Understanding polar bear distribution, body condition, and genetics in eastern James Bay through community-led approaches

Southern Hudson Bay Polar Bear Hearing

February 4-6,
Kuujjuarapik, Nunavik

EEYOU MARINE REGION WILDLIFE BOARD
CONSEIL DE GESTION DES RESSOURCES FAUNIQUES DE LA RÉGION MARINE D'EEYOU

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CREE TRAPPERS' ASSOCIATION "EST" 1978

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Supervised by Prof. Murray Humphries

Requests for information

1. Harvest levels
2. Polar bear knowledge (abundance, health, and environment of polar bears)
3. Management approaches and techniques
4. Conservation Concerns
5. Human-Bear Interactions
6. What should the Polar Bear Management Objectives be for this area?

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1. Harvest levels
2. **Polar bear knowledge (abundance, health, and environment of polar bears)**
3. **Management approaches and techniques**
4. Conservation Concerns
5. Human-Bear Interactions
6. What should the Polar Bear Management Objectives be for this area?

Community-led polar bear research approach

Information collected through this ongoing effort in eastern James Bay

- *Polar bear distribution*
- *Body condition*
- *Preliminary genetics*

Eeyou Marine Region Polar Bear Project

- Community-identified polar bear research priority from observations of changing polar bear distribution and abundance
- Developing community-led and non-invasive research tools to provide information on polar bears
- Partnership between communities, EMRWB, CTA and McGill University to address research questions of interest
- 2021- present, four seasons of field data

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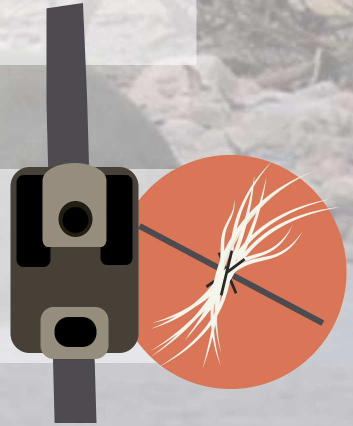
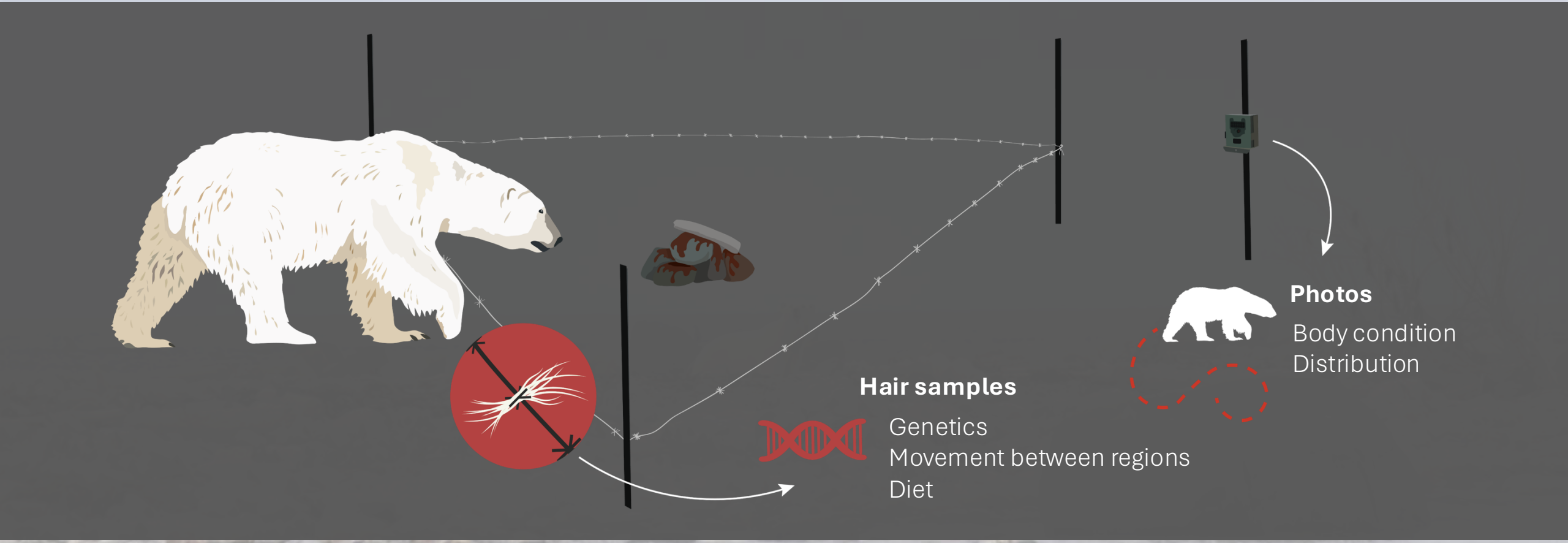
Communities of
Waskaganish, Eastmain, Wemindji and Chisasibi

Cree Knowledge Interviews

Hair snare & camera trap sampling stations



Field methods: hair snare and camera trap sampling stations

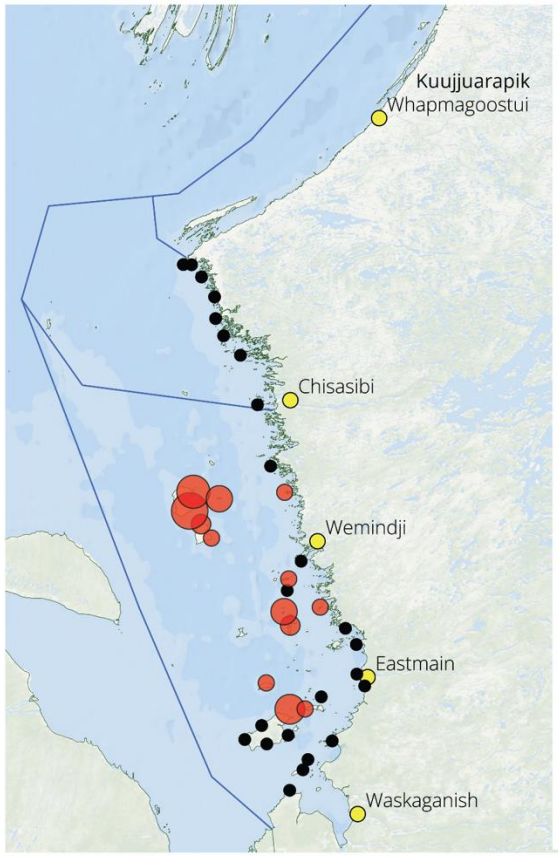


Field methods: hair snare and camera trap sampling stations

Yearly polar bear detections per week at sampling stations in eastern James Bay (July-September)

Yearly polar bear detections per week at sampling stations in eastern James Bay (July-September)

2021



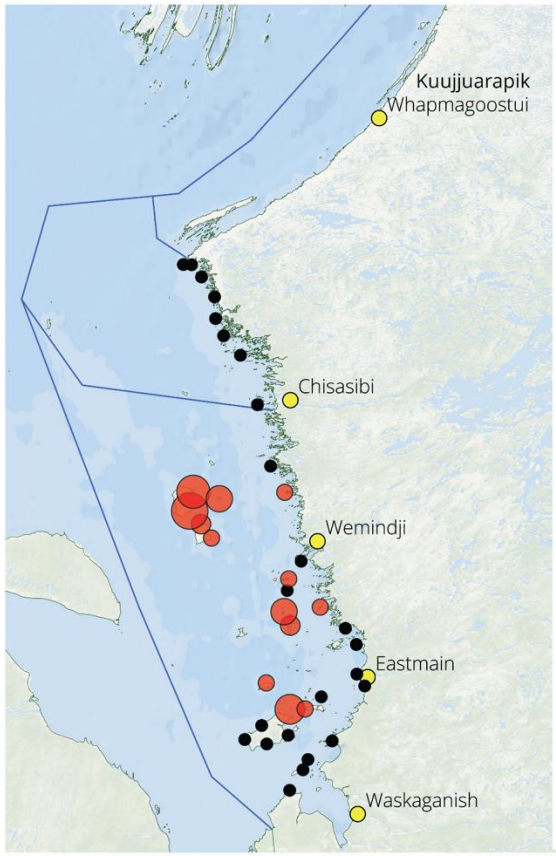
Polar bear detections per week
0
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6

Community
EMR- NMR Boundary

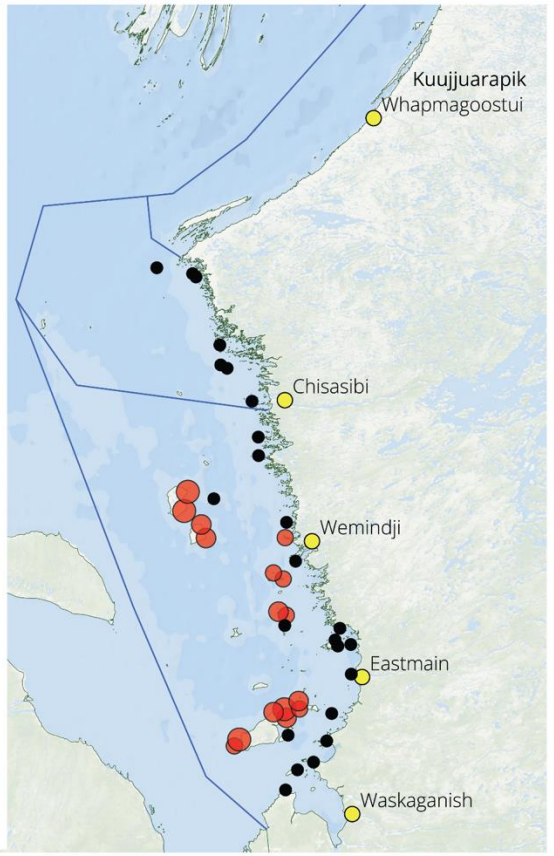
0 50 100 km

Yearly polar bear detections per week at sampling stations in eastern James Bay (July-September)

2021



2022



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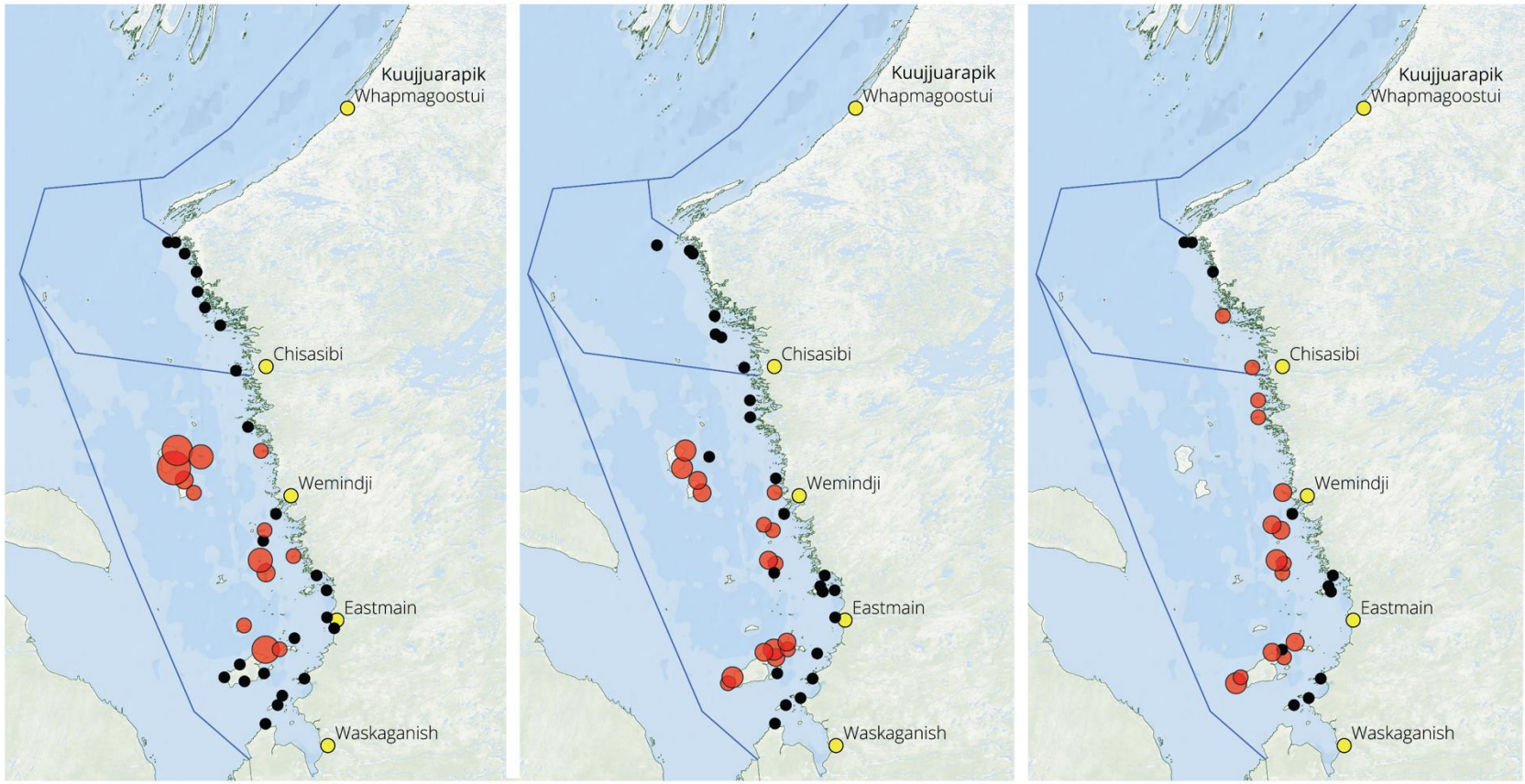

