ᓄᓇᕗᑦ
Parcs ᑲᖏᒍᐊᓂᖅ
Nunavik
Parks

PARC NATIONAL
ILUILIQ PROJECT

STATUS REPORT
FEBRUARY 2019

ᑲᑎᕕᒃ ᓄᓇᓕᖕᒥᒃ ᑲᔪᓯᑎᒃ
Administration régionale KATIVIK Regional Government
KATIVIK

ᓄᓇᕗᑦ
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Nunavik
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PARC NATIONAL
ILUILIQ PROJECT

STATUS REPORT
FEBRUARY 2019

KATIVIK
ᓄᑕᕆᓕᑎᕐᓂᓐᓇᑕᓂᖅᓯᒪᑦ, ᐊᐅᑎᓕᓂᖅᓯᒪᑦ, ᓄᓇᕗᓂᖅᓯᒪᑦ ᑎᓴᒍᐃᓕᖅᓂᓂᖅᓯᒪᔪᓄᑦ ᐱᑦᔨᕆᕐᕈᑦ
Renewable Resources, Environment, Lands and Parks Department
Service des ressources renouvelables, de l'environnement, du territoire et des parcs

REFERENCE

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Kangirsualuup Itivia close to the Pointe du Saint-François, northwest limit of the study area
Credit: Alain Thibault

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INUKTITUT SUMMARY

Kangirsualuup Itivia close to the Pointe du Saint-François, northwest limit of the study area
Credit: Alain Thibault

1 ᖁᐅᐃᓕᓯᓂᖅ

ᐊᐯᑦ ᒥᖅᓄᐃᓕᓴᕐᓂᖅᑕ

ᐊᐯᑦᐊᑦ ᒥᖅᓄᐃᓕᓴᐃᓕᓚᓂᖅᑎᑕ ᐱᑐᑦᓭᒪᐅᑎᖏᓂᖅ ᓴᓚᕐᔪᐊᓚᒥᒃ ᐊᑐᖁᑎᑦᑕᐅᐊᓱᓂ ᐱᐅᓴᖅᑎᑦ ᓄᐃᑎᑕᐅᓭᒪᔾᔪᑎ ᑲᓚᕐᔪᐊᓚᒥᒃ ᖁᑦᓴᐅᖏᖅᑎᑦᑎᓂᖅ ᐊᐅᓚᑦ (IUCN). Ċᑦᐊᐊ ᒥᖅᓄᐃᓕᓴᐃᓂ ᐃᓚᐅᑦᖁᑕᐅᓱᐃᖅᓯᖅᓚᓂ ᖁᖏᑦᓂᐊᓂᐅᑕᐅᐊᑦᓂᓂ ᐊᒃᓚᓗ ᐱᑦᓴᐃᒪᓐᓇᒪᖏᒃᑕ ᖁᑎᑦᑭᑎᓂᐅᑕᐅᐊᑦᓂᓂ ᐊᒃᓚᓗ ᐃᓕᓴᐅᑎᑦᑭᑦᓴᓂᑦ ᐊᒃᓚᓗ ᐃᐊᓚᓂᐅᑕᑎᑦᓴᓱᐅᑦᑎᓂ. ᖁᑎᑦᑭᓂᖏᖅᑎᓱᓂᑦ ᑐᓴᐅᓚᓂᕐᒥᑦ ᒥᖅᓄᐃᓕᓴᐃᓂ ᐱᐅᓴᖅᓴᖅᓱᓂᑦ ᑭᓚᓂᑦᑐᓂᓗ ᐅᓂᒃᑳᓂᑦ, ᐅᐸᖁᓂᐅᐊᖁᑦᓴᓂᑦ ᐊᒃᓚᓗ ᐃᐊᓚᓂᐅᑕᐅᑎᑦᓴᓱᐅᑦᑎᓂ. ᖁᑎᑦᑭᓂᖏᖅᓱᓂᑦ ᑐᑦᓴᐃᓂᑦᑐᓂᑦ ᑐᓴᔪᑐᓂᓕᒥ ᒥᖅᓄᐃᓕᓴᐃᓂ ᐱᐅᓴᖅᓴᖅᓱᓂ ᐊᒃᓚᓗ ᐃᓗᓕᓴᐅᑎᑦᓴᓱᐅᑦᑎᓂ ᑭᓚᓂᑦᑐᓂᓗ ᐃᓕᓴᐅᑎᑦᓴᓱᐅᑦᑎᓂ ᐃᓗᓕᓴᐅᑎᑦᓴᓱᐅᑦᑎᓂ. ᐃᓕᓴᐅᑎᑦᓴᓱᐅᑦᑎᓂ ᐊᒃᓚᓗ ᐃᓗᓕᓴᐅᑎᑦᓴᓱᐅᑦᑎᓂ ᐃᓕᓴᐅᑎᑦᓴᓱᐅᑦᑎᓂ ᐃᓗ

2 ᐃᓄᖁᑎᑦᓴᓕᖅᓯᒪᔨᑦ-ᑭᓚᐅᔭᕆᑎᔪᑦ ᑐᖅᖅᓯᐃᐅᔨᓯᑦ

ᓄᓇᒪᒥ ᐅᑭᐅᖁᑕᑐᓗ ᓄᓇᕐᑭᑦ

ᐊᖏᓂᖅ ᐱᖅᓯᔨᓕᐊᓕᒫᓴᖅᓯᖅ ᑯᐯᖅ ᓄᓇᖁᑎᖅᓯᓂ, ᓄᓇᕕᖅ 55 ᐃᑯᑕᖅᓯᑕ ᑕᖁᖅᓯᓂᑐᖅ ᐃᓕᖁᖁᓂᓂ ᑲᑎᕕᖅ ᓄᓇᖅᓂᖅ, ᓄᐃᑕᕕᓂᖅ 1975ᒥ ᖃᒪᖅ ᐯ ᑯᐯᖅᓗ ᑕᖁᖅᓯᓂ ᐊᖏᖁᑎᑎᔪᑎᖅᓯᓂᑦ. ᓄᓇᕕᐅᑦ ᐊᐅᓕᑕᐅᔪᓂᖅ ᐊᒪᓗᓐ ᓄᓇᐅᑦ ᐃᓂᒋᓕᔪᓂᑦ ᐅᖁᖁᑦᓕᐅᔾᑦ ᖃᒪᖅ ᐯᐯᖅ ᑕᖁᖅᓯᓂ ᐊᖏᖁᑎᑎᔪᑎᖅᓯᓂ ᐊᒪᓗᓐ ᐅᑭᐅᖁᑕᐅᒥ ᐊᖏᖁᑎᑎᔪᑎᖅᓯᓂ. ᓄᓇᖁᑦᓭᒪᔾᑦ ᓄᓇᓕᖏᑦ ᐃᓕᐅᔾᑦ Ċᒃᑯᓄᖅ ᐊᖏᖁᑎᑎᔪᑎᓄᑦ ᐱᖁᑯᓕᓂᓂᑎᒍᑦ ᐊᐅᓕᑦᓭᔪᓐᓄᓂᑎᒍᑦᓐᓗ ᐃᒪᒥᓂᒃ ᐱᒍᓐᓇᓕᖏᑦ ᐃᓕᐅᐅᑎᓗᑎᑦ ᐅᐱᒪᔨᓂᐊᕐᓇᖅᓴᖅ, ᐃᖁᓕᓕᐊᕐᓇᓂᖅ ᒥᑭᑎᔨᓂᐊᕐᓇᓂᓗ ᓄᓇᓂ ᐁᖅᑭᑕᐅᒪᔨᓂᑦ, ᐊᓐᓂ ᐊᐅᓕᑕᐅᔨᖅ ᐱᖅᓯᓕᖅᓴᓂᑦ ᑐᑭᓯᓂᑦ ᐊᐅᓕᓭᓂᖅ. ᐅᓇᒥᓕᓗ ᑲᕐᒪᔭᒃᑯᑦ ᐊᖏᓗ ᑲᕐᒪᔭᒃ, ᐊᓯᖏᓐᓗ ᑎᒥᐅᔨᑦ ᐃᓕᐅᔨᐃᓗ ᐃᓕᐅᕐᓂ ᓄᓇᓂ ᐊᐅᓕᑕᐅᓂᖅᓴᓂᑦ ᑲᒪᕐᓂᖅ: ᒪᑭᕐᓂᖅ ᑯᐊᕐᓇᔭᓴᖅ, ᑲᑎᕕᖅ ᓄᓇᓕᓕᒫᑦ ᑲᕐᒪᖅ, 14 ᐅᑭᐅᖁᑕᒥ ᓄᓇᓖᑦ ᐊᒪᓗᓐ ᓄᓇᒥᒃ ᑎᒍᒥᐊᖁᑦᑎᓯᑦ. ᐊᖏᖁᑎᑎᔪᑎᖅᓯᓂ ᐃᓐᓇᐸᓕᐊᓂᖅᓴᐅᓕᖅᓴᖅ ᑲᓇᓕᒫᒥ. ᐊᖏᖁᑎᑎᔪᑎᖅᓯᓂ ᐃᓐᓇᐸᓕᐊᓂᖅᓴᐅᓕᖅᓴᖅ 25%ᓂᑦ 1996 2011 ᐊᑯᓐᓂᖅᓯᓂ. ᐃᓄᖁᑎᖅᓯᑦ 2016ᒥ 13,188ᓯᕗᓐᓂᖁᑦ 60ᓂᑦ 73%ᓄᑦ ᐃᓄᖁᑎᖅᓯᑦ 15ᓂᑦ ᐅᑭᐅᖁᑕᖁᑎᑦ ᐊᖏᓕᓯᔪᓐᓂᑦ, ᑕᑯᓐᓇᓯᑦ ᐊᓯᖅᑦ ᑯᐯᖅᓗᒥᒃ 84%ᖁᑎᓐᓄᑦ.

ᐊᖏᖁᑎᑎᔪᓐᓂᖁᑎᓄᑦ ᖃᒪᖅ ᐯ ᑯᐯᖅᓗ ᑕᖁᖅᓯᓂ ᐊᖏᖁᑎᑎᔪᑎᑎᑐᖅ, ᐱᖅᓯᔨᓐᓄᐊᖏᑦ ᓄᓇᕕᒪᒥ ᐃᓄᖅᑦ ᑌᑦᓭᒪᓂ, ᐊᑎᓕᐅᑭᑎᑎᐅᑦᓴᓐᓂᖅᓴᓐᓂᑦᓕᑦ ᐅᑯᐊ ᐃᓄᐃᑦ ᓄᓇᕐᓂᖅᓂ ᐱᒋᐊᕐᓂᖅᓴᖅᓯᑦᓕᑦ ᐊᖏᖁᑎᑎᔪᑎᖅᓯᓂ ᐃᓐᓇᐸᓕᐊᓂᖅᓴᐅᓕᖅᓴᖅ ᐊᑎᓕᐅᑭᑎᑎᐅᑦᓴᓐᓂᑦᓕᑦ ᐊᖏᖁᑎᑎᔪᑎᖅᓯᓂ ᐃᓐᓇᐸᓕᐊᓂᖅᓴᐅᓕᖅᓴᖅ

ᒥᕐᖏᔪᐊᓂᕐᓱᐸᑦ ᐱᕐᔾᔨᖏᓐᓄᓕ. ᐃᕐᖃᓕᕆᔨᓴᓗᑎᑕᐅᔾᔪᑦ ᒪᓕᑦᓂᑎᑦ ᐊᑦᑭᑕᐅᒪᔾᔪᓕᓕ. ᓂᐅᓄ ᓄᓇᕐᔪᑎᖏᑦ ᖃᐅᔨᓴᕐᑕᐅᔾᔪᒥ ᓄᓇᒥ ᐊᒥᓂᔪᓐᓄᑦ ᐅᒪᔾᔪᓕᖅ ᐊᑐᕐᑕᐅᐸᑦᓂᓂᑎᓗ ᐃᓄᖓᓄᑦ ᐅᒪᔾᔪᓂᐊᕐᓂᑎᑦ. ᑭᓱᐊᓄ, ᓄᓇᐅᑦ ᖃᓄᐃᓕᖓᓄᖏᑦ ᐊᕐᕕᑎᑎᐅᔪᖓᓂᑦ ᐊᒥᓂᓄᐅᔪᖓᓂᑦ ᐱᑕᖃᖅᖅᑐᑦᖅ ᓄᓇᕐᔪᑎᖓᓄ ᒥᕐᖏᔪᐊᓂᕐᓱᐸᑦ.

