Surveys

Barents Sea: 2004; Covered land, glaciers, and pack ice

Seasonal ice populations

- Foxe Basin: 2009 - 2010
- Western Hudson Bay: 2011
- Southern Hudson Bay: 2011 - 2012

Also, numerous pilot studies, including the Chukchi Sea, Baffin Bay, Beaufort Sea

Where have aerial surveys worked well?

To generalize, onshore regions during ice-free season

- Higher densities of bears
- Better detection
- Relatively low topographic relief
- Limited habitat structure affecting detection
- Stable study area

Barents Sea as the exception for large-scale surveys: transects over land and ice

Remote Sensing: Satellite Imagery

- Provides coarse information of abundance and distribution **in certain conditions**
- Benefits
  - Regular accessibility to remote areas
  - Reduced safety concerns
  - Cost reductions, particularly in the future (with technological improvements and methodological development)
- Initial, proof-of-concept work in Foxe Basin, Nunavut

Satellite Imagery: Current applications and limitations

- Promising tool for monitoring at *some* sites
  - Demonstrated ability to distinguish bears from non-targets in ideal conditions
  - Abundance estimates based on imagery and aerial surveys are consistent
  - Provides coarse data on distribution and abundance
- But…
  - Less detailed information than other methods
  - Applications limited to sites with little topographic relief and no snow cover
  - Some manual review required: automating detection is in the works!
  - Cannot discriminate cubs
  - Cannot completely synchronize satellites and ground surveys: potential for false positives and negatives?

New platforms, such as WorldView-3 (launched in August, 2014), will greatly improve resolution.

Regulatory changes are increasing the availability of high resolution imagery.

Applications will likely expand in the near future with technological and regulatory improvements.

Genetic mark-recapture

- Variation on traditional physical capture programs
  - Small tissue sample obtained via darting: no immobilization needed
  - Multiple years of sampling required
- Yields data on abundance, survival, some information on recruitment, and population growth
- Does not provide detailed information on age structure nor quantitative data on body condition
- Intensive studies in Baffin Bay and Kane Basin underway! More to come….
- Combining methods to draw on relative benefits?