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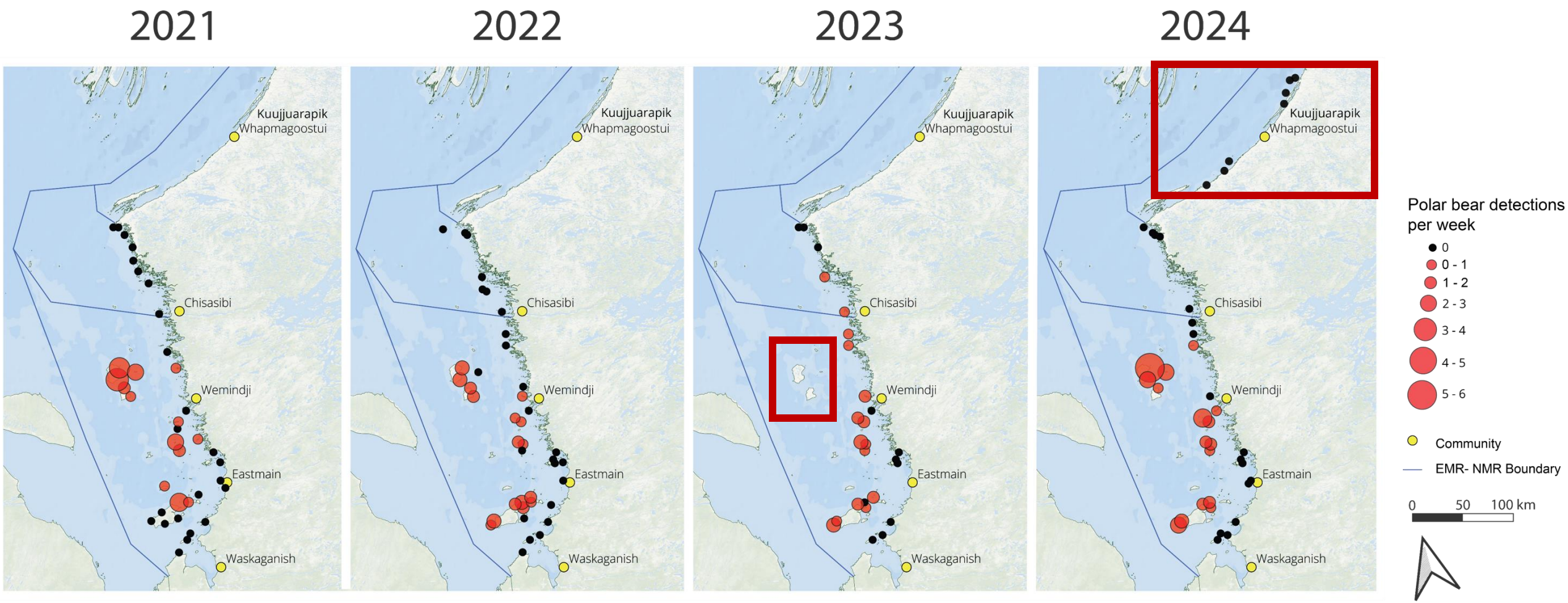
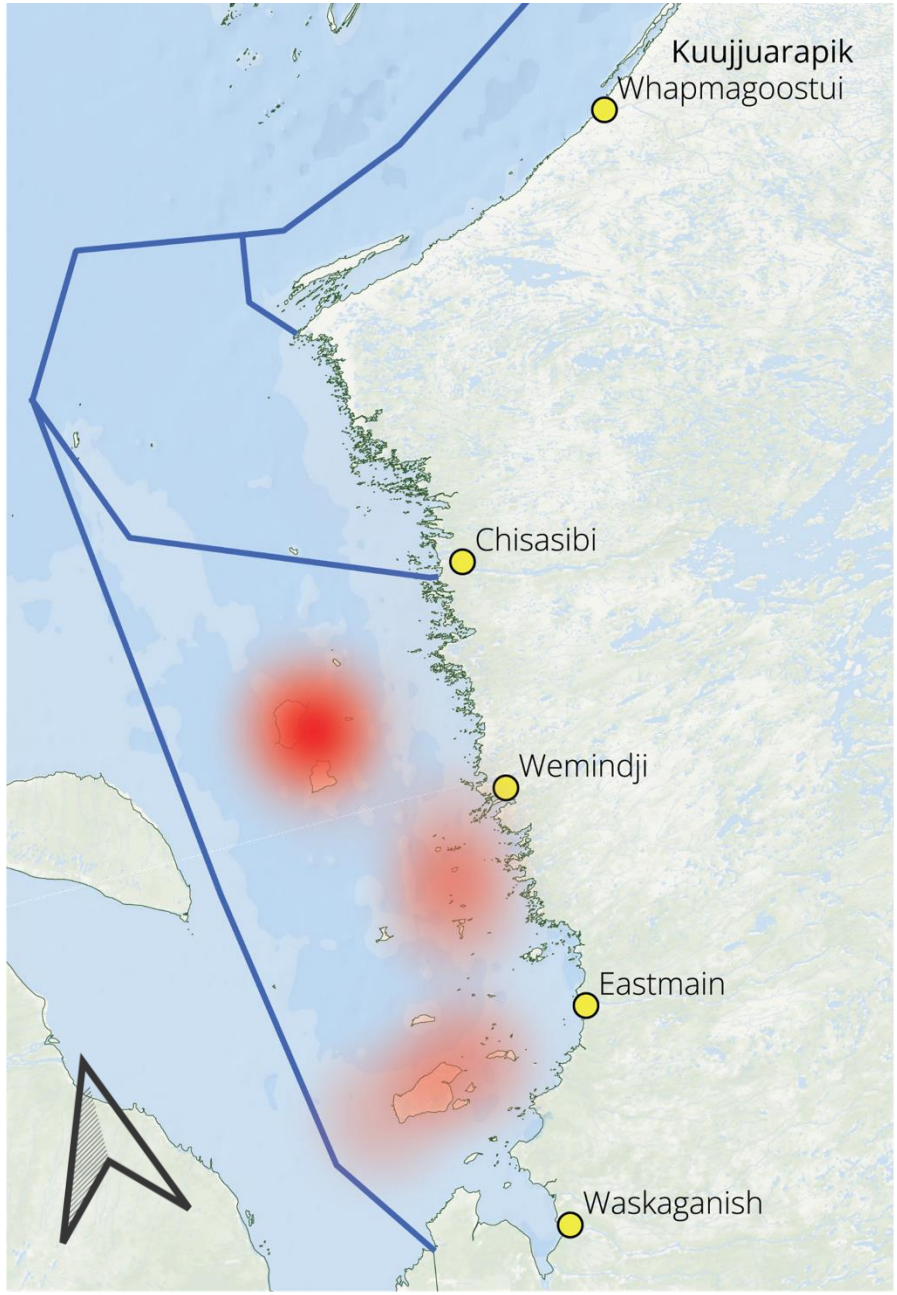


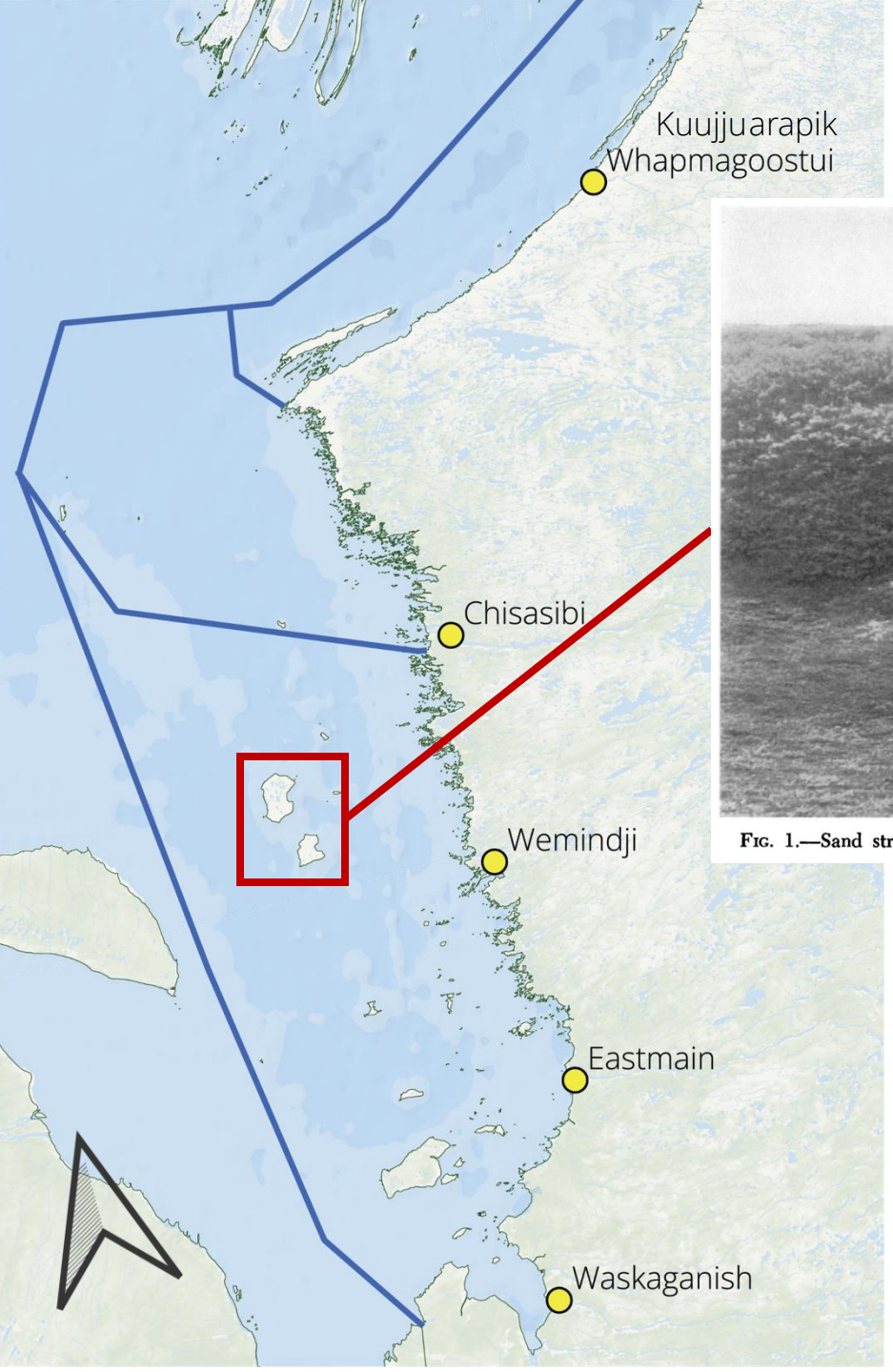
Polar bear activity hotspots



Polar bear distribution in eastern James Bay

- Used the detection rates and different island characteristics to investigate patterns of polar bear distribution in the EMR
- Models using:
  - *Distance to mainland*
  - *Island size*
  - *Latitude*
  - *Vegetation type*