ᐱᖓᓱᓪᓗᐊᖓᓄ ᐊᖏᓂᕐᓂᐅᒪᔾᔪᒥᒃ ᖃᐅᔨᓴᕐᑕᐅᔾᔪᒥ ᓄᓇᒥ ᑲᑎᔪᓇ II ᓄᓇᕐᔪᑎᖏᑦ; ᐅᑦᑐᑎᒥᓗᒍ ᓴᓪᓗᐃᑦ ᑲᑎᔪᓇ II ᓄᓇᖏᑦ 26.7 %ᖏᒍᑦ ᖃᐅᔨᓴᕐᑕᐅᔾᔪᒥ ᓄᓇᒥ ᐊᒪᓚᓗ ᐃᖅᔨᐱᒪᒥ ᑲᑎᔪᓇ II ᓄᓇᖏᑦ, 9.93%ᖏᒍᑦ. ᑲᑎᔪᓇ III ᓄᓇᖏᑦ ᐊᔪᓕᒫᖓ, ᑕᒃ ᐊᖏᓂᖏᖓ 63%ᖏᒍᑦ ᖃᐅᔨᓴᕐᑕᐅᔾᔪᒥ ᓄᓇᒥ.

ᓴᓗᒥᑦᔨᐅᔾᔪᑦ ᓄᓐᓂᑦ

Cap Wolstenholme ᓄᓇᖏᖓ ᓇᓗᓐᓂᕐᑕᐅᓂᕐᔪᓐᓇᖅ 1998ᒥ ᑲᑎᐱᒃ ᓄᓇᓕᓕᒫᑦ ᑲᓪᒪᖏᑕ ᑐᖅᖏᓪᓕᐊᓂᖅ ᐸᕐᓇᓂᖅᑐᑦ ᓄᓇᖏᖓ ᑐᓂᕐᓂᐊᕐᓂᑕᐅᔾᔪᔭᐅᑦᓂᓂ ᖃᑦᓴ V ᑲᒪᔾᔪᓂ ᑕᐅᕐᓱᐱᖏᖓ ᓴᓇᔨᐱᓂᐅᓂᖏᓐᓄᑦ ᐱᒋᐊᕐᓂᖅᑐᑦ 1900 ᐊᕐᕿᔪᖅᑕ. ᓇᓗᓐᓂᕐᑕᐅᒪᒋᔾᔪᖅ ᓄᓇᖏᖓ ᐃᓂᕐᔪᓇᕐᑐᒋᐊᖏᖓ ᓄᓇᖏᑕ ᓴᓇᒪᓂᖅᑐᓄᑦ ᑕᒫᓂ ᓄᓇᕐᔪᑎᖏᓂ ᐊᒪᓚᓗ ᐊᒥᓱᓂᕐᔾᔨᐅᑦ ᐅᑦᓗᔪᑎᖅᑕ. ᑎᕐᖏᔪᐊᓂᕐᓱᐊᕐᖅᔪᑎᑕᐅᓇᐅᕐᑐᐊᓂᖅ Cap-Wolstenholme 1991ᒥ ᐋᕐᑭᒋᐊᕐᑕᐅᓂᒃᑲᓂᑕᒥᓂ 2015ᒥ ᓄᓇᓕᖏᖓ ᐃᖅᔨᐱᐅᔨ ᑐᑭᒫᕐᓂᓗᒍᑦ ᑲᑎᔪᓇ I ᐊᒪᓚᓗ II ᓄᓇᕐᔪᑎᑦᓴᒥᓂᒃ. ᐅᑦᓗᒥ, ᒥᕐᖏᔪᐊᓂᕐᓱᐊᕐᖏᖓ Cap-Wolstenhome ᐊᖏᓂᓕᒃ 779.49 ᓂᒃᑭᑦᓗᐊᓂᑦ ᑭᓇᒥᑕᓂᑦ² ᐁᑦᑐᓕ ᖃᐅᔨᓴᕐᑕᐅᔾᔪᖅ ᓄᓇ ᒥᕐᖏᔪᐊᓂᕐᓱᐊᖏᖓ ᐃᓗᐃᓕᖅᖅ ᐊᖏᓂᖃᕐᓂᑎᓗᒍ 2,164.70 ᓂᒃᑭᑦᓗ

3 ᐊᓯᑎᓐᓄᒃ

ᓂᓪᓚᓄᒃ

ᑕᕐᕋᓄᑦ ᐅᓄᒋᓯᐅᑦ ᓂᐊᓕ, ᖃᐅᔨᕐᑕᐅᔪᒥ ᓂᓇᒥ ᒥᕐᓄᒍᐊᓂᕐᕆᓕᕐᓄᑦ ᐃᓚᐃᓕᓂᐅᑦ ᓂᓪᓚᓄᒃ ᐊᔪᓄᑦᑐᑦ ᐅᑭᐅᕐᑕᒥ ᐊᑯᓂᐅᓂᕐᕋᑦ ᐱᑭᕐᑐᓂ ᐱᑭᕐᐃᐅᓂᓄᓂᓂᓄ. ᐊᑯᓐᓄᓕᓂᑕᕐᕋᑦ ᐅᑭᐅᕐᑕᒥ ᓂᓇᓕᒥᐅᑦ ᐃᑲᔪᐃᑦ ᓴᓪᓚᐃᓚᓗ, ᓂᓪᓚᓄᓄ ᖃᐅᔨᕐᑕᓂᕐᕋᑦ ᓂᓪᕿᑕᓪᓕᔪᑲᕐᕋᑦ ᖃᓄᓪᑐᓂᓄᓕᓂᓄ ᑕᓂᐅᔭᕐᓴᐊᒍᑦ ᓂᓇᓕᒥᐅᑦ ᓂᓪᓚᓄᒃ ᐃᓕᓴᐃᓚᒥᑦ, ᓄᑲᒍᑦ ᓱᕐᔪᑐᐊᓗ ᐃᒪᓴᐃᓄᓗ, ᐁᔨᓄᓄᓄᓄᑦ ᓂᓪᓚᓄᓗ, ᓄᑲᑦ ᓂᓪᓚᓄᒃ ᓄᓇᐃᒪᒥᒃ. ᐊᐅᓚᐅᖏᓪᓗ, ᓄᑲᑦ ᓂᓪᓚᓄᒃ ᓄᓇᐃᒪᒥᒃ -8.4°C.

ᓂᓪᓚᐅᑦ ᐅᕐᓴᑲᓪᓕᕆᓂᐊᓄᓄᓚᓪᓚᓂᓪᓚᕐᓂ, ᐅᕐᓴᑲᓂᐅᒥᓂᕐᕋᓄᑲᓂᓄᑲᓄᕐᕋᑦ ᓄᓇᐃᒪᒥ Cap Wolstenholme ᓄᓇᓄᓂ. 2050ᐅᓂᕐᕋᑦ, ᓂᓪᓚᐅᑦ ᐅᕐᓴᓄᓄ ᓄᓇᕐᓴᑎᓄᓂ ᖃᐅᔨᕐᑕᐅᔪᒥ ᓂᓚᐅᑎᕐᐅᔪᕐᓄ ᕿᐅᔪᓄᓂᓂᓄᑦ 2.01°C-ᓄᑦ ᐅᐱᕐᓄᒍᒥ ᐊᒪᓚᓗ 4.3°C-ᓄᑦ ᐅᑭᐅᓴᑦ. ᑕᒪᓐᓇ ᐊᐅᖃᐱᑎᓂᓕᒍᓄᑦᓓᓕᕐᓄᑦ ᐊᓂᐅᒥᑦ ᓂᓪᓓᓗᑐᒪᓚᓂᓂ ᓄᓇᐅᑦ ᐃᑭᐊᓂᕐᑐᒥᑦ ᓂᓴᒥ. ᐅᓚᑎᐊᓂᓗ, ᓄᓇᕐᓴᑎᓄᓄᓄ ᐊᓂᐅᒥᒍᑎᓄᓂᓗ 18%ᒥ ᓂᑭᔪᓂᐅᒥᑐᐃᓐᓇᓚᐊᖃᕐᓴᑦᑐᓄᑦ. ᒡᓴᔪᐊ ᐊᓂᑦᓂᓂ ᓂᓪᓓᓚᐊᕐᕋᓄᑦ ᐱᑭᕐᑐᓂ ᐊᑦᑎᓂᖅᑭᑐᓂ ᓂᓴᓂᐊᓂᓐᓂᖅᑎᓂᓗ.

ᐅᖃᕐᓄᒃ

ᖃᐅᔨᕐᑕᐅᔪᒥ ᓄᓇᒥ ᒥᕐᓄᒍᐊᓂᕐᕆᓕᕐᓄᑦ ᐃᓗᐃᓂᒥ ᐅᖃᕐᓄᒃ ᓂᑦᓂᐊ ᐅᖃᕐᑦᓴᓚᓓᕐᓄᒃ, ᔪᐯᐳᒥ ᓄᐃᑕᔪᓄᑦ ᒪᕐᑭᓂ ᓄᓇᓪᓂ, ᐅᑭᖃᓪ ᖃᕐᓱᒃᑎᓂ ᓄᑦᒡᒥ ᔪᐯᐳᒥ ᐊᒪᒪᓗ ᐅᑭᖃᓪ ᖃᕐᕋᒃᑎᓂ ᐅᖅᓄᓕᕐᓂ. ᕿᑎᐅᓄᓄ ᖃᐅᔨᕐᑕᐅᔪᒥ ᓄᓇᒥ ᐱᑐᓕᕐᓂᓂ ᐊᑦᑭᕐᑐᓂ ᐅᓴᕐᓂ ᖃᐅᔨᒪᔭᑎᓂᓂ ᖃᐅᔨᓂᑕᐅᓂᑎᓪᓂᓂ ᐊᓯᑦᓴᓂᓂᓂᓄᓂᓂ: ᓯᕿᓂᓄᓂ ᑕᕐᕋᓄᓂᓂ ᓄᓇᓂ, ᓇᔪᓴᐊᕐᕋᑦ ᓄᑲᒍᓄᓄ ᐊᒪᓚᓗ ᔪᐃᐱᑦ ᓴᓇᓂᓄᓂᑦ. ᔪᐃᐱᐳᑦ ᓴᓇᓂᓄᓂ ᐅᖃᕐᓴᖅᓄᑦᕋᑦ ᖃᐅᔨᕐᑕᐅᔪᒥ ᓄᓇᒥ, ᑌᒣᓂᔨᐃᓂᕋᑦ ᓯᓂᔪᔨᕐᕋᑦ ᓄᓇᕐᑦ ᐊᐃᑦᑐᓂᓂᓂᑎᓪᓂᑦ. ᐃᓚᓂᑕᓂᓪᑦ ᐅᖃᕐᕋᕐᓄᐃᓂᒃᑎᑦ ᐃᕐᕋᒋᑦᑐᑦ ᐊᒪᓚᓗ ᐅᖃᕐᓇᒃᑦ ᓄᓇᐃᑦ ᐃᐱᐊᓂᑦᑐᑦ ᓄᓇᕐᑦ ᐃᐱᐊᓂᓂᓂᓂᑦ ᐅᖃᕐᕋᒃᑎᓪᓂᑦ ᐅᖃᕐᕋᑎᑐᓂᑦᑐᓂᓂ, ᓯᑎᓯᔨᐃᓂᓂ ᐃᓂᓯᑎᓪᓂᑦ ᐊᒪᓚᓗ ᐅᖃᕐᓇᒃᑦ ᐃᐱᐊᓂᓂᓂᓂᑦ ᐅᖃᕐᓴᑐᐃᓂᓂ, ᓯᑎᓯᔨᐃᓂᓂ ᐃᓂᓯᑎᓪᓂᑦ ᐊᓂᐅᒥᒍᑎᓄᓂᓂ ᐅᖃᕐᓴᑐᐃᓂᓂᓂᓄᓂᓂ ᖃᐅᔨᕐᑕᐅᔪᒥ ᓄᓇᒥ, ᐃᓕᓴᐅᑎᓂᓂᓂᓂ

ᓄᖅᑲ ᑕᑭᓴᖅᓂᖅ (400 ᑭᓇᒥᑕᒪᓕᒃ) ᖃᐅᑭᑐᓗᓂ (100 ᑭᓇᒥᑕᒪᓕᒃ) ᐅᑦᑐᒃ ᒪᖅᑮᓄᑦ ᐃᒪᒻᒪᓱᓄᒃ ᐱᑐᑦᓭᓗᓂ ᑕᓭᐅᖅᕿᐊᒧᑦ ᐊᒻᒪᓗ ᑕᖅᖁᓂ ᐊᑦᓯᓐᑎᒃ ᐃᒪᖅᐱᖏᓄᑦ. ᓄᖅᒥ, ᐃᒪᖏᓪ ᓂᑦᓂᓇᖅᑐᖅ ᐅᑦᑐᒃ ᑕᖅᖁᓂ ᓴᑦᔭᖏᓂ ᐅᐊᓐᓂᒥ ᓂᒻᒥᒧᑦ, ᓂᑭᒥᓐᓂᖅᖁᖅ ᑕᓚᐅᖏᔪᖅᑕᖅᖁᖅ ᐅᑦᑐᒃ ᓓᓇᓂ ᓂᒻᒥᑦ ᐅᐊᓐᓂᒧᑦ. ᓄᖅᒥ ᑕᓚᐅᖏᔪᖅᑕᑐᒥᑉ ᐃᒪᖏᓪ ᐱᖏᓴᓭᒻᒪᐅᖅᖁᖅ ᐊᖅᑭᓂᖅᓯᓂ ᑕᖅᖁᖅᓂ ᐃᒪᖅᐱᖏᓂ. ᐃᐃᓪᓕ, 15% ᐃᒪᓪᓕᖏᓂ ᐊᒻᒪᓗ 50%ᖏᓪ ᐃᒪᖅ ᑕᓚᐅᖏᔪᖅᑕᑐᖅᖁᖅ ᐃᓂᖅᑎᑎᑕᐅᔨᖅ ᓭᑦᑐᑐᓄ ᐃᓂᖅᖁᓂᑭᓐᓂᓄᑦ ᓄᖅᒥ ᐅᑦᑐᒃ ᐃᒪᖅᐱᖏᓂ. ᐃᓕᓴᖅᑐᑎᓪᓗᒍ ᐊᑦᑐᒃ ᐅᓇᖅᑐᖅ ᐱᑦᐃᐅᓂᖏᓪᓗ ᐊᑦᓯᓐᑎᒃ ᐅᓇᖅᑐᖅ. ᐅᓪᓗᓕᒫᑦᓂᖅᑐᑦ ᐊᒻᒪᓗ ᐃᓂᖅᑎᑎᑕᐅᔨᖅ ᐊᑦᓯᓐᑎᒃ ᐅᓇᖅᑐᖅ ᐃᒪᖅᐱᖏᓂ. ᐃᓕᓴᖅᑐᑎᓪᓗᒍ ᐃᒪᖅᐱᖏᓂ ᐊᑦᓯᓐᑎᒃ

4 ᐱᑭᔅᑐᖅᑕ ᐊᒻᒪᓗ ᐅᒪᔪᐃᓪᓗ

ᐱᑭᓯᐊᑦ

ᓯᓚᐅᑦ ᖃᐅᔨᓇᔅᓂᖅᖢ ᐃᑦᐱᓇᔅᑐᖅ ᖃᐅᐅᔭᖅᓀᐅᔪᒥ ᓄᓇᒥ ᐱᑭᔅᑐᖃᐊᖅᑎᓂᓂᐊᖅᓂᑦ ᐅᖅᓯᐅᑦ ᖃᖅᑐᓂᖅᓂᑦ ᓴᓪᓗᐃᑦ ᐃᔅᐅᐃᐅᑦᓗ ᐊᐯᐅᖅᓂᓗ. ᖃᐅᐅᔭᖅᑕᐅᔪᖅ ᓄᓇᵇ ᐅᑭᐅᔅᑕᓂᕐᖃᖅᑕᐅᔪᑦ ᓯᖃᓂᖅᓂᓂᐅᖅᓂ, ᐅᑭᐅᔅᑕᑐᒥ ᐱᑭᔅᓕᒻᒥ ᓇᔪᔅᑐᖅᑐᒥ, ᐅᑦᑐᑎᑎᓗᒍ ᓄᓇᖅᓂ ᑕᖃᖅᓂᓂᔪᔪᖅ ᔪᐯᵇᓕᒻᒥ. ᖃᑎᖅᑲᓕᖅᓂ ᐊᖅᑭᓂᓂᓗ ᖃᐅᐅᔭᖅᑕᐅᔪᒥ ᓄᓇᒥ ᐱᑭᔅᑐᓕᵇ ᓄᓇᔪᑦ ᐊᑕᐅᔪᓂᓕᐊᑎᵇ ᓯᑕᒪᐅᑎᓕᑐᒥ ᐊᖅᑭᓂᓗ ᐅᐸᖃᖅᖢ ᐱᑭᔅᑐᖅᑕ ᓄᓇᒥ ᐱᑭᔅᑐᓕᵇ ᓄᓇᔪᑦ ᐊᑕᐅᔪᓂᓕᐊᑎᵇ ᓯᑕᒪᐅᑎᓕᑐᒥ.

2015ᒥ ᖃᐅᔨᓴᓗᑎᑦ ᓄᓇᒥ ᐱᑭᔅᑐᓂ ᖃᐅᔨᒪᔪᒪᓇᓕᑦ, ᑕᔪᐅᐅᓂᔪᑦ ᐊᒥᓯᓂᖅᖢᑦ ᐱᑭᔅᑐᗅᑦ ᐊᒧᖃᖅᖢᑦ ᑎᓴᒪᐅᖅᑐᑦ ᐅᐅᖅᓯᓂᑦ ᓄᓇᗅᑐᓂᖅᓂᓂ ᐊᒻᒪᓗ ᓄᓇᔪᑦ ᖃᐅᐅᔭᖅᑕᐅᔪᒥ. 228 ᐊᑦᑎᑯᖅᑐᑦ ᑎᓴᒪᐅᔪᑦ ᐊᒻᒪᓗ 197 ᐊᑦᑎᑯᖅᑐᑦ ᐱᑭᔅᑐᗅᑦ (57 ᐅᖅᐅᐅᓪᓚᑦ ᐊᒻᒪᓗ 140 ᓄᓇᔪᑦ) ᓇᓗᓀᖅᑕᐅᓂᖅᓄᑦ. Ċᐅᔪᓇᓂ ᑎᓴᒪᐅᓪᓂ, 2 ᑕᔪᐅᐅᑎᔅᑐᖅᓚᓐᓂᑦ ᓯᔪᐃᗅᔭᖅᓄᓂᓂᓇᓂᑦ, 9 ᓄᑲᔅᔪᑦᑐᑦ ᐅᓇᒥᑐ, 31 ᓄᑲᔅᔪᑦᑐᑦ ᔪᐯᵇᒥ ᐊᒻᒪᓗ 3 ᐱᑕᖅᓴᐃᖅᑎᑦᑐᑦ ᔪᐯᵇᒥ. 197ᓂ ᐱᑭᔅᑐᓂ, 6 ᐊᑦᑎᖅᓴᐃᖅᑎᑦᑐᑦ ᓄᓇᔪᑦ ᐊᒻᒪᓗ 4 ᐊᑦᑎᖅᓴᐃᖅᑎᑦᑐᑦ ᐱᑭᔅᑐᗅᑦ.

2015ᒥ ᖃᐅᔨᒪᔪᓂᒥ 187ᖅᑐᓂᔪᑦ ᑲᑎᑦᓯᑎᑦ ᖃᐅᔨᓕᓴᐅᔪᑦ ᐱᑭᔅᑐᗅᑦ ᓇᔪᔨᗅᑦ ᖃᐅᔨᒪᔪᑦᑕᐅᔪᒥ ᓄᓇᒥ ᒥᖅᔪᐃᗅᓯᔪᒪᖅᓄᓂᓂ ᐃᓗᐃᓕᐅᔨᑦ. ᑲᑎᑦᓯᑎᑦ ᐅᖅᐱᑦ (20 ᐊᑦᑎᑯᖅᑐᑦ) ᐃᑭᖅᓂᒪᓕᑦ ᐱᑭᔅᑐᓂ ᓄᓇᔪᑦ ᐊᑦᑐᔪᓂ (167 ᐊᑦᑎᑯᖅᑐᑦ), ᓄᓇᒥ ᐱᑕᖅᓂᒪᓕᑦ ᐊᒥᓯᒪᓕᖅᓂᑦ ᐱᑭᔅᔪᐅᔪᓂ. ᖃᐅᔨᒪᔪᓂᒥ ᐱᓇᓯᑕᐅᔪᒥ ᑕᔪᖅᓂᔪᑦ ᐊᑕᐅᓯᒥᖅ ᓄᑕᒥᖅ ᐱᑭᔅᑐᒥᖅ ᓇᑦᔪᒥᖅ ᔪᐯᵇ ᓭᑦᑐᐊ ᓄᑲᓂᓂ, 8 ᐱᑭᔅᑐᗅᑦ ᐃᓕᓴᓇᔅᑐᒋᑦᑐᑦ ᐅᕐᓀᓗᖅᓂ ᓄᑲᔅᑐᗅᖅᓇᓀᐊᖅᓂ ᔪᐯᵇᒥ ᐊᓪᓚᐅᑎᓯᔅᑐᓴᐅᓂᖅ, 1 ᐊᑦᑎᖅᓴᐃᖅᑎᑦᑐᖅᓄᑦ ᖃᓇᒥᖢ, 1 ᐊᑦᑎᖅᓴᐃᖅᑎᑦᑐᖅᓄᑦ ᖃᓇᑕᐅᑦ ᐅᐸᖃᖅᑐᑦᑐᑦ, 2 ᐊᑦᑎᖅᓴᐃᖅᑎᑦᑐᑦ ᑕᒪᑎᓂᓂ ᖃᓇᒥᖢᓗ, 13 ᐊᑦᑎᖅᓴᐃᖅᑎᑦᑐᑦ ᔪᐯᵇᒥ ᐊᒻᒪᓗ ᐊᑕᐅᔪᓄᑦ ᐅᖅᓯᐅᑦ ᔪᓕᐊᖅᓂᓂ ᐱᑕᓂᵇ.

ᖃᐅᔨᒪᔪᑕᐅᔪᖅ ᓄᓇᒥ ᐅᖅᓯᔪᑕᓇᑕᑐᓂᓂ ᐱᑭᔅᑐᓂᖅ ᐊᑦᑎᖅᓴᐃᖅᑐᓂᓂ ᐱᑦᔪᑎᖅᓴᔪᑎᑦ ᔪᓇᑕᖅᓴᓂᖅᑭᓂᓗ. **ᐃᑎᔪᑦᔪᓂ ᐃᒪᔅᐱᒥ ᔪᔪᒧᑦ ᐊᐅᑦᑐᒧᑦ ᖃᑭᒪᔅᖃᔪᓇᓂᖅᑭᓐᓂᑦ ᐱᑕᓂᵇ,** ᑲᑦᔪᐊᒪᑕᓪᒪᓇᵇ, ᐊᒥᐊᔪᓂᖅᑕ ᐃᑦᔪᑐᐃᖅᓂ ᐃᒪᔅᐱᒥ ᐊᒻᒪᓗ ᐊᑦᑎᖅᓴᐃᖅᑐᒥᑦᑐᑦ ᐱᑭᔅᑐᐃᔪᑦᔪᑦᑎᓂᖅᓄᑦ. ᖃᓄᐃᑦᑐᓂᔪᓇᓂᓂ ᓄᓇᖅ ᐱᑭᔅᑐᐃᔪᑦᓂᗅᑦ ᑎᑦᑐᑕᓂᖅᓂᑦᑐᑦ ᐱᑭᔅᑐᓂ ᒥᑭᔅᑐᓂᖅᓂᑦ ᐱᑭᔅᑐᓂᓕᒻᒥ ᓄᓇᒥ. ᐊᒥᓱᓂᖅᓂᑦᑐᑦ ᐊᑦᑎᖅᓴᐃᖅᑐᒥᑦᑐᑦ ᐱᑭᔅᑐᓂᖅᓂᑦ ᐊᑦᑎᖅᓴᐃᖅᑐᒥᑦᑐᑦ ᐱᑭᔅᑐᓂᓕᒻᒥ ᓄᓇᒥ. **ᔪᓚᑕ ᑭᓪ ᓄᓇᖅᓂ** ᐱᑭᔅᑐᖃᖅᑎᓯᖅ ᐊᑦᑎᖅᓴᐃᖅᑐᓂᓂ ᖃᐅᔨᒪᔪᑕᐅᔪᒥ ᓄᓇᒥ. ᓇᖅᑦ, ᐱᑦᔪᐊᒪᓕᖅᓄᖅᔪᐊᔪᓂᑦ ᓄᓇᒥ ᐃᒪᔅᒥᓗ ᐅᖅᓯᔪᓂᖅᑭᑦ ᐊᑦᑎᖅᓴᐃᖅᑐᓂᓂᓇᓂᖅᓂᑦ, ᐊᒥᓱᓂᑦ ᓭᔪᔪᑦ ᖃᖅᔪᐃᓂᖅᑭᑦ ᐊᑦᑎᖅᓴᐃᖅᑐᓂᓂᓇᓂᖅᓂᑦ ᐱᑭᔅᑐᓂᓕᒻᒥ ᐅᐊᑐᓂᖅᓂᑦ ᐊᑦᑎᖅᓴᐃᖅᑐᒥᑦᑐᑦ ᐱᑭᔅᑐᓂᖅᓂᑦ ᐃᓕᓴᐅᔪᓂᖅᓄᑦ ᐱᑭᔅᑐᓂᓕᒻᒥ ᓄᓇᒥ. ᐊᒥᓱᓂᖅᓂᑦᑐᑦ ᐱᑭᔅᑐᓂᖅᓂᑦ ᐊᑦᑎᖅᓴᐃᖅᑐᒥᑦᑐᑦ ᐱᑭᔅᑐᓂᓕᒻᒥ ᓄᓇᒥ ᐱᑭᔅᑐᓂᖅᓂᑦ ᐃᓕᓴᐅᔪᓂᖅᓄ