Polar bear denning in eastern James Bay



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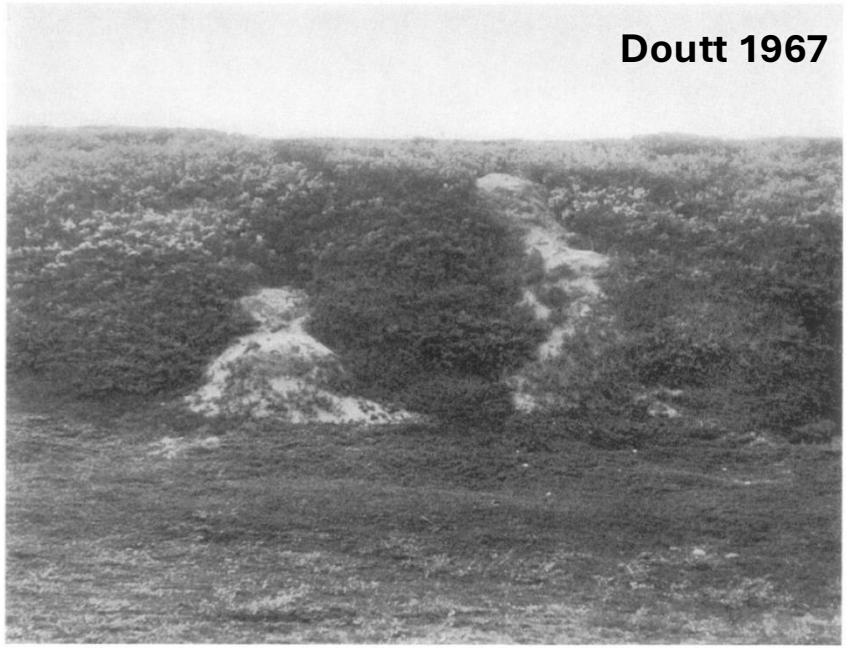

Fig. 1.—Sand strewn out from two bear dens on Bear Den Ridge, 24 July 1935.

2021

Photo of polar bear dens from field teams on Twin Islands, July 2021

- Twin Islands important denning habitat first described in the 1930's
- Continued use through the 1960's (Jonkel et al., 1972) and to present (Langwieder et al., 2023)
- 20+ denning sites identified in community fieldwork (led by George Natawapineskum), unknown how regularly used

Polar bear body condition

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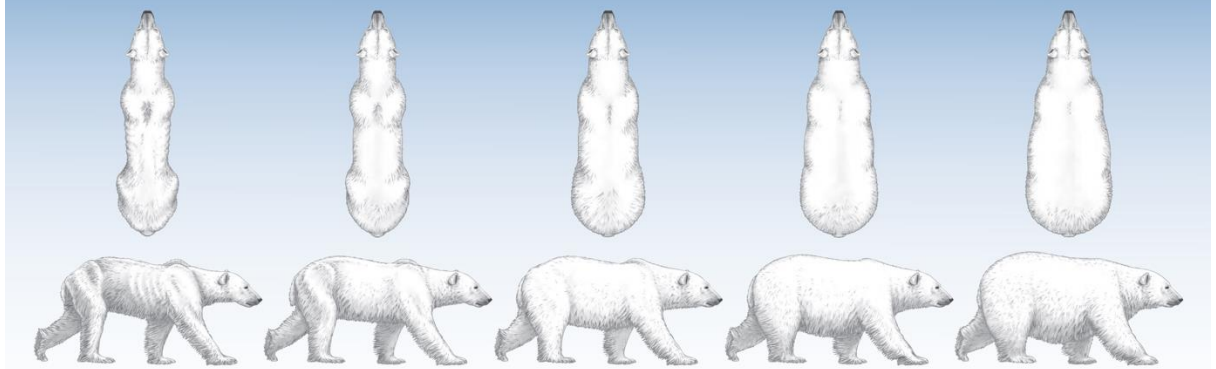
Polar Bear Scorecard: A Standardized Fatness Index

Illustrations by Emily S. Damstra



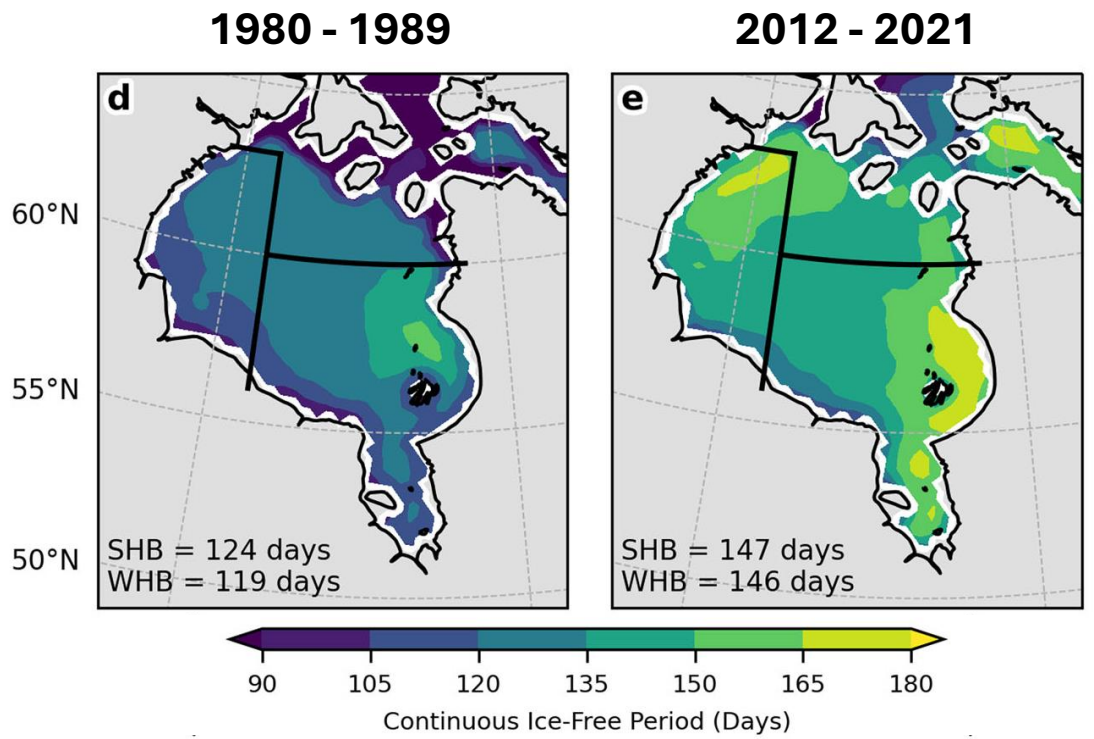
SKINNY	THIN	AVERAGE	FAT	VERY FAT
Skinny; emaciated appearance; vertebrae, ribs, and hip bones externally visible without palpation; no fat palpable between skin and muscle over the dorsal body, hips, or lower rump.	Thin; vertebrae and hip bones (but not ribs) partially visible, easily palpable under the skin; little/no fat between skin and muscle over the back; small amounts of fat detectable on lower rump.	Average; healthy appearance; vertebrae and hip bones not visible; upper 1/3 to 1/2 of the spinal column can be felt under the skin; detectable layer of fat between skin and muscle over rear half of body, thickening slightly but detectably over lower rump.	Fat; vertebrae and hip bones not visible; palpation reveals fat deposited over upper vertebrae; hip bones difficult to feel through fat; fat thick over rump; a hand rubbed above the rump will initiate ripples in the skin over the fat layer.	Obese; vertebrae and hip bones undetectable by palpation; thick layer of fat is apparent between skin and muscle 2/3 of the way up the back & over rump; a hand rubbed on lower back above rump sets off waves of rolling fat, possibly jiggling.

This is a subjective determination of a bear's body condition based on assessment of body fat. Source: I. Stirling, G.W. Thiemann, E. Richardson. 2008 Quantitative Support for a Subjective Fatness Index of Immobilized Polar Bears. Journal of Wildlife Management 72(2): 568-574.

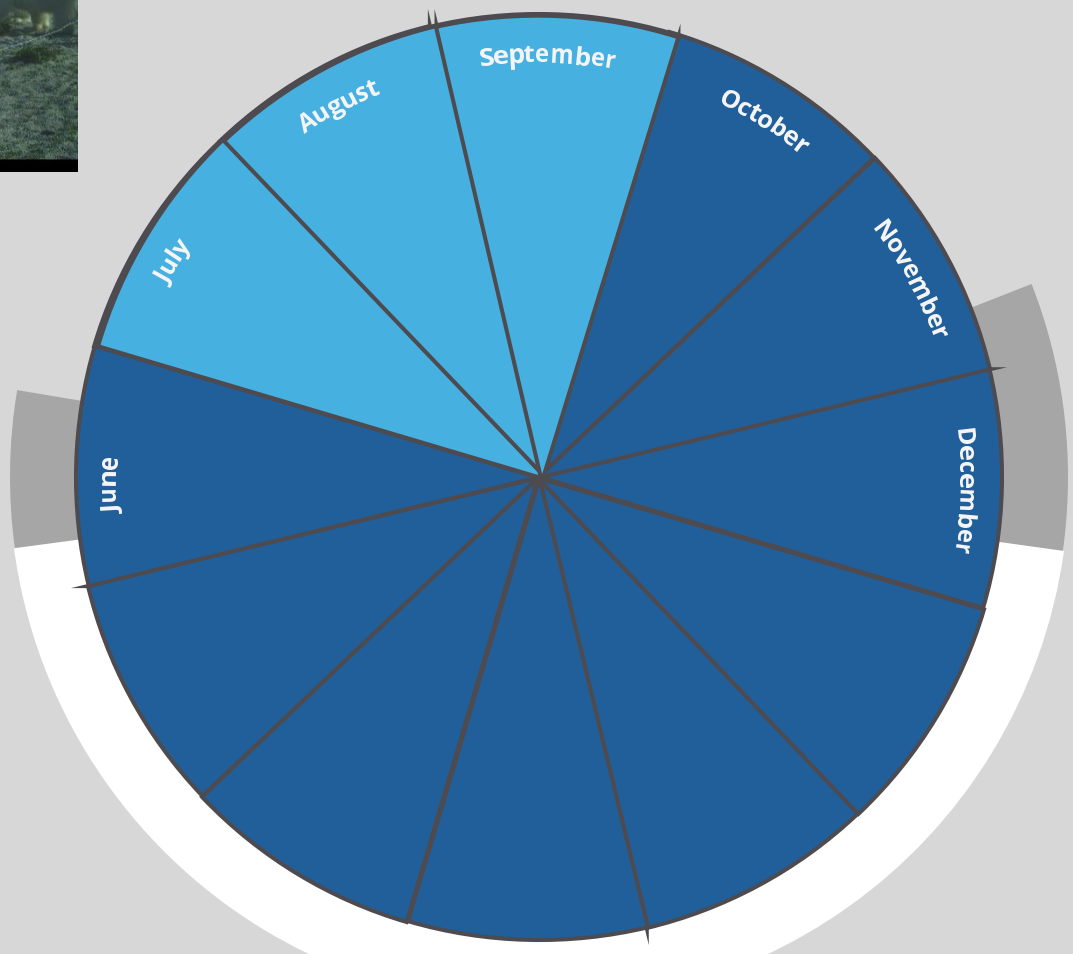
Polar bear body condition

- Body condition determines reproductive success and survival
- Polar bears are known to lose 1-2kg of body mass for every day spent fasting (Pilfold et al., 2016)
- Fasting for long periods (>117 days) causes reduced body condition that impacts milk production and cub survival (Molnár et al., 2020)
- Southern Hudson Bay has one of the longest ice- free seasons across polar bear range (Stroeve et al., 2024)
- Previous studies in Southern Hudson Bay found sea ice and body condition have declined between 1980 and 2012 (Obbard et al., 2016)
- Ice free period in Southern Hudson Bay is increasing, reducing polar bear access to hunting on the ice (Stroeve et al., 2024)

Figure from Stroeve et al. (2024) showing changes to **continuous ice-free days** between 1980-1989 and 2012-2021



Sea ice in eastern James Bay



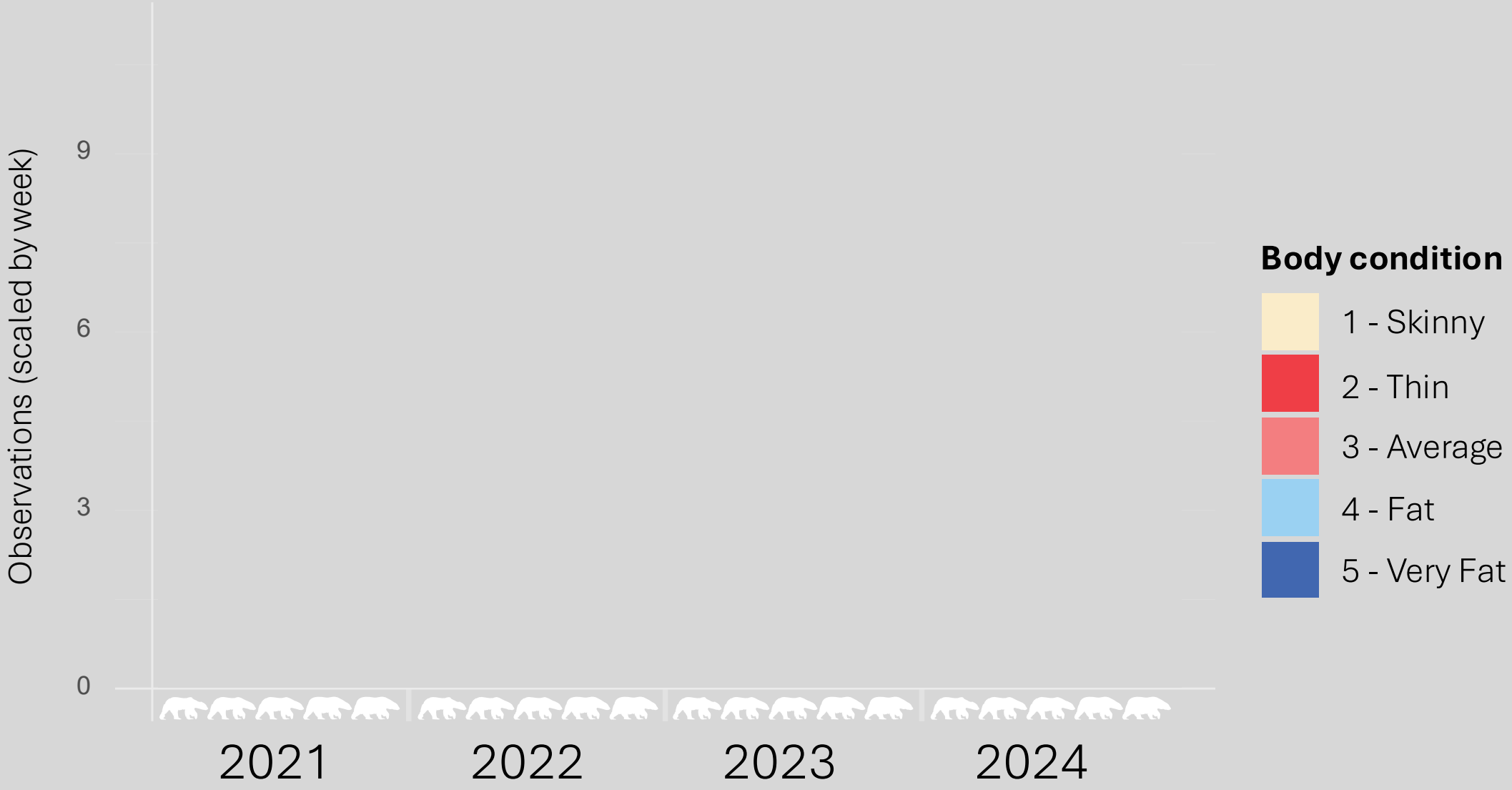
Sea ice breakup in offshore areas

Sea ice breakup in nearshore areas

Sea ice reforms in nearshore areas

Sea ice reforms in offshore areas

Polar bear body condition observations from camera traps
in eastern James Bay between 2021 and 2024



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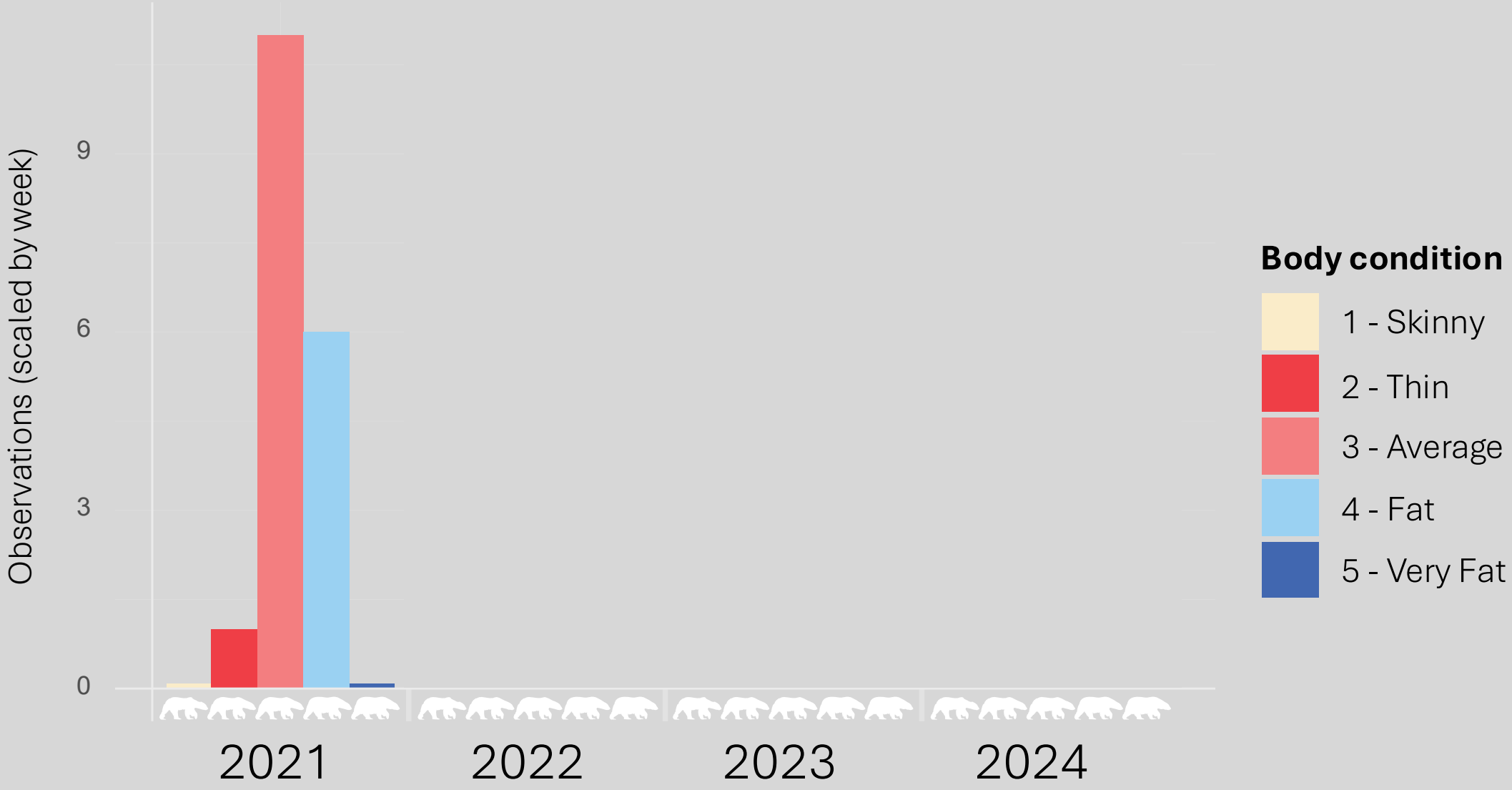

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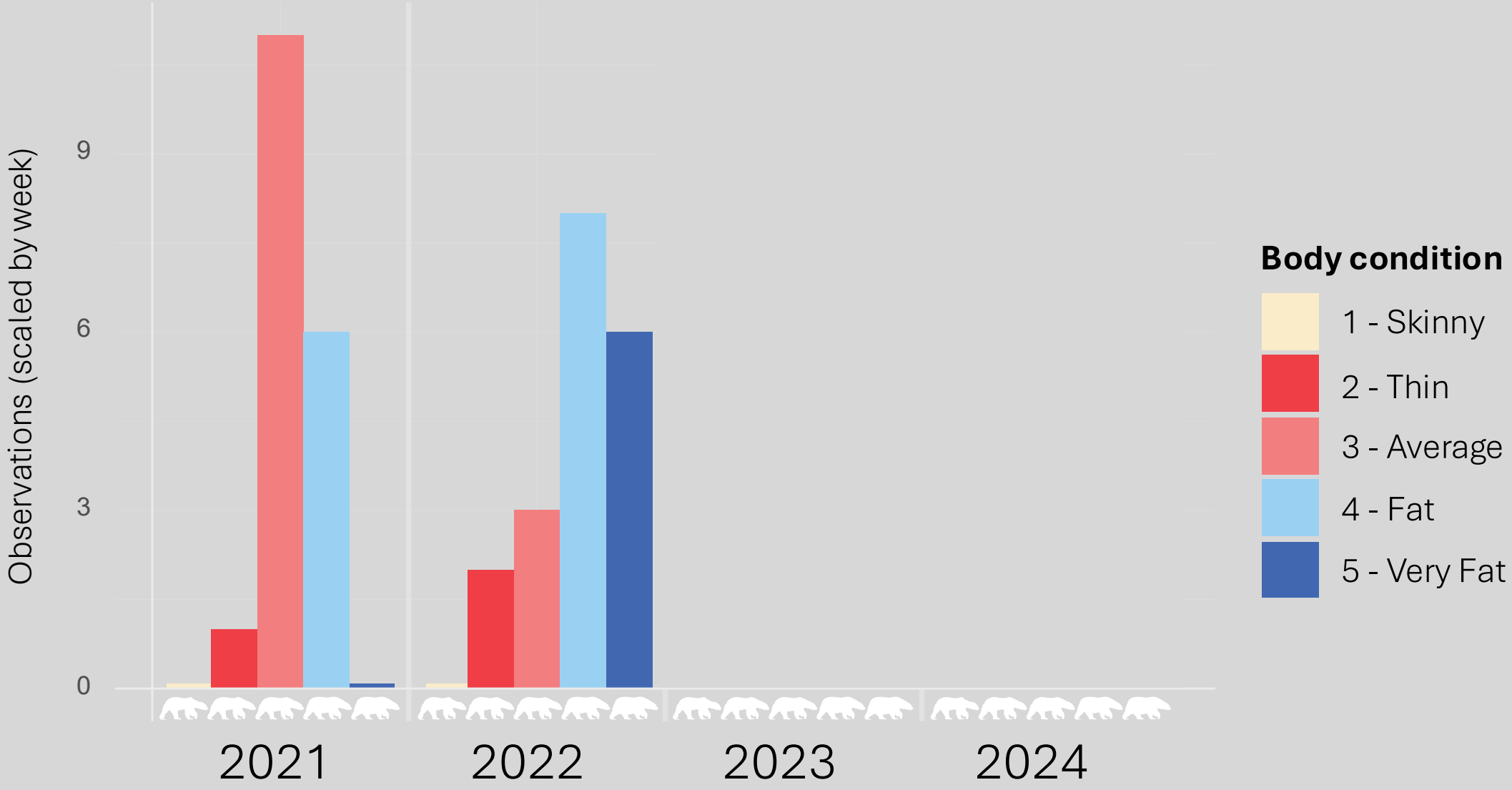