ᐊᒥᓂᓗᓪ ᐃᒪᖏᒥᑐᑌᓪ ᐅᒪᔪᐃᓪ ᓄᓇᓐᖏᑕᐅᓂᖏᓕᓪ ᐅᕐᓂᓂᑐᓴᖅᓪ ᖃᓄᓐᔅᐃᓐᓄᓐᖏᑕᐅᓂᖏᓕᓪ ᖁᐅᐅᔪᖏᑕᐅᔪᒥ ᓄᓇᒥ. ᐃᓕᓴᕐᓪ ᐅᒪᔪᖏᐊᑕᐅᓂᓪ ᓂᓚᔨᑦᓴᐅᓂᑐᓪ ᐊᓂᓴᕐᓪ ᐃᓇᖏᓐᓇ ᐃᓇᖏᑦᓂᐊᓪ ᐃᓕᐅᑦᓂᑐᓪ, ᑭᓚᐅᐅᑎᔪᓪ ᒪᑭᑕᒪᓂᓂᖏᓪᓕᓪ ᐊᓪᓚ ᐅᐸᐊᕐᓴᓴᓂᓴᓪ ᐃᓄᐃᓪ ᐱᒪᓚᐅᑦᓂᑐᓪ. ᐊᒥᓂᖏᑦᓴᑦ ᐅᒪᔪᖏᓐᓇᓴᓪ ᐃᓄᐃᓪ ᐃᓇᖏᓂᓴᓴᓂᓴᓪ ᓂᓚᔨᐅᓂᓴᓂᓂᑐᓇ. ᑌᑦᓂᒪᓂ, ᖁᓕᓇᒉᑦ ᐅᒪᔪᖏᐊᑕᐅᖏᓐᖏᑕᓂᓂᖏᓪ ᒪᓕᑦᑕᐅᓂᓂᓇ ᖁᔪᔭᓂ, ᖁᓕᓇᑦᓴ ᓄᐅᐅᓂᑕᐅᓂᓂᓇᑕᒪ. ᑌᑦᓂᒪᓂ, ᐅᑦᓇᒥᑐᓪ ᐃᓕᓴᕐᓪ ᐱᒪᓚᐅᐅᓇᓐᓇᑦ ᐃᓄᐃᓪ ᐃᓇᖏᓂᓴᓴᓂᓴᓪ ᓂᓚᔨᐅᓂᓴᓂᓂᑐᓇ. ᑌᑦᓂᒪᓂ, ᐅᑦᓇᒥᑐᓪ ᐱᒪᓚᐅᐅᓇᓐᓇᑦ ᐃᓄᐃᓪ ᐃᓇᖏᓂᓴᓴᓂᓴᓪ ᖁᔪᔭᓂ ᐅᑦᓇᒥᑐᓪ ᐃᓕᓴᕐᓪ ᐃᓇᖏᓂᓴᓴᓂᓴᓪ ᓂᓚᔨᐅᓂᓴᓂᓂᑐᓇ. ᑌᑦᓂᒪᓂ, ᐅᑦᓇᒥᑐᓪ ᐱᒪᓚᐅᐅᓇᓐᓇᑦ ᐃᓄᐃ

5 ᐃᓄᖅᓄᑦ ᓄᓇᕗᑦᑕᐅᖏᑦᑕᑐᐃᓂᖅ

ᐅᑭᐅᕐᑕᖅᓴᓂ ᔪᐯᖅ ᒪᕐᑭᐃᓇᖅᓯᓂᔪᖅ ᐃᓗᕐᑭᓯᖅ ᓯᓚᑦᓂᐃᓂᕐᓂ ᑕᒪᓂᖏᑦᑕᑐᐃᓂᕐᓂ: ᕿᓂᐅ ᐃᖅᑎᐊᖅ (ᓯᓚᑦᓂᖅᓭᐃᓂᖅᑎᑦ ᐊᑦᓗᑦ) ᐊᒪᒪᓗ ᕿᓂᐅ ᐃᓕᑭᒧ (ᓯᓚᑦᓂᐃᓂᖅᑎᑦ ᐃᓇᐃᑦ). ᓯᓚᑦᓂᖅᑎᑦ ᕿᓂᐅ-ᐃᓕᑭᒧ ᐅᑭᐅᕐᑕᒍᑲᖅᓯᔪᑦ ᐅᑭᐅᕐᑕᔨᖏᑕᐅᔨᓗᓗ ᓯᕐᓂᖅᓴᓂᑦ 4,500 ᐊᕐᕿᒍᐃᑦ ᓇᓂᕐᑕᑦ ᐅᑦᓗᒥᓂᕐᑐᖅ. ᐃᑭᑕᔨᓇᑎᓯᑎᑦ ᐅᓪᓗᓂᑦ ᒪᓂᖅᑕᑐᐃᓇᓂᑦ ᐅᓴᖏᕐᒥ ᓴᓇᕐᑎᖅᓂᕐᑐᑎᑦ. ᒎᓕᐊ ᐃᑭᑕᔨᓇᑎᑕᑦ ᐱᖓᓱᐃᓂᖅᓴᓂᖅᓯᔪᑦ ᐊᐃᑕᑐᓯᒪᓴᑎᑦᑐᑦ ᓄᓇᒥ ᐅᑦᑕᓯᒪᓴᑎᑐᒍᑦ: ᐃᒪᒥᔪᑦᑕ I (ᑲᓇᑕᐅᑦ ᐅᑭᐅᕐᑕᖅᓴᓂ ᑕᕐᖏᓂᐅᓂᕐᒋᖅ ᐊᒪᒪᓗ ᑕᕐᖏᓂᖅ ᐊᐐᑭᑕᔨᑦ), ᕿᕿᑲᖅ (ᑎᓕᐊ ᑲᖅᑎᓯᖅᓂᖅ ᐊᒪᒪᓗ ᓯᕐᓂᖅᓴᓂᖅ ᓂᓪᒥᒥ ᐊᐐᑭᑕᒥ) ᐊᒪᒪᓗ ᐃᓄᐃᑦ ᓯᓚᑦᓂᐃᓂᖅᑎᑦ (ᑲᓇᑕᐅᑦ ᐅᑭᐅᕐᑕᖅᓯᑕ ᓯᕐᓂᖅᓴᓂ, ᓄᓇᕗᑦ, ᓄᓇᕆᑲ ᐊᒪᒪᓗ ᓄᓇᑦᓯᐊᕗᑦ).

4,000ᓂᑦ 2,500ᓄᑦ ᓯᕗᓂᐊᒍᑦ ᐅᑦᓗᒥᓂᕐᑐᖅ, ᐃᓄᐃᑦ ᓯᓚᑦᓂᐃᓂᖅᑎᑦ, ᐃᓄᐃᑦ ᑕᐃᒪᐅᕐᕆᑐᖅᓯᑕᓂᑦ ᐅᑭᐅᕐᑕᑦ ᐅᐊᖓᓂᖅᓴᓂ ᑲᓇᑕᐅᑦ ᐅᑭᐅᕐᑕᖅᓴᓂ, ᓯᓇᓚᒥᓗᒍᓱᓂᕐᓂᑦ ᐅᖅᓯᒪᔭᑦ ᐃᒪᓕᕐᓂᑦ ᐅᖅᓯᒪᔨᐅᑦ ᓄᓇᖓᓂᖅ. ᐃᓗᕐᓯᓂᖅᓴᓂ ᐅᑦᓗᒥᓂᕐᑐᖅ; ᓴᓇᕐᑎᖅᓴᓂᖅᓯᓂᑦ ᐃᓄᐃᑦ ᑕᐃᒪᐅᕐᕆᑐᖅᓯᑕᓂᑦ ᐊᑐᐊᓂᖅᓴᓂᖅ ᓄᓇᕗᑦ ᐃᓄᐃᑦ ᐊᑐᐊᓂᖅᓴᓂᖅ ᐃᓄᐃ

ᐊᑐᑎᓴᐅᔨᕕᒋᑦ ᖃᓄᐃᓕᓐᓂᓕᕆᓂᖅᑎᑦ

ᑎᑭᓕᐅᖅᓂᓇᒋᑦ ᑕᓇᐅᑦ ᐊᑭᐊᓂᒥᐅᖅᓴᑦ, ᐃᓄᐃᑦ ᐃᓄᓯᓵᖅᓂᕆᑦ ᓄᓯᖅᓄᑦᓯᓂᑎᑦ ᐃᓄᐃᔪᑎᖅᓂᑦ ᐅᒪᔨᖅᓂᐊᓂᒥᒥᑦᑐ, ᐃᖅᑲᓕᐊᓂᒥᒥᑦᑐ ᓄᓂᖓᓐᓂᒥᓗᓗ. ᓄᑦᑎᖅᑦᑕᓯᑎᑦ ᐊᖅᖃᔪᑦ ᐃᓗᐊᓂ ᖃᓄᐃᓕᓐᓂᓕᖅᖢᓐᓂᑦ ᓯᓚᐅᑦ ᒪᓕᑦᓯᑎᑦ ᐊᑦᒪᓗ ᐅᒪᔨᐅᐃᑦ ᐊᑐᐃᓐᓇᐅᓂᖅᖢᓐᓂᑦ ᒪᓕᑦᓯᑎᑦ. ᐊᑦᔨᖅᑲᖅᑐᑐᓂᑦ ᐱᐅᔨᓂᑦ ᓴᓇᖅᑦᑕᓂᖅᓯᑦ ᐅᑯᓂᖅᑕ ᐃᓕᓴᕐᔪᐊᑦ, ᖃᑲᓂᖅ, ᐅᓗᑦ, ᖃᑯᓕᖅ, ᐊᓐᓄᔭᖅ ᒥᖅᓯᑯᓂ ᐊᑦᒪᓗ ᐅᓴᓂ ᐅᓪᓗᑎᒃ ᐊᐳᖓᓕᓯᑎᑦ.