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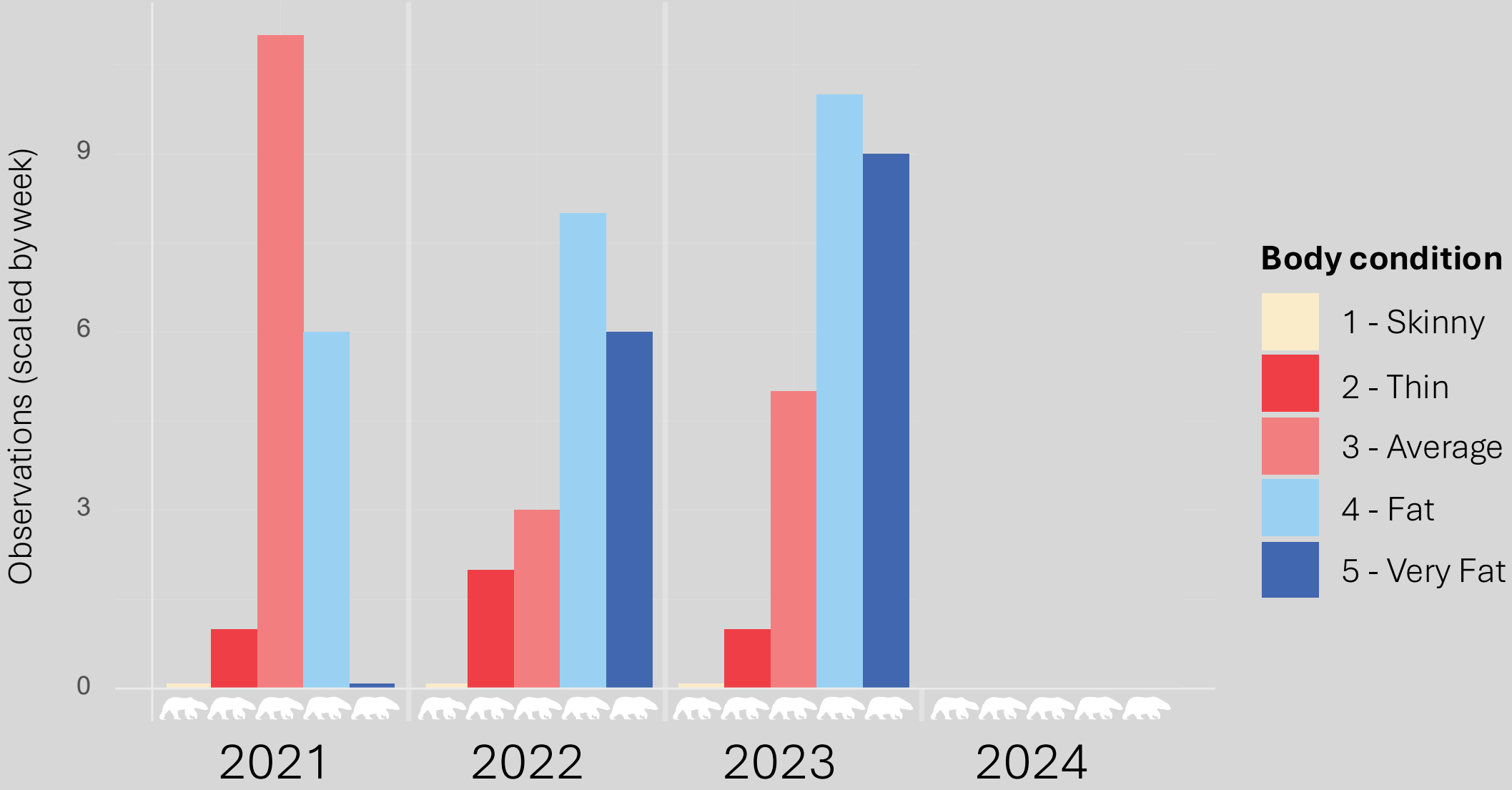

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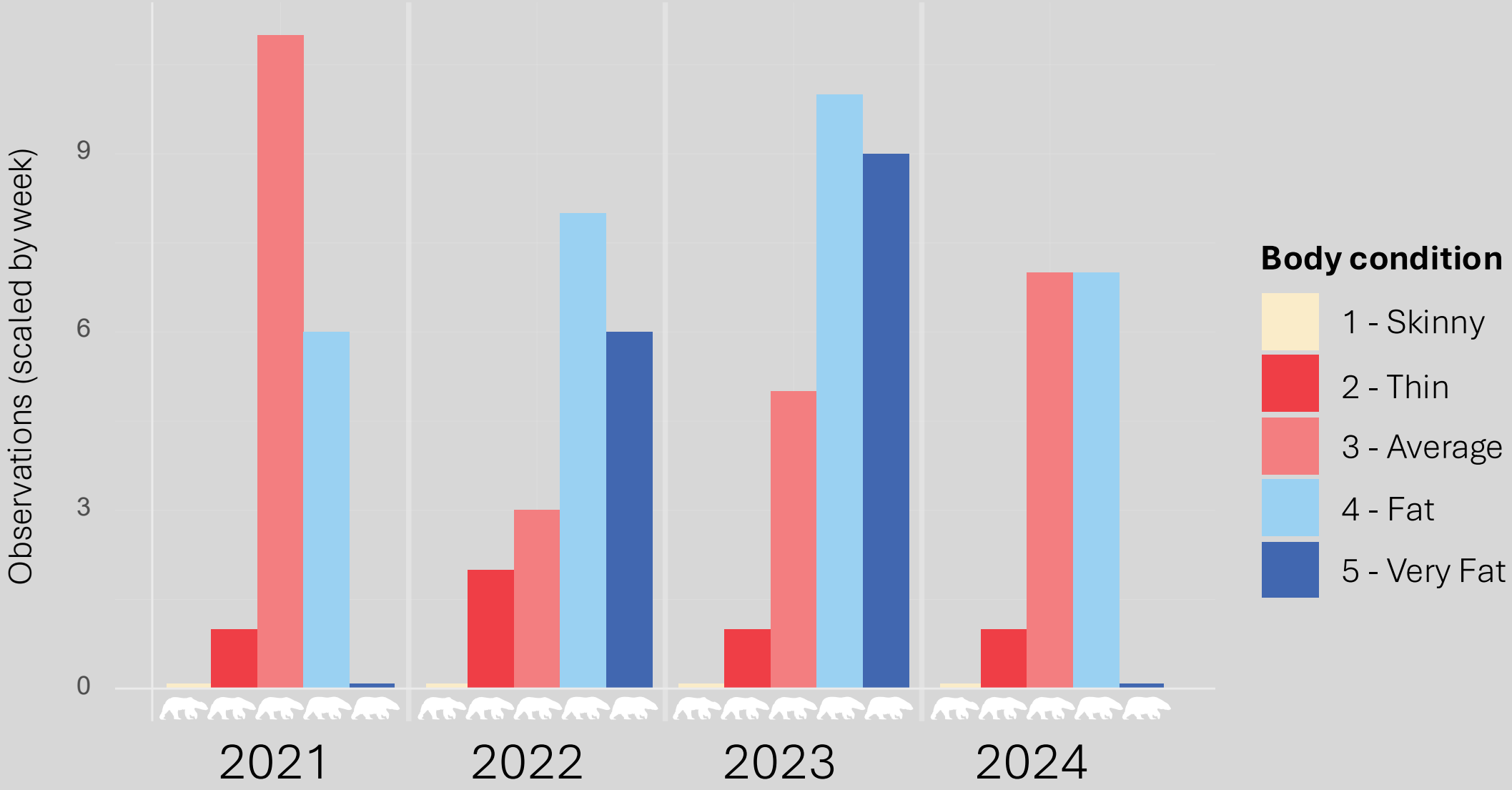
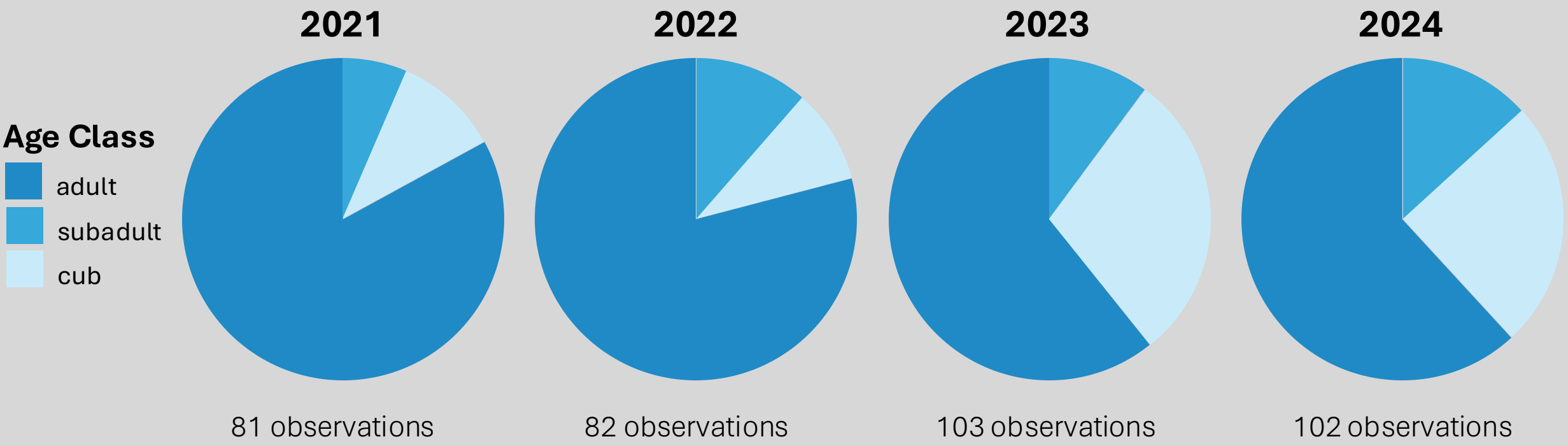
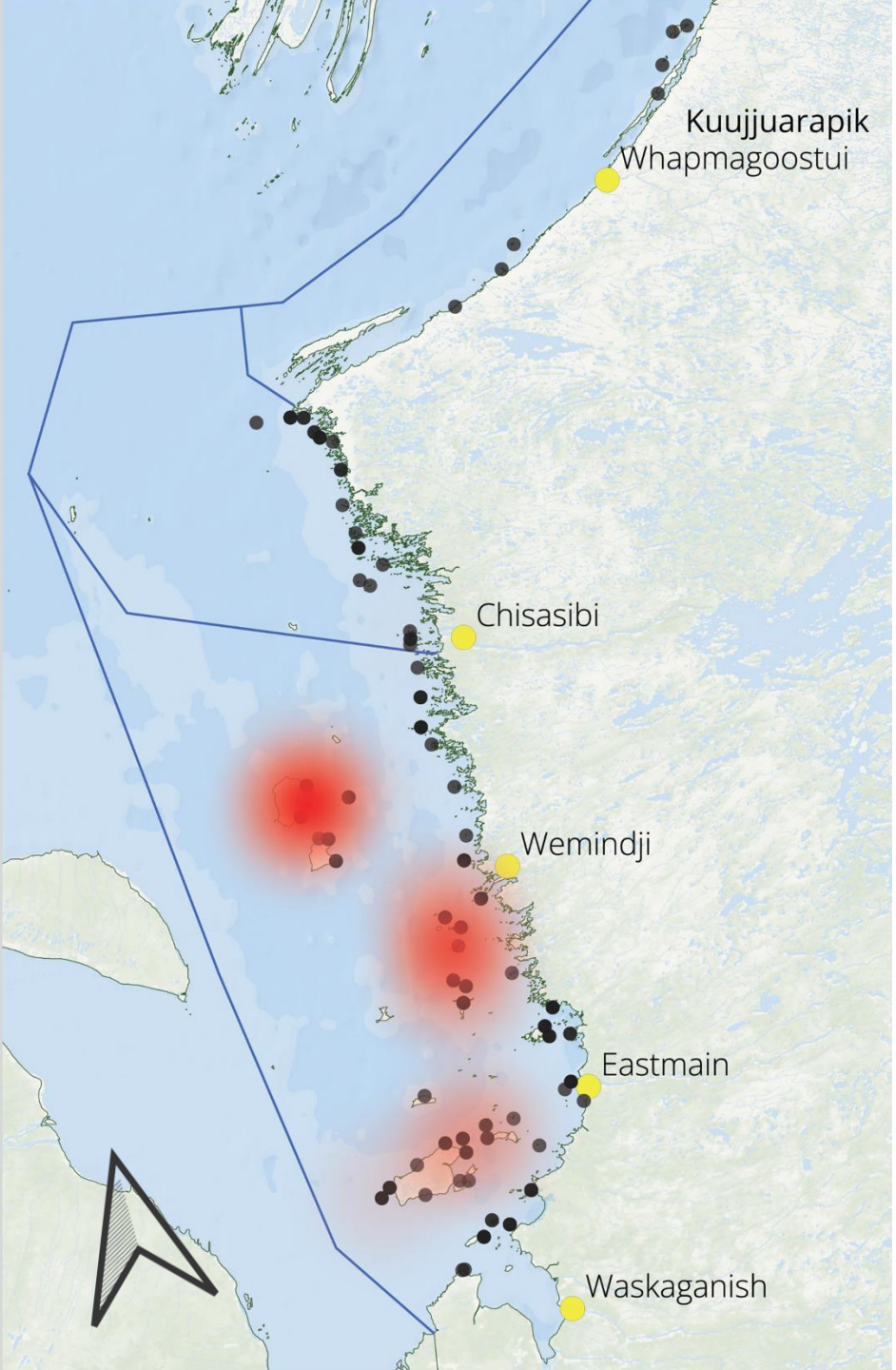


Proportions of age class observations from camera traps in eastern James Bay between 2021 and 2024

368 total observations



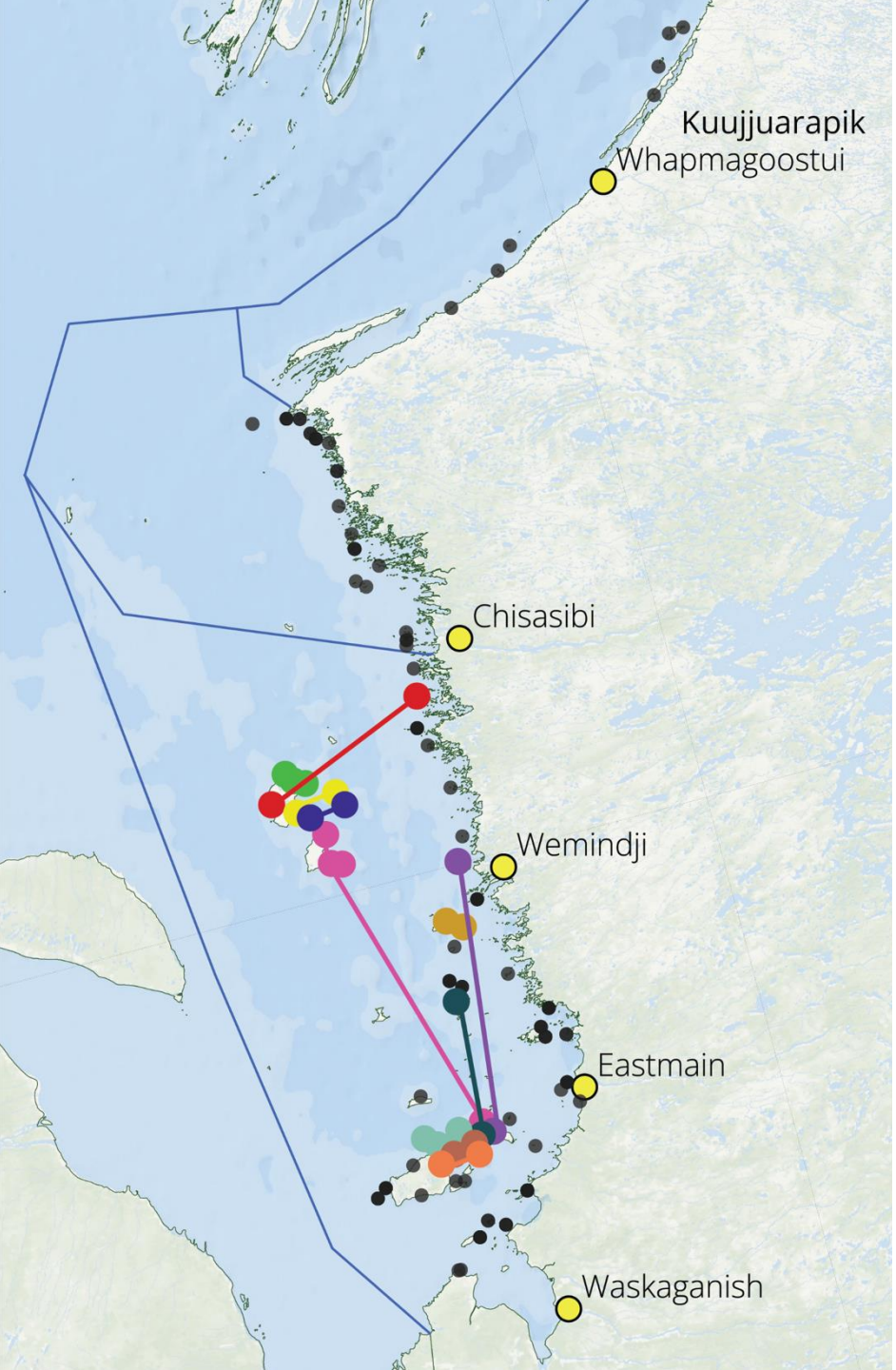
observations scaled by sampling station deployment period



Females with cubs distribution

- Twin Islands again important with offshore islands of Wemindji and Waskaganish
- *Only sampled Kuujjuarapik and Whapmagoostui area in 2024*

- Sampled location
- Female & cub detections at sampling stations



Detecting individuals through hair samples across the study area (2021 & 2022 data)

63 bears identified through genetics in eastern James Bay

Individuals most often detected on neighboring islands, some individuals moved longer distances

No bears sampled on both east and west side of James Bay

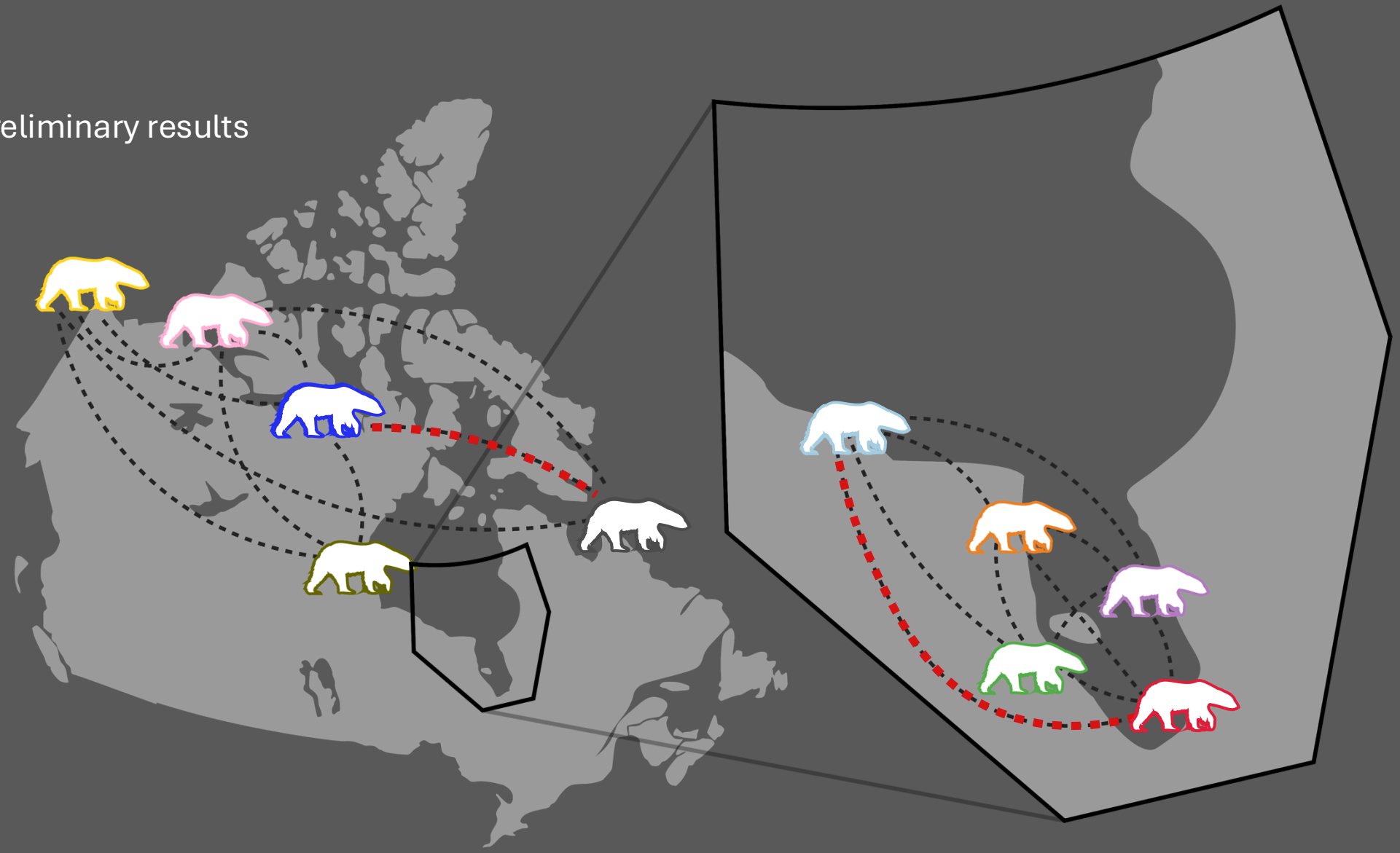
- Bear_1 (L52033)
- Bear_3
- Bear_2 (L52040)
- Bear_4
- Bear_6
- Bear_9
- Bear_13
- Bear_8
- Bear_7
- Bear_10
- Bear_11

In collaboration with Ontario and federal governments

Genetics in James Bay

- Studying genetics through DNA can help us understand **how closely related different groups are**
- Mixing between groups leads them to be more closely related. When groups don't mix, they become more distantly related
- Polar bears from different subpopulations have different levels of relatedness because of different opportunities to mix
- Within Southern Hudson Bay, bears in James Bay have been found to mix less with the rest of the subpopulation (Crompton et al., 2008; Viengkone et al., 2016, 2018)