ᐃᓄᐃᑦ ᓄᑲᒪᒥᐅᑦ: ᑕᖅᒥᐅᑦ

ᑕᑯᓐᓇᑕᐅᔨᓂ ᐃᓵᐱᑎᔨᐅᖅᖃᑦᑕᑐᓕᕆᓂ 1700 ᐊᖅᑭᒧᖅᓐᓂ, ᑕᓯᐅᔨᐅᓵ ᑯᓴᒪᑕ ᓄᓇᖅᓄᓂ ᓄᑲᒥᓗ ᐃᓄᓴᖅᓄᓯᑯᑦ ᑕᖅᒥᐅᓂᒃ, ᑐᐸᓂ Cape Wolstenhome ᓄᓇᖅᓂᑐᓂᒃ, ᐅᖅᖃᑕᐅᒪᒥᔨᖅᖢᓂ ᐃᓗᖅᓯᐳᖅᓇᐊᖅᑎᑦ ᐊᑦᔨᐅᖅᑦᑐᒥᑦ ᐊᓯᒥᓄᑦ ᑕᖅᖅᓂᑦᑐᓂᒃ ᐅᖅᖃᓄᖅᑦᑕᑎᓗᒃ ᐊᑦᔨᐅᖅᑦᑐᒥᑦ.

ᑕᑯᒥᐊᖅᖅᓂᕆᓂᖅᓴᑦ ᑕᓇᐅᑦ ᐊᑭᐊᓂᒥᐅᔪᓂᑦ ᑕᐅᖅᓯᖅᑎᑕᒧᑦᑑᓂᐊᓯᕆᓂᓗ

ᑕᑯᖅᑎᑎᒋᐊᖅᖅᓂᓴᓂᖅᓴᑦ ᐃᓄᐃᑦ ᑕᓇᐅᑦ ᐊᑭᐊᓂᒥᐅᔪᖓᓗ ᖃᑭᓂᑎᓗᒋᑦ ᐅᑭᐅᖅᑕᑐᒥ ᐃᒪᖅᓯᐅᑦ ᐊᖅᖁᓂᒥᑦ. ᐅᒥᐊᖅᓴᓴᐊᑦ ᑕᒪᐅᓵᓇᐊᖅᖅᓂᖅᑕᐊᕆᕕᓂᖅ ᖃᑭᓐᓇ ᖃᑦᓂᖅᓂ ᑕᖅᖅᓂᑦ ᓂᒋᖅᓂᓂ ᓄᓇᕕᐅᑦ. ᓂᓪᑭᐊᖅᔪᓴᓇᐊᖅᖅ, ᓇᓐᓐᓄᑦᓂᖅᖅᓯᒪᓂᖅᖢᓂᑦ ᐅᑭᐅᖅᑕᑐᒥ ᐃᒪᖅᓯᐅᑦ ᐃᓕᓴᕐᔪᐊᑦ ᐅᒥᐊᖅᓴᓴᐊᑦ ᐃᓕᓴᕐᔪᐊᑦ ᐃᓄᓴᖅᓄᑦᓯᑎᑦ ᓂᐱᖅᑐᒥᑦ ᐃᓄᐃᑦ ᐅᒥᐊᖅᓴᓴᐊᓂᒃ ᐊᑦᔨᐅᖅᑦᑐᒥᑦ ᐃᓄᐃᑦ ᐃᓕᓴᕐᔪᐊᑦ ᐃᓄᓴᖅᓄᑦᓯᑎᑦ ᓂᐱᖅ

6 ᓄᓇᐅᖏᑦ ᐊᒻᒪᓗ ᐃᓗᖏᓱᓪᓗᐅᐅᑦ ᓴᓇᒻᒥᓂᖅ

ᒥᖅᔪᐃᐅᓯᕐᓴᓴᖅᑐᓴ ᐃᓗᐃᓕᐅᑦ ᐱᓇᓂᑕᐅᔪᖅ ᐃᓂᖅᓯᓇᖏᖅᑐᓂ ᓄᓇᖅᖏᖅᓱᖅ; ᐃᓐᓇᑭᐸᐃᑦ 400ᑭᒡᓂ ᐳᖏᓂᓲᑦ ᐊᖅᑭᔪᓂᓯᓂ ᓄᓇᑐᐃᓐᓇᒥ ᓴᖏᖅᑎᑐᓂᖅᑐᓴ, ᐃᓂᖅᓯᓇᖏᑦ ᖅᓯᖅᔪᐃᐸᑦ ᓇᖏᖅᑎᑦ. ᑕᒃᓯᐊ ᐊᑦᑭᑦᖅᑎᑦ ᐊᔪᑎᖅᓄᓂᑦ ᓄᐃᑎᑎᑕᐅᐅᖏᑦ ᐊᑦᑭᑦᖅᑎᑦᓂ ᓄᓇᓂ ᖅᑲᑦᓴᖏᑕᐅᔪᓂᓂ. ᓄᓇᖅᓴ ᖅᑲᑦᓴᖏᑕᐅᔪᖅ ᓄᐃᑎᑎᑦᓯᒥᔪᖅ ᐃᓄᐃᑦ ᑕᔪᕐᓂᖅᓴᓂᓂᑦ ᑕᓯᐅᓂᓂᑦ ᑐᓴᒪᓂᓂᑦ ᐃᓗᓕ ᐊᒻᒪᓗ ᐊᑐᑎᑲᐅᖅᓴᖅᓱᖅᓂᖅᑕᐃᓂᓂᑦ ᓯᖏᓪᓗᐃᓕᓯᒪᑎᖅᑐᓄᑦ. ᑕᒪᓕᒪᑦ ᓄᓂᑦ ᐅᓪᒪᒋᐅᑲᐅᔪᑦ ᑎᒍᒪᔭᖅᑐᓄᑦ ᖃᐅᔨᓴᓂᒃᑯᑦ ᖅᑲᐅᑦᖅᑎᑦᑐᓴᓂᓂᑦ ᓄᓇᐅᑦ ᖅᓄᐃᓕᓴᖅᑭᑦᓯᓂᑦ ᐃᓗᓕ ᓄᓇᐅᑦ ᐱᑭᑐᖅᑭᑦ ᐃᓕᓴᖅᑎᓯᒪᑦ ᐃᓗᓕᑦ ᐊᐃᑎᖅᑲᖅᑭᑦᓯᓂᑦ ᐃᓗᓕ ᐊᒻᒪᓗ ᐊᐃᑎᖅᑲᖅᑭᑦᓯᓂᑦ.

1) ᔪᐸᒃ ᔪᖅᓴᑕ ᓄᓇᖅᓂᓂ (RIVIÈRE GUICHAUD (KUURUK) SECTOR)

ᑕᑭᓂᓗᒃ 40 ᑭᓪᒥᑕᓂᑦ, ᔪᖅᓴ ᔪᐸᒃ ᓇᖅᑎᐅᔪᖅ ᓭᔪᑦᓭᓂ ᐊᖅᑭᓂᖅᓯᑎᐅᔪᖅ ᓇᖅᓂᓂ ᖅᑲᐅᑦᖅᑎᑦᑕᐅᐃᓕᓪᓚᒥ ᓄᓇᒥ ᐊᒻᒪᓗ ᓄᓇᑦᓴᐅᑦᓭᓂᓂ ᓄᓇᐅᑦ ᓴᓚᒪᖅᑭᑦ ᐃᓂᖅᓯᓇᖏᑦᓄᓂᑦ. ᐊᖅᑭᓂᖅᓴ 860 ᑭᓪᒥᑕᑌᑦ ᓭᓴᑭᓪᓗᐊᑦ ᖅᑲᐅᑦᖅᑎᑦᑕᐅᔪᒥ ᓄᓇᒥ, ᓴᓂᖅᑭᑎᑦ ᔪᐸᒃ ᔪᖅᓴᓂ ᐃᓐᓇᓪᓕᓚᓴᖅᑎᑦ ᐃᓕᐅᐅᖅᑐᑦ (96.6%) ᖅᑲᐅᑦᖅᑎᑦᑕᐅᔪᒥ ᓄᓇᒥ. ᑕᑯᓚ ᔪᐸᒃ ᐊᖅᖏᓂᐅᔪᐅᐅᑦᑕᐃᓂᓂᖅᖅ ᐃᓄᓐᓄᑦ, ᓄᓇᓕᐊᓯᑎᑦ. ᐊᒥᓱᓐᓂᑦ ᐊᑎᖅᑭᑦ (ᓄᓇᐅᑦ ᐊᑎᖅᑭᑦ) ᐊᑐᑦᑕᐅᓂᖅᑐᓄᓕᓂᖅᓴᓚᑦ ᔪᐸᑦ ᓄᓇᖏᑎᖅᓴᓂ, ᐅᑦᑐᑎᑭᓗᒍ ᐃᖅᑲᓪᑐᑐᑦ. ᐃᓄᐃᑦ ᑕᑯᓂᖅᑕᓯᓚᓂᖅᑭᑦ ᑕᒪᓂ ᓄᓇᒥ ᓄᐃᑎᑦ ᐊᒥᓯᒪᓕᐊᓂᓂ ᓄᓇᓂ ᑕᔪᕐᓂᖅᓴᓚᑕ ᐃᓄᓐᓄᑦ ᐱᑭᕐᐅᑕᐊᖅᑭᑦ (750 ᐊᖏᕐᔪᐃᑦ ᐅᓪᓗᒥᐅᓕᑐᑦ ᓯᑐᓂᖅᓂᓂ ᑎᑭᑦᓯᒪ ᐊᑐᑎᑲᐅᖅᑎᑦᑕᓯᒪᔪᑦ ᖅᖏᖅᐅᓂᐃᓂᖅᓂᓄᑦ). ᔪᖅᓴ ᓯᔪᐊᓗᖅᓭᐅᓂᓯᔪᖅ ᐃᒪᓕᐱᖅ ᐳᓐᓇᖅᓂᓂ 122 ᑭᒡᓂᑦ, ᑎᓂᓪᓕᓚᓂᐃᓂᖅᓂᓂᖅ ᐃᓕᑕᓴᓄᑎᖅᓴᑎᓯᓂᓂ. ᔪᐸᑦ ᓴᓇᒪᓂᖅᓴ ᐅᓕᓴᓂᓱᖅᓯᓂ ᐱᑭᓴᓂᔪᓚᖅᔪᓯᓂ ᐱᑭᓐᓇᓄᑦ ᐅᓄᓯᐅᑎᑎᓯᓂᓚᑕ ᐊᑦᑕᑭᓐᓄᑦᑎᓯᓂᓂ ᐱᑭᓐᓇᓂ ᖅᑲᐅᑦᖅᑎᑦᑕᐅᔪᓂᑦ ᓄᓇᑎ ᖅᑲᐅᑦᖅᑎᑦᑕᐅᔪᒥ.

ᐊᑦᑕᓂᐅᖓᓂᖅᓴᖅ Alain Thibault

2) ᐊᖏᖅᑭᑦ ᐅᐊᓐᖏᓚᓂ/ᓂᒋᖏᓚᓂ ᑲᖏᕐᓂᒋᑦ (ANNGIIT EAST/WEST BAYS SECTOR)