Preliminary results



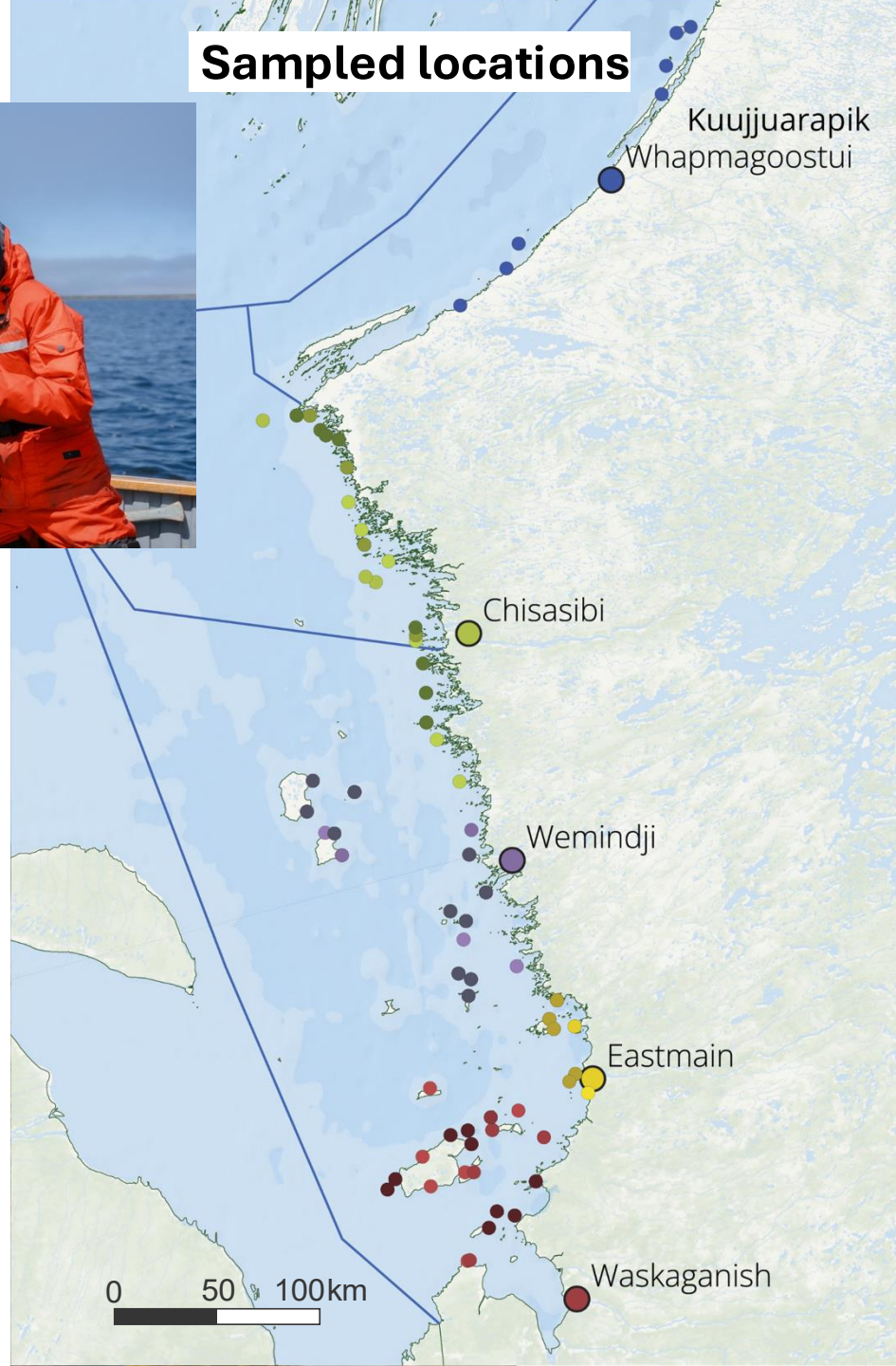
What does this mean?

- Different genetics in populations can lead to adaptations or vulnerabilities to change
- There may be a distinct polar bear genetic group in James Bay separate from other bears in the subpopulation
- Genetic differences between groups of bears should be considered and can be used to help define subpopulations and can inform management decisions

Community-based field approach

- Research grounded in community knowledge of the land
- Additional tool to understand polar bears
- Collect samples that provide valuable information about polar bears
  - *More than 400 polar bear hair samples collected, hundreds of photo observations*

Sampled locations



Requests for information

- Polar bear knowledge (abundance, health, and environment of polar bears)
- Management approaches and techniques

Information collected to date through community-based approach:

- *In eastern James Bay, polar bears were detected mainly on offshore islands*
- *Polar bears were observed in different body conditions during the ice-free season, depending on year*
- *Polar bears in southeast James Bay are more distantly related than other bears in the subpopulation*

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Miigwetch, thank you, merci to everyone who made this work possible!

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Harry Erless
Bernard Diamond
Stephanie Salt
Dwayne Weistche

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Russell Cheezo

Chisasibi Field Crew:
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John E Sam
Ghislain Bobbish
Lawrence Napash
Steven Bobbish
Elmer Bobbish
Irvin Matches

Wemindji Field Crew:
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Ernie Hughboy
Cody Mark
Louis Lariviere

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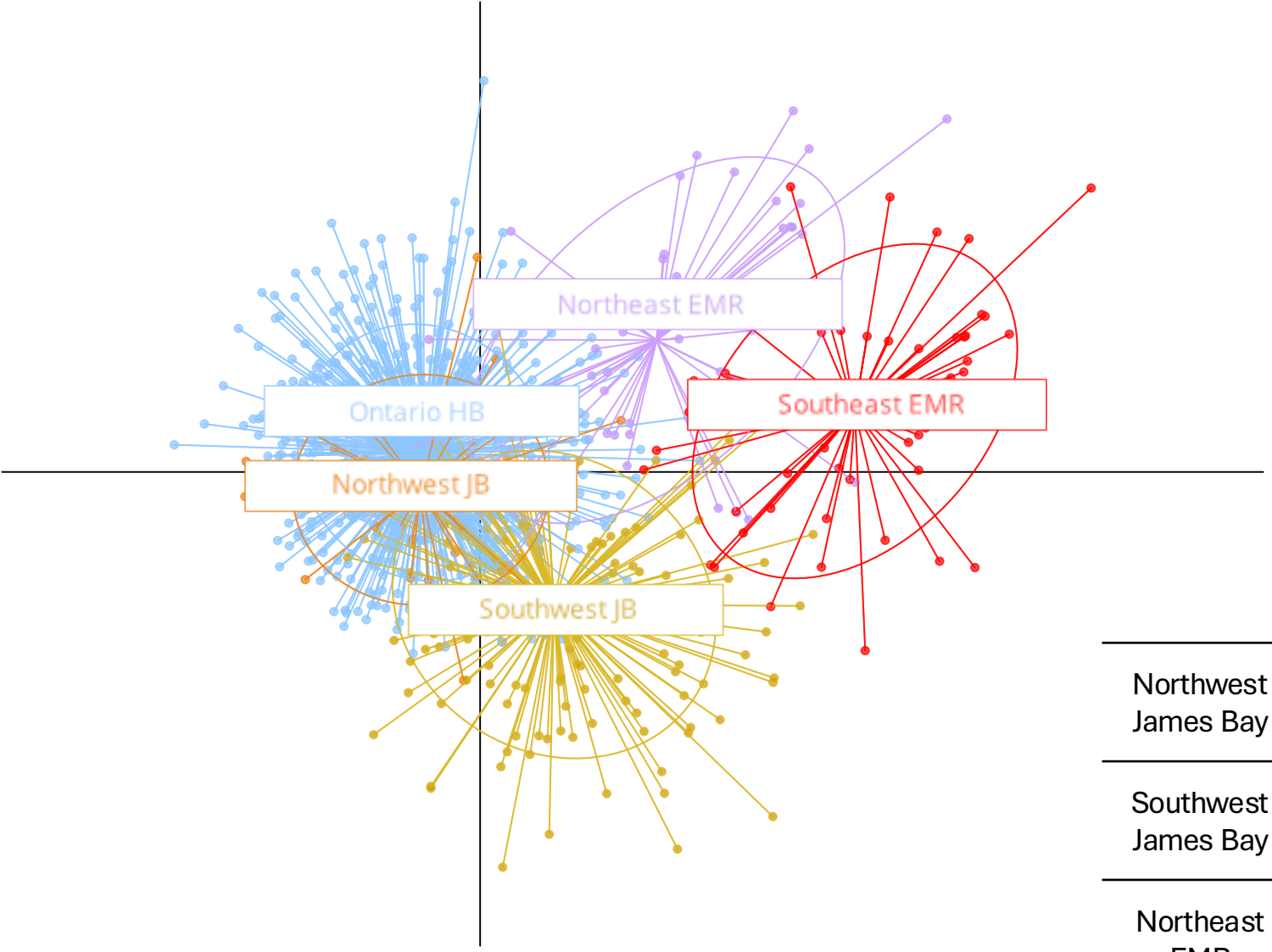
Supplementary materials

Supplementary materials

Table 1. Summary of the results of the model selection evaluating influence of environmental characteristics on polar bear presence at sampling stations

Model	K	AIC_c	ΔAIC_c	AIC_c Wt.
Distance from mainland	4	73.62	0	0.68
Distance from mainland + size	5	75.61	1.99	0.25
Distance from mainland + size + latitude	6	78.4	4.77	0.06
Distance from mainland + size + latitude + land cover (PC1 + PC2)	8	83.89	10.26	0
Null	3	84.83	11.21	0
Size	4	86.48	12.86	0
Latitude	4	86.83	13.20	0
Land cover (PC1 + PC2)	5	88.70	15.07	0



Genetic clusters of different regions in SH from Discriminant Analysis of Principle Components (DAPC, following Jombart et al., 2010)
Data from 1980 – 2022

Paired genetic distances (Nei's distance) for each subregion – data from 1980 through 2022

	Ontario Hudson Bay	Northwest James Bay	Southwest James Bay	Northeast EMR
Northwest James Bay	0.038			
Southwest James Bay	0.045	0.062		
Northeast EMR	0.095	0.102	0.071	
Southeast EMR	**0.201**	**0.198**	**0.121**	**0.094**

Paired genetic distances (Nei's distance) for national polar bear subpopulations from Paetkau et al., 1995

Table 4 Results of G-test (above diagonal) and Nei's (1972) genetic distance (below diagonal). Values for the G-test are χ^2 values (d.f.). All probabilities < 0.00001 except SB/NB ($P < 0.026$) and WH/DS ($P < 0.00005$)

	MB	SB	NB	WH	DS
SB	0.072		65 (43)	237 (44)	154 (46)
NB	0.055	0.058		286 (50)	189 (49)
WH	0.312	0.306	0.308		91 (43)
DS	0.204	0.184	0.186	0.050	

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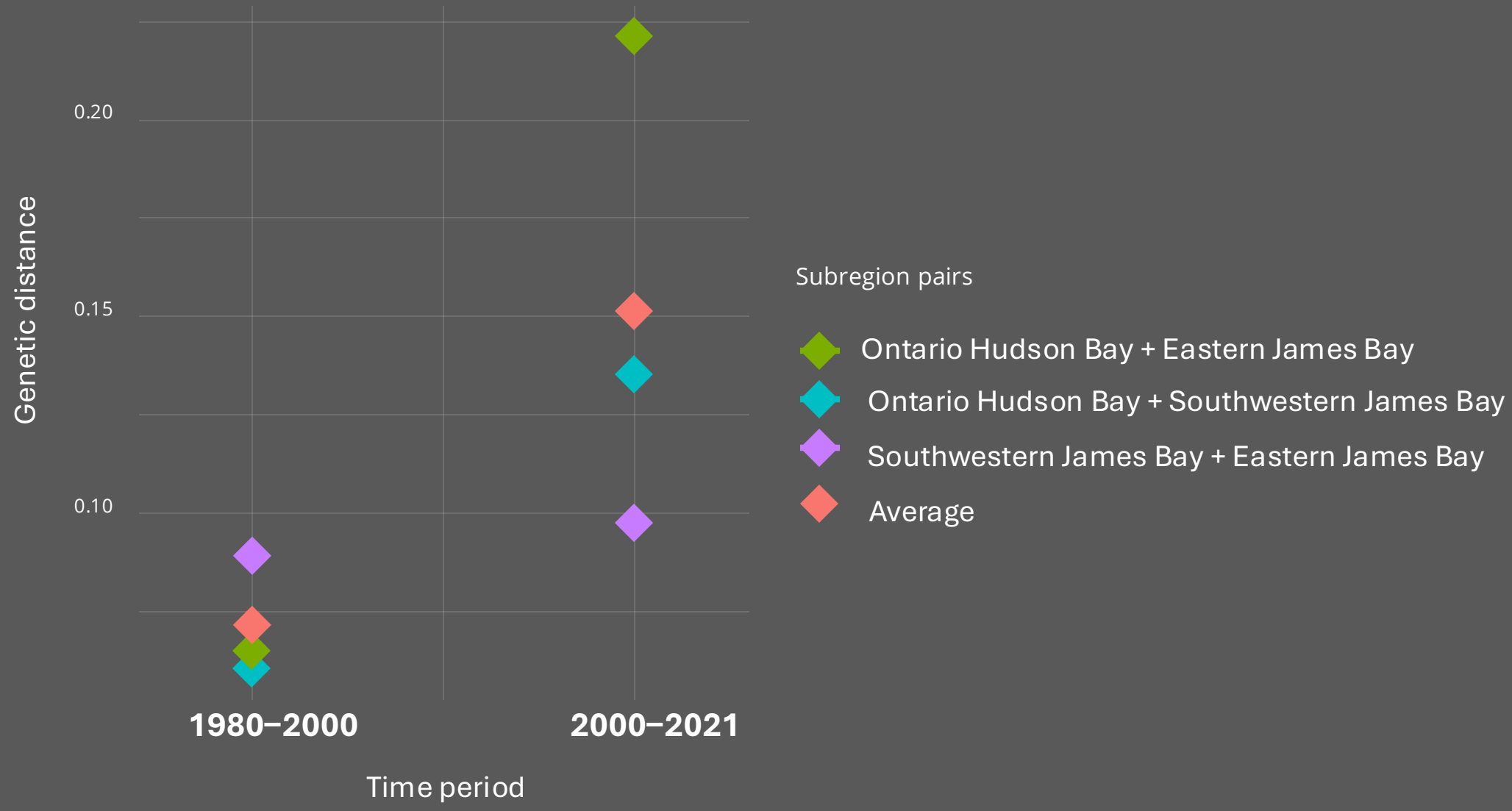
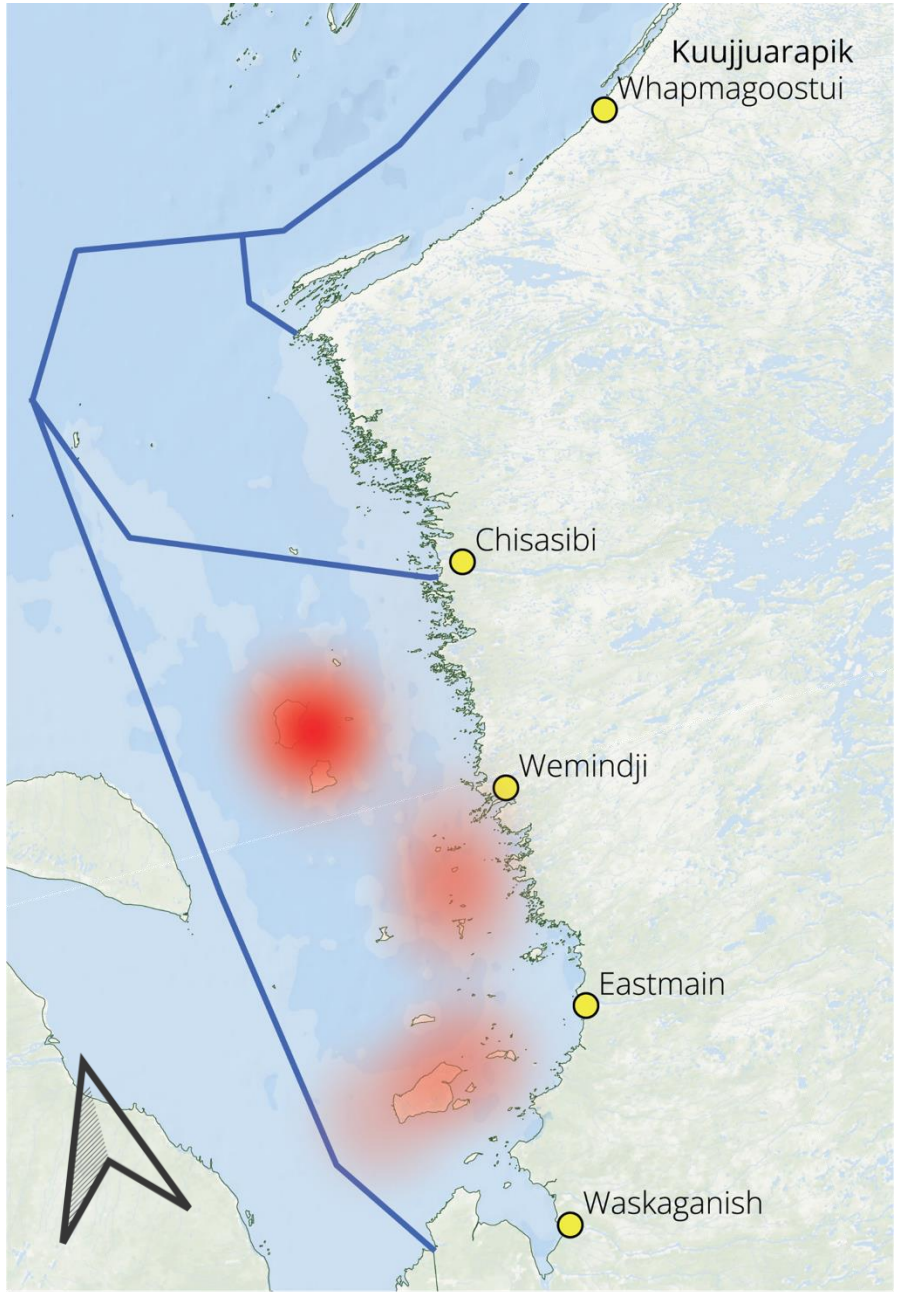
- Within Southern Hudson Bay genetic distances are similar in magnitude to between subpopulation genetic distance in other studies.
- Particularly southeastern EMR near Charlton Island

Genetic distances within SH over time

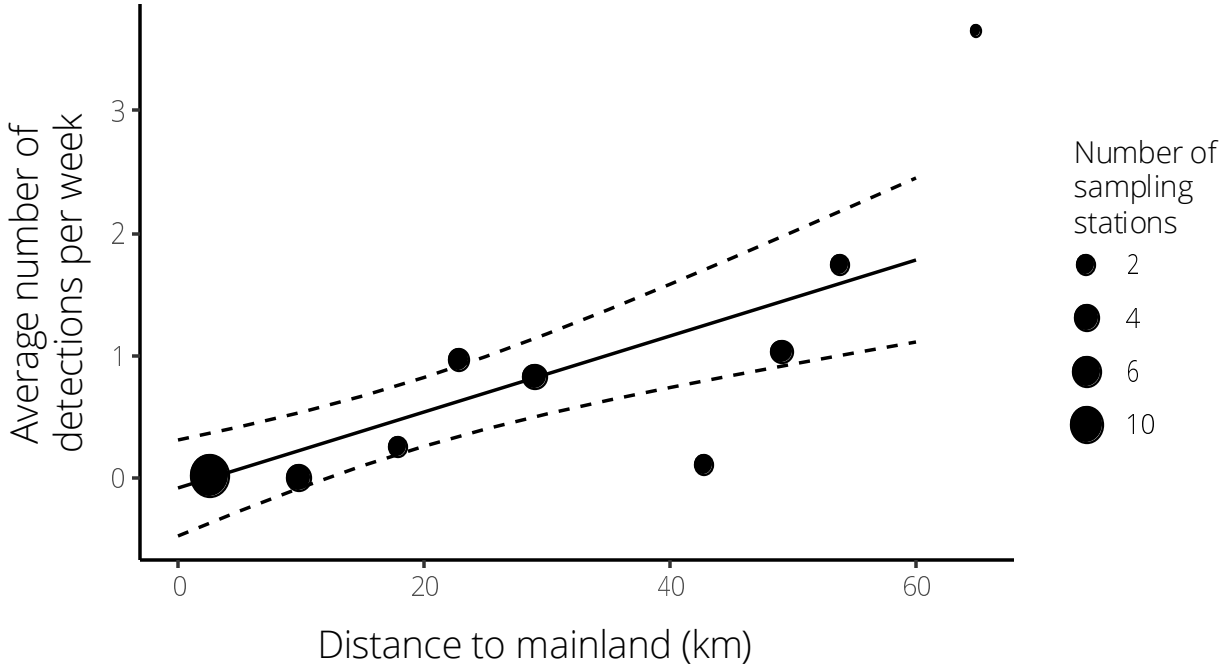


Polar bear activity hotspots



Polar bear distribution in eastern James Bay

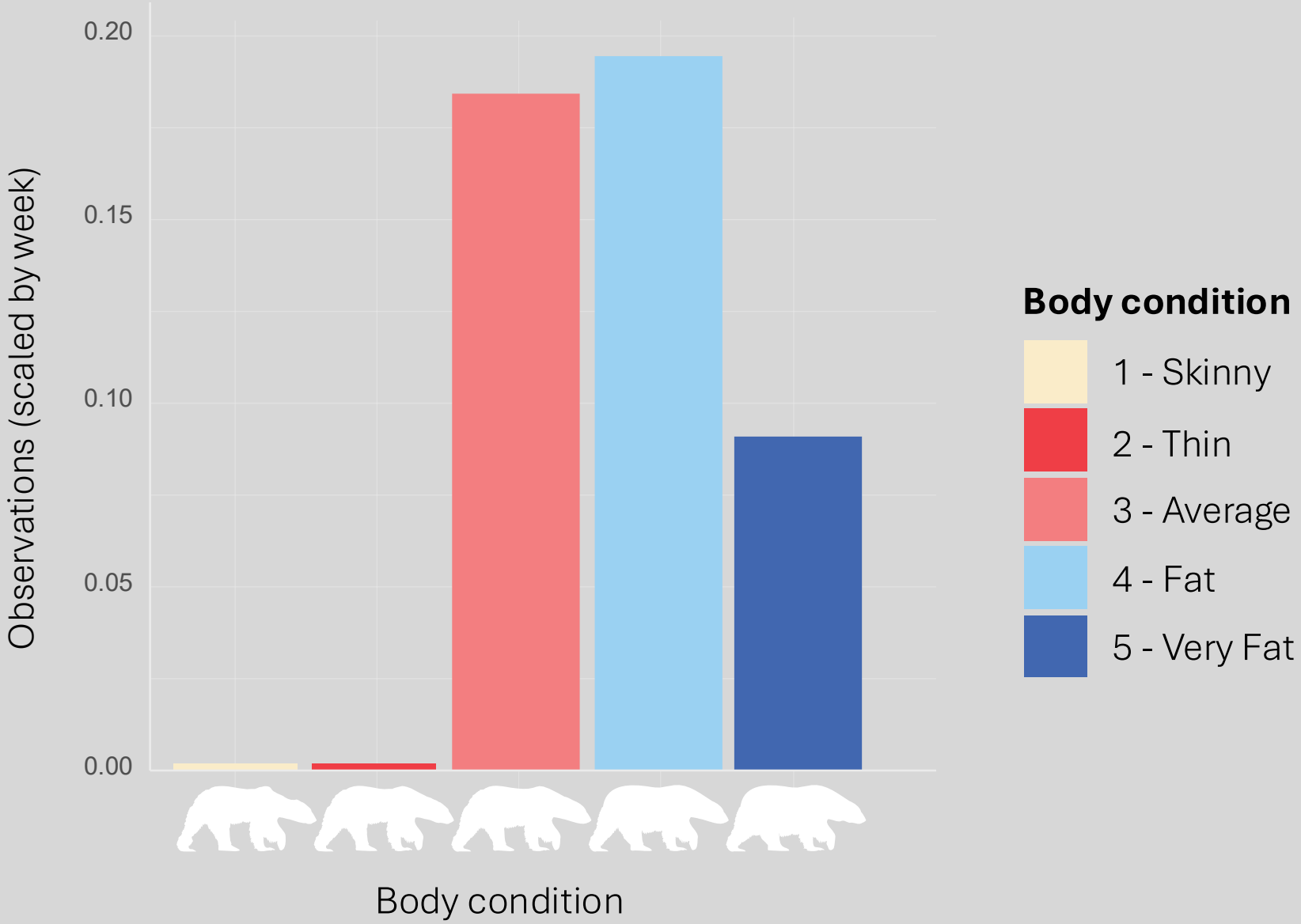
- Used the detection rates and different island characteristics to investigate patterns of polar bear distribution in the EMR
- Models using:
  - *Distance to mainland*
  - *Island size*
  - *Latitude*
  - *Land class*



Langwieder et al., 2023

Average body condition of females with cubs from camera trap observations in eastern James Bay (2021-2024)

33 observations



Average bear body condition observations from camera traps
in eastern James Bay (2021 – 2024)
288 observations