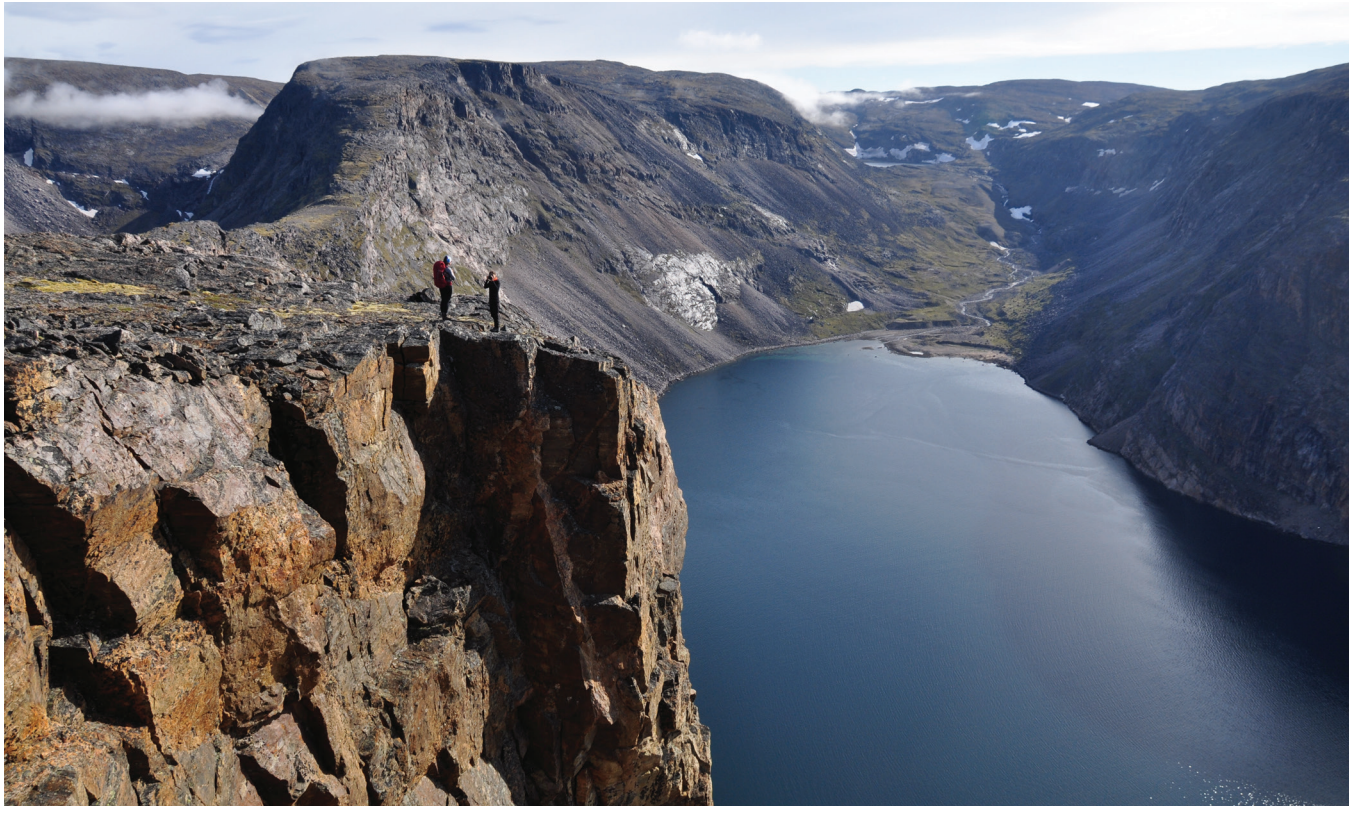
ᐊᖏᖅᑭᑦ ᓴᓪᓗᐃᑦ ᓴᓂᐊᓂᑕᕐᖅ, ᐅᐸᑦᑕᐅᒍᓐᓇᓕᔪᐊᕐᑐᖅ ᐅᐱᕐᖏᒻᒥ (ᖃᐅᓴᓇᐅᓐᔪᑦ) ᐅᑭᐅᒥᓗ (ᓂᑭᑐᐅᔪᑦ), ᓴᓪᓗᒥᐅᑦ ᑕᕐᓂᓕᕆᓚᐅᖅᑭᑦ ᐅᒪᔪᕐᓇᐊᐱᑦᓂᒍᒍ (ᑐᑦᑐ, ᖃᓄᓗᒃᖏᖅ ᓴᐃᒋᖅ). ᑕᒪᑭᐅ ᑲᖏᕐᓂᑦ ᓄᓇᖏᓂ ᑎᓂᕐᓴᓂᐊᓂᖏᖅᓚᓂᑦ ᑕᔪᒍᒥᓇᕐᑐᑕᓄᑦ; ᐅᐊᓐᓂᖏᓂᓐᓂᓴᒋᑦᑐᖅ ᓇᕐᓴᖏ ᓂᔪᑦᓂ ᕐᔪᖅᒍᐅᖅ ᐊᒪᒪᓗ ᑐᖏᓇᑦᓂ ᐊᖏᓚᑭᐅᖏᖅᓴᕐᖅ 1.2 ᑭᓪᒥᑕᓂᓄᑦ ᓂᓪᓂᓄᑦ ᐃᑎᕐᓴᖏᓗ ᐃᓂᔪᓇᑦᓂᓂᔪᑦ ᐊᑭᓐᓇᓂᓂ ᐊᒪᓚᑭᐅᖏᖅᓴᕐᖅᓴᕐᕕᖅ ᐱᑦᐃᓂᑦᓂᓂᔪᑦ ᐃᒪᕐᓇᕐᓂᓂᔪᑦ ᐊᑭᓐᓇᓂᓂ ᓂᔪᓄ ᐊᐅᑦᑎᓗᒍ ᓂᔪᒥ ᐱᐊᔪᓂᑦ ᐃᒪᕐᓇᕐᓂᓂᔪᑦ ᐊᑭᓐᓇᓂᓂ ᐃᒪᕐᓇᕐᓂᓂᔪᑦ. ᑕᒪᓂ ᑲᖏᕐᓂᒥ ᐱᑭᑐᓗᒍ ᐱᑭᕐᓂᓗᓂᔪᑦ ᐃᒪᕐᓇᕐᓂᓂᔪᑦ ᐊᑭᓐᓇᓂᓂ ᐃᒪᕐᓇᕐᓂᓂᔪᑦ. ᐃᕐᓂᖅᓱᓂᑦ ᐊᑦᑐᖅᓱᓂᑦ ᐃᒪᕐᓇᕐᓂᓂᔪᑦ ᐊᑭᓐᓇᓂᓂ ᐃᒪᕐᓇᕐᓂᓂᔪᑦ (ᐊᐅᑦᓂᓂᔪᑦ ᐃᒪᕐᓇᕐᓂᓂᔪᑦ). ᑌᒻᒪᑦ, ᑕᒪᓐᓇ ᐱᑭᕐᓇᐅᔪᖅ ᐊᑦᑐᖅᑲᓐᓇᖅᑭᑐᓂᑦ ᐱᑭᑐᓂᑦ. ᓄᑦᖅ ᑯᐯᐅᓐᓂᒪᖅ ᑲᐅᔪᐅᓐᓂᑯᖅ ᑲᐅᓐᓂᑦ ᐱᑭᑐᖅ ᒪᓕᒐᓂᑦ ᐱᑭᑐᖅ ᐊᑭᑕᓇᑦᑎᑐᐃᓐᓇᓚᐅᓐᖅ ᑕᔪᔪᐅᓐᓂᔪᑦ ᑕᒪᓐᓇᑦ.

ᐊᑦᑭᓕᐅᕐᒐᓂᖅ Benoit Tremblay

3) ᖃᑭᕐᑕᑭᓕᐅᔪᑦ ᑲᖏᕐᓂᖅᓚᑕ ᓄᓇᖅ (QIKIRTAARULIUP KANGIRSUNGA SECTOR)

ᑕᓐᓇ ᑲᖏᕐᓂᐊᕐᖅ ᐅᐊᓐᖏᓚᓂᑕᒍᖅ ᓄᑦᓚᒥ ᐊᑭᑭᓴᖅᑎᑦᓂᕐᓂᑦ ᓄᓇᔪᑦ ᓴᓇᓚᖅᑭᑦ. ᐊᒥᓂᓚᓇᐅᑦᑦ ᕐᑦᒍᑦ ᑲᖏᕐᓂᒥ, ᓂᕐᕆᐊᓪᓚᓇᕐᖅᑭᑦ ᓂᔪᓄ ᑌᑭᑦ ᓄᓇᔪᑦ (Tyrrell Strait) ᓂᓚᕐᔪᐊᑦ ᕐᑦᒍᓂᐅᒥᓂᐊᓂᖏᓚᓂᑯᑦ (ᕿᐅᖅᓴᑦᓚᓇᐊᕐᖅᑭᑦ ᓄᓇᖅᑭᑦ ᓴᓂᐊᓂᖏᓚᓂᑦ ᓂᔪᓄ ᐊᐅᑦᑎᓚᓇᐊᑦᑦ). ᑕᓐᓇ ᑲᖏᕐᓂᑯ ᖃᓄᐅᒍᓚᓇᐅᑦᑦ ᓴᓪᓗᒥᐅᑦ ᐅᓂᖅᑭᑦ ᓄᓇᔪᑦ, ᖃᓄᖅᓇᐊᖅᑭᑦ ᐃᓄᓐᓂᑦ ᑫᓐᓇᓚᐅᓂᑦ ᓂᔪᓄ ᐊᐅᑦᑎᓚᓇᐊᑦᑦ. ᐃᓕᓴᕐᓂᑦ ᐊᑎᖅᑕᑦ ᓄᓇᔪᑦ ᐃᓂᖅᑭᑦ ᐊᑭᑭᓴᖅᑎᑦᓂᕐᓂᑦ ᓄᓇᔪ

ᐊᑦᔨᓕᐅᔪᑐᓂᖅ Alain Thibault



ᐊᑦᔨᓕᐅᔪᑐᓂᖅ Alain Thibault

ᒪᔪᑎᐅᑦᔾᔪᓂᑎᑦ. ᒥᑭᔪᒥᐣ ᖃᐅᔨᒥᓗᑕᓂᐣ ᐊᑯᓐᖓᓂᐅ ᑐᖓᓕᖓᒃ ᐱᖓᓱᖓᓗ ᐊᒡᒪᓗᑭᑕᐅᖓᓱᓐᓂᐣ. ᓄᓇᖓᓂ ᐱᖓᓱᓂᑦ ᐊᑦᔨᖅᓴᓗᐊᖓᑎᑦᑐᓂᑦ ᐱᑭᔪᓱᐊᖅᖃᔨᖅ ᐃᑎᔨᒥᐣ ᓱᓚᒪ. ᐱᒪᓕᒥᐣ ᖃᐅᔨᓴᖅᓯᓐᓂᑦ ᐊᑦᑕᓇᖃᑐᑐᐃᓇᓐᓂᖃᖅᓯᓂᑦ ᐊᒡᑕᑕᐅᒪᔨᓴᓐᓂᑦ. ᐱᒪᓕᒥᐣ ᖃᐅᔨᔭᓐᓄᑦ ᑕᒪᓐᓇ: ᐱᑭᔪᐊᑦ ᐱᑭᑐᖓᑦ ᐅᖓᓯᖅᓴᑦ ᑯᓚᓐᓇᓂᑦ ᐃᓄᓐᓄᑦ ᓇᔨᑕᐅᓂᕐᓗᓂᖅᓄᑦ ᖃᐅᔨᓴᖅᓯᓐᓂᑦ ᓱᓕᔨᐊᑕᓂᒪᒥ. ᑕᒪᓂᓗ ᓄᓇᒥ ᖃᐅᔨᔪᖅᐊᐅᔨᒥ ᑌᑦᓯᒪᓂᑕᐅᓂᔨᑦᓂᑦ ᐃᓄᓐᓄᑦ ᓇᔨᑕᐅᓂᐊᓂᖅᓄᑦ ᖃᐅᔨᐊᐅᓂᖅᓄᑦ ᖃᐅᔨᐅᓂᐊᖅᓱᓂᖅ, ᐃᓄᓐᖓᓱᓐᓂᑦ 2,500 ᐊᑦᖏᔭᐃᑦ ᐅᓪᓗᑎᓂᑦᑐᓂᑦ ᓱᖓᓂᐊᔪᑦᓂᕐᓂᑦ. ᐃᑭᑦᑐᓂᑦᖁᔨᑦ ᐃᓄᓐᖁᓕᓴᖅᑐᑦ ᓄᖅ ᐃᓂᒪᑦᑕᑕᐊᓂᖅᓄᑦ ᓄᖓᒪᒥᐣ (ᐅᑐᑦᑭᑎᓵ, ᒪᑦᑭᓂᑦᑕᓂᖅ ᐱᓪᔪᑎᓵ ᐊᓯᖅᓄᑦᒫ) ᐱᒪᓚᐅᑭᒡᓪᓕᐅᓂᒥᔨᖅ. ᐅᓪᑦᖁᑎᓄᑦ ᐅᐸᑦᑕᐅᔪᓪᓚᐅᑦᑐᓗᓂᑦ ᑕᒪᓐᓇ ᓄᓇᒥ ᐱᓪᓗᑎᓂᑦ ᐊᑦᑕᐅᔪᓂᑕᒪ ᑌᒪᔪᑦ. ᐃᓕᓴᐅᑎᓂᖅᓄᑦ ᓄᖓᓄᑦᓯᓂᖅᓄᑦ ᐃᓕᓴᐅᑎᓂᖅᓄᑦ ᐅᓂᒃᑯᓐᓂᖅᓄᑦ 1909ᒥᑦ 1947ᒧᑦ. ᐃᒡᓗᓇᓂᑦᑕᖏᖅᑐᑦᓄ ᓄᓇᖓᓂ, ᑕᒪᓐᓇᖅᑐᐃᓂᑦ ᑭᓱᐊᓂ ᑌᒪᔪᓂᕐᕿᑦ ᐃᓗᓇᐸᓗᓐ. ᓱᑕᒪᑦ ᑐᓂᑕᑕᓂᑦ ᑕᐊᔨᐅᓱᒪᓐᓂᑦ ᑕᒪᓐᓇ ᓄᓇᒥ (ᓇᑦᓴᐅᑦ ᐱᒋᐊᖓᓇᓕᖏᓂᖅ). ᐊᓇᐅᓂᖓᓵᖅ ᖃᐅᔨᔪᖅᑕᐅᔨᒥ ᓄᓇᒥᖏᑐᑐᓗᓂᐊᖓᖅ, ᐃᓕᐅᑎᑕᐅᔨᖅ ᑕᒪᐅᖏᓐ ᓄᓇᒧᑦ ᐊᒥᓱᓗᓕᓕᒫᑦ; ᖃᓄᑕᓂᖅᑭᑦ ᑕᐅᔪᓐ ᐅᖏᒪᑦᓂᑐᓂᑦ ᐊᑦᑦᖃᓱᖓᒧᓪᓚᑦ, ᑭᓱᐊᓂ ᐃᓂᖓᓇᑦᑐᓚᓇᐅᑦᓱᓂ ᓄᓇ ᐃᓐᓇᑭᑦᑕᓄᖅ ᓱᐯᖅ ᓄᓇᖓᑎᑎᒪᑦ ᑕᑦᖏᖅᒪᒪᑦ, ᑕᒪᓐᓇ ᓄᓇᒥ, ᓄᑲᖅ ᐊᓱᑦᐅᑐᖅ ᐃᒪᔪᐱᓗ ᐃᖅᑎᐅᓂᓱᒧᓱᓂ ᐅᒥᐊᔪᑐᐃᓚᓱᓂ. ᕿᓗᐊᖓᓂᑦ, ᑕᒪᐃᓐᓇᓓᒧ, ᑕᒪᓐᓇ ᓄᓇᖅ ᐅᑦᑕᑎᓂᐅᔨᒪᓐᓂᑦ ᐊᑐᓂᑦᑐᓂᑦ (ᓄᓂᐅᓐᓂᖅ, ᖃᓄᐃᓕᓴᐅᓂᖅ, ᓴᐃᓪᓕᐊᓂᖅ ᐊᓱᖅᑎᓗ).

ᖃᓄᐃᓗᐱᑎᐅᓂᐊᓕᖅᑎᓪᓗᒍᑦ ᑎᖅᓯᐃᐅᓱᐃᐱᖅᓂᕆᔨᓄᑦᓴᒍᑦ

ᖃᓄᐃᓕᓄᑦᓴᒪᖅᓴᒋᑦ ᑐᔨᖅᑎᓂᓱᐃᑎᓄᓗᐃ, ᐊᑎᓕᓱᒪᔪᓕᐊᓂᐊᖓᓂᑦ ᑌᓴᐅᔪᑦ «ᔨᖅᖅᑭᑕᐅᑭᐊᖅᖅᓴᐃᑎᑎᖅᑎᑦ ᑐᖅᖅᓴᐃᖏᓕᓕᓂ-ᐅᓂᐊᖅᑎᑦ ᕿᖅᓄᑭᐣ» ᓄᐃᑕᐅᓯᖅᑎᑦ ᑐᖅᖅᓴᑕᖅᓴᓄᑦ ᓀᓱᖅᑐᓕᓇᓂᖅᑎᑦ ᐅᒪᔪᓇᓇᓂᖅᑎᑦ ᒥᖅᖅᓴᐃᓂᓱᐊᓕᓇᓂᖅᓴᒧᓗ. ᑭᓐᓀ ᐊᑎᓕᓱᒪᔪᓕᐊᓂᐊᖓᖅᓄᖅ ᐃᑲᔪᖅᓱᐃᓴᐃᓇᐅᖅᑎᑦ ᖃᓄᐃᓕᓄᑦᓴᓂᖅᓄᑭᓐᓂᑦ ᑐᖅᖅᓴᐃᓐᓇᑐᑦ ᐊᑎᓕᓱᒪᔪᓕᐊᓂᐊᖓᓂᑦ ᑭᓐᓀᓕᐊᑕᐅᔨᒪᓐᓂᑦ ᑕᒪᓐᓇ ᐊᑯᓂᖓᓂᑦ ᐃᓕᓴᐅᓂᐊᓕᖅᑎᓂᑦ ᐱᓕᓕᒫᓂᖅᓄᑦ ᖃᓄᐃᓕᓴᐅᓂᐊᓕᖅᑎᓂᖅᓄᑦ ᐊᑐᓂᑦᑐᓂᑦ ᐃᓄᓐᓄᑦ ᓇᔨᑕᐅᓂᐊᓕᖅᑎᓂᖅᓄᑦ ᐃᓄᓐᓄᑦ ᐃᓕᓴ

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EDITOR'S NOTE

THIS STATUS REPORT WAS PREPARED BY THE KATIVIK REGIONAL GOVERNMENT

In April 2002, the Québec government, the Kativik Regional Government (KRG) and the Makivik Corporation signed the *Partnership Agreement on Economic and Community Development in Nunavik* (Sanarrutik Agreement). One of the objectives of the Sanarrutik Agreement is to stimulate the development of the tourism industry in Nunavik through the creation of national parks. To this end, a specific agreement concerning park development in Nunavik was signed in June 2002 by the KRG and the Société de la faune et des parcs du Québec (wildlife and parks, FAPAQ). In March 2004, this specific agreement was integrated as a mandate in the *Agreement concerning Block Funding for the Kativik Regional Government* (Sivunirmut Agreement).

This mandate and the action plan appended to the 2002 specific agreement define the roles of the KRG and the Québec government with respect to the development and management of parks in Nunavik. For its part, the KRG is responsible for preparing park project status reports.

The boundaries of the study area of the Parc national Iluiliq Project, covered in this status report, included the boundaries of the Parc national du Cap-Wosltenholme Reserve set by the Québec government. Although the definition of coastal and offshore territorial limits differ between organizations and land claims agreements, the working group decided to extend the study area to the contact zone between the mainland and the Hudson Strait, in order to obtain a global portrait of the region. The study area, as defined, does not represent a position on the part of the KRG or the working group with regard to the offshore area of the region. The proposed boundaries of the future park will be determined by the working group.

The KRG is pleased to present the *Status Report on the Parc national Iluiliq Project*. It has been prepared through an intensive review of documentation and traditional knowledge, fieldwork inventories and meetings of the working group.

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In particular, the contributions of the working group on the Parc national Iluiliq Project deserve special mention. Without the support, expertise, ideas, comments and suggestions of its members, the design, development and successful accomplishment of this project would not have been possible. The members of the working group are Quitsak Tarriasuk (Northern Village of Ivujivik), Adamie Kalingo (president of Nuvummi Landholding Corporation of Ivujivik), Adamie Naluijuk (Northern Village of Salluit), Susie Sakiagak (Qaqqalik Landholding Corporation of Salluit), Mylène Larivière (Makivik Corporation), Alain Thibault (MFFP), Nathalie Girard (MFFP) and Michael Barrett (KRG).

The KRG extends a further thank you to the Inuit of Salluit and Ivujivik who so willingly shared their knowledge about the study area, as well as welcoming us into their territory. The KRG would like to acknowledge the work of Juupi Tunniq, Joanasie Kakayuk, Joshua Papigatuk, Christopher Moses, Mark Alaku, all from Salluit, and Mosusie Audlaluk, Peter Ainalik (younger), Charlie Tarkirk and Tumasi Audlaluk, all from Ivujivik, who have wisely guided us and ensure our safety in the field, in addition to participating in the work of acquiring knowledge.

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Thank you all for your passion and your enthusiasm!

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1 INTRODUCTION

Freighter canoe navigating near the study area for the Parc national Iluiliq Project
Credit: Alain Thibault

NATIONAL PARKS IN QUÉBEC

Created to ensure the protection of areas representative of Québec's natural landscapes and outstanding natural sites, as well as their use for generations to come, the Québec national park network fosters enhancement of the province's natural diversity and abundance among those keen to discover it. To date, the network consists of 27 parks covering a combined 42,744.5 km^2, i.e. 2.5% of Québec, plus the 1,246 km^2 of the Saguenay–St. Lawrence Marine Park (Figure 1.1). Several more park projects are also currently underway and will eventually further expand the network.

"PARK" TO "NATIONAL PARK" STATUS

Mindful of the collective heritage present within its borders, Québec took a first step towards ensuring its protection in 1895 when it established the first park in the province, Parc de la Montagne-Tremblante, today known as Parc national du Mont-Tremblant. Until the end of the 1970s, park status comprised a variety of purposes. Some parks were strictly dedicated to protection of natural heritage, while others permitted the sustainable use of forest and wildlife resources.

With the adoption of the *Parks Act*[1] in 1977 and the publication of the *Parks Policy* in 1982, Québec laid a solid foundation for consolidating the mission of its park network. From that point on, the commercial and industrial use of forest, mineral and energy resources was prohibited in parks, along with hunting[2] and the laying of oil and gas pipelines, as well as power lines. The purpose of these measures is to prioritize conservation of natural and cultural heritages in parks for future generations, while permitting recreational activities.

The 1977 *Parks Act* was revised in 2001 in order to insist on the preservation mission of all national parks in Québec. Accordingly, each park designated "national park" means:

"[A] national park whose primary purpose is to ensure the conservation and permanent protection of areas representative of the natural regions of Québec and of natural sites with outstanding features, in particular because of their biological diversity, while providing the public with access to those areas or sites for educational or cross-country recreation purposes".

Most national parks in Québec are considered category II protected areas under the criteria set by the International Union for the Conservation of Nature (IUCN). The term "national park" ensures that the parks fulfill the standards defined by the highest global body for protected areas, in addition to positioning the parks as a product of tourist interest.

CREATION PROCESS

The national park creation process involves a number of steps taking several years (Figure 1.2). Based on territorial analysis, a park project must meet several criteria, including representativeness of a natural region, remarkable landscapes, accessibility and local community support. More specifically regarding the final element, information sessions are organized with concerned actors to present the project and, with their agreement, a working group composed of local, regional and government representatives and other stakeholders is set up. The first mandate of a working group is to establish the boundaries of a study area. Next, the working group contributes to knowledge acquisition about the territory aimed at developing the most complete profile possible of the natural and cultural heritages to be preserved. The working group must also ensure that this information is shared with residents concerned by the project and organize discussions to validate the social acceptability or unacceptability of the project. Moreover, national park projects situated on territory covered under the *James Bay and Northern Québec Agreement* (JBNQA)[3] are subject to an environmental and social impact study and an economic impact study, pursuant to requirements under the environmental and social impact assessment and review procedure established by the JBNQA.

A provisional master plan outlining the different aspects of the park project, such as proposed boundaries, zoning and development concept, is prepared by the Québec government and presented to the general public. At least 60 days following its release, a public hearing is held to collect opinions regarding the park project. If the findings of the public hearing support the creation of a park, a recommendation is made to the Québec government to that effect. Subsequently, an application is submitted for a certificate of authorization pursuant to the *Environment Quality Act*[4] and the JBNQA. Once a decision is made by the Conseil des ministres (cabinet) to move forward with the project, the national park is officially created by order in council and an agreement is reached delegating park operations. In Nunavik, the Kativik Regional Government (KRG) is given the mandate to protect the park territory and to manage and develop the park for visitors in accordance

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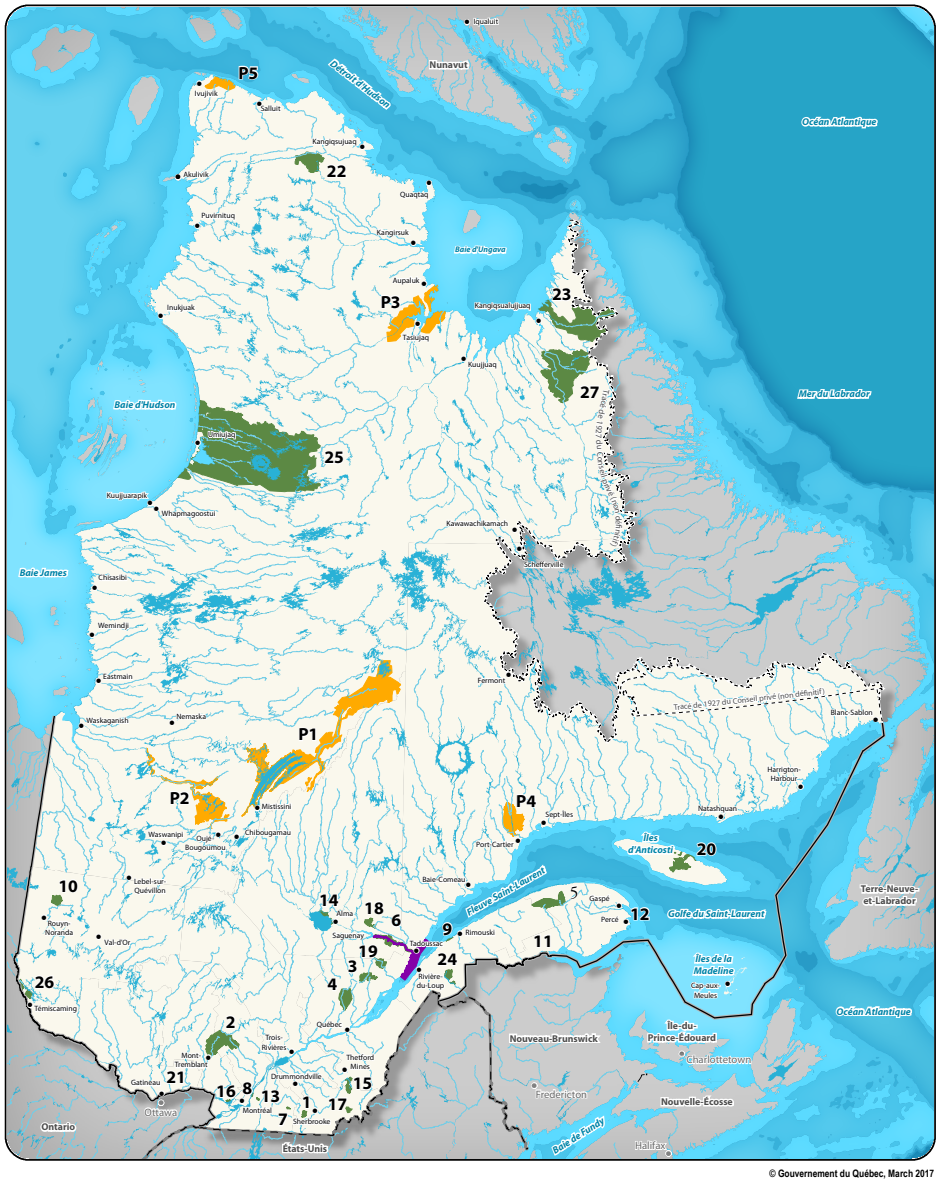
1 *Parks Act*, CQLR, c. P-9.

2 This provision does not apply to beneficiaries of the *James Bay and Northern Québec Agreement* within the boundaries of any park created in its territory.

3 *James Bay and Northern Québec Agreement*, CQLR, c. C-67.

4 *Environment Quality Act*, CQLR, c. Q-2.

QUEBEC NATIONAL PARKS



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Parc national (order of creation)

1 du Mont-Orford
2 du Mont-Tremblant
3 des Grands-Jardins
4 de la Jacques-Cartier
5 de la Gaspésie
6 du Fjord-du-Saguenay
7 de la Yamaska
8 des Îles-de-Boucherville
9 du Bic
10 d'Aiguebelle
11 de Miguasha
12 de l'Île-Bonaventure-et-du-Rocher-Percé
13 du Mont-Saint-Bruno
14 de la Pointe-Taillon
15 de Frontenac
16 d'Oka
17 du Mont-Mégantic
18 des Monts-Valin
19 des Hautes-Gorges-de-la-Rivière-Malbaie
20 d'Anticosti
21 de Plaisance
22 des Pingualuit
23 Kuururjuaq
24 du Lac-Témiscouata
25 Tursujuq
26 d'Opémican
27 Ulittaniujalik

Marine Park

Saguenay-St. Lawrence

Parc national Project

P1 Nibiischii
P2 Assinica
P3 de la Baie-aux-Feuilles
P4 du Lac-Walker
P5 Iluiliq

Forêts, Faune et Parcs Québec

Figure 1.1 Quebec National Parks Network

Source: MFFP (2016a)

Figure 1.2 Steps leading to the creation of a national park in Quebec
Inspired by MFFP (2016b)

with the park master plan prepared by the Ministère des Forêts, de la Faune et des Parcs (forests, wildlife and parks, MFFP). This document outlines the proposals retained regarding the park's boundaries, zoning, development concept and management orientations.

PARC NATIONAL ILUILIQ PROJECT

Parc national Iluiliq is the sixth park project undertaken in Nunavik, after Parc national des Pingualuit, Parc national Kuururjuaq, Parc national Tursujuq, Parc national Ulittaniujalik and the Parc national de la Baie-aux-Feuilles Project (Figure 1.1).

A look back at national park development in Québec provides interesting insight into the origin of the Parc national Iluiliq Project.

CREATION OF A NATIONAL PARK RESERVE

In accordance with the 1977 *Parks Act* and 1982 *Parks Policy*, the Québec government modified between 1980 and 1986 the boundaries of four existing parks and created ten new parks south of the 49th parallel, i.e. in the part of Québec where environmental pressures and the exploitation of natural resources are most intense. It then ordered a moratorium on new park creation in order to consolidate and develop its existing parks. This moratorium remained in place until 1992.

Despite the moratorium, efforts were continued to plan the parks network. In the *Parks Policy*, the Ministère du Loisir, de la Chasse et de la Pêche (recreation, hunting and fishing, MLCP)[5] divided the province into 43 natural regions (MLCP, 1982) and prepared a list of several areas in Northern Québec of interest for protected status based on outstanding features (contained in the report *Pitsiataugik* : *"que l'on te protège"* [that must be protected]). The Cap Wolstenholme area was included as representative of the province's far north, and because it possesses a nesting site for one of the largest colonies of thick-billed murres (*Uria lomvia*), a high concentration of marine mammals and archaeological sites dating back to the arrival of Palaeoeskimos in Nunavik, not to mention majestic headlands, glacial cirques and fjords incised into the plateau. The diversity of the area's geological, plant and wildlife elements, as well as the beauty of the landscapes make it one of the most interesting sites to be protected (MLCP, 1985).

In 1989, the MLCP submitted a position paper to the Comité ministériel permanent de l'aménagement, du développement régional et de l'environnement (permanent ministerial committee on land use, regional development and environment, COMPADRE) regarding sites of interest north of the 49th parallel in Québec and asked that the Ministère de l'Énergie et des Ressources (energy and resources, MER) list them as park projects in the public land use plan that was then in preparation. The Cap Wolstenholme area was among these sites. In 1990, following an inter-ministerial consultation, the COMPADRE endorsed the 18 projects

[5] Between 1979 and 2014, responsibility for the planning of the national park network in Québec was transferred in 1994 from the Ministère du Loisir, de la Chasse et de la Pêche (MLCP) to the Ministère de l'Environnement et de la Faune (MEF) and, then in 1999 following its creation, to the Société de la faune et des parcs du Québec (FAPAQ). In 2004, national park network responsibility was under the Ministère des Ressources naturelles, de la Faune et des Parcs (MRNFP), before being transferred in 2005 to the Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP), in 2013 to the Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP) and, finally, in 2014 to the Ministère de la Forêt, de la Faune et des Parcs (MFFP).

submitted by the MLCP and asked the MER to include these sites in the public land use plan.

In 1992, the territory designated for the protection of the Cap Wolstenholme area was included in a group of territories north of the 49th parallel reserved for park purposes and excluded, pursuant to a ministerial order issued by the MER (A.M. 91-192 [July 11, 1991], 1992 G.O.2., 4573, effective 1991-08-07), from staking, map designation, mineral exploration and mining. The ministerial order provides provisional protection status until permanent legal status is granted. The territory concerned covered 1,263 km^2 (Map 1.1).

In 1992, the moratorium on park creation in Québec, which had been in effect since 1986, was lifted and the MLCP unveiled its action plan (*La nature en heritage* [nature heritage]) setting out its intention to create national parks in Nunavik with the close involvement of the regional community in their development and management. The action plan emphasized that the concerned communities would be consulted first, and that care would be taken to ensure the park projects complied with the JBNQA. At that time, the community of Ivujivik, which stands less than 25 km from Cap Wolstenholme, had still not signed the JBNQA with the federal and provincial governments. Notwithstanding, a territory reserved for Category I and II land selection purposes as outlined in the JBNQA suggested that the boundaries of the park reserve would be modified once the JBNQA was signed[6].

In 1996, the KRG which is responsible for land use planning in the Kativik Region produced the *Master Plan for Land Use in the Kativik Region*, listing all the park projects in this region of Québec, including Cap Wolstenholme. With the introduction of the Master Plan that same year, the Québec government and the KRG undertook work to create the first national park in Nunavik, i.e. Parc national des Pingualuit. The Master Plan was adopted by resolution of the KRG Council in 1998.

In 2002, the Québec government, represented by the Société de la faune et des parcs du Québec (wildlife and parks, FAPAQ), and the KRG reached an agreement concerning park development in Nunavik (refer to the Editor's Note). The agreement defined the respective roles of the FAPAQ and the KRG regarding park development, operation and management. The agreement resulted in the creation of Parc national des Pingualuit in 2004, Parc national Kuururjuaq in 2009, Parc national Tursujuq in 2013 and Parc national Ulittaniujalik in 2016.

In 2008, in line with the Québec government's target to designate 8% of the province's territory as protected area, the Parc national du Cap-Wolstenholme Reserve was officially created and added to the Registre des aires protégées (protected areas register)[7] (MDDELCC, 2014a). With the formalization of the Inuit community of Ivujivik's concurrence with the JBNQA in July 2015, in particular the transfer of Category I lands to the Nuvummi Landholding Corporation of Ivujivik, the area of the park reserve was reduced to 777.49 km^2 (Map 1.1).

WORKING GROUP

In March and April 2015, information sessions were organized with representatives of the two concerned communities, i.e. Ivujivik and Salluit, to present the national park project. The meetings led to the creation of a working group composed of representatives of the MFFP, the KRG, the northern villages of Ivujivik and Salluit, the Makivik Corporation, and the Nuvummi and Qaqqalik landholding corporations of Ivujivik and Salluit respectively. The first meeting of the working group took place in May 2015 and, since, the group meets regularly to discuss and implement actions to advance the project, while ensuring respect for Inuit rights and concerns. With the creation of each new national park, a harmonization committee is established. Its composition is very similar to that of the working group.

Meeting with the working group in Salluit
Credit: Marianne Ricard

[6] The boundaries of a national park project or a national park can not overlap Category I lands. Category I lands are typically lands in and around communities, and are reserved for the exclusive use of the JBNQA beneficiaries of the community and, if applicable, for collective private ownership (see Section 6 of the JBNQA, paragraph 6.1.1, subparagraph 6, and Section 6, Schedule 3 C.C.6 2. Ivjivik Category I withdrawal area (detail)).

[7] The *Natural Heritage Conservation Act*, CQLR, c. C-61.01, was adopted in 2002. It requires the Québec government to maintain a protected areas register. This requirement ensures government compliance with various agreements, in particular the *Convention of Biological Diversity* (United Nations, 1992) and the *Plan d'action stratégique sur les aires protégées* (protected areas strategic action plan) (MDDEP, 2000), which require regular reporting on the status of the network. The register permits a standardized approach and consistent assessment of each protected area according to criteria recognized by the IUCN (MDDEP, 2002).

The harmonization committee's responsibilities include keeping the park operator and manager apprised of Inuit concerns so that they are considered and respected.

BOUNDARIES OF THE STUDY AREA

One of the first mandates of the working group was to set the boundaries of the study area which was going to be subject to field surveying and documentary research for knowledge acquisition purposes. The study area is the territory where research is focused in order to produce the status report, i.e. this document. The results of this research are used to propose park boundaries and a zoning plan that are presented at public hearings in the concerned communities.

The starting point for the study area was the Parc national du Cap-Wolstenholme Reserve designated in the Québec protected areas register. The study area was then expanded significantly to the east and southeast. Three major elements that emerged during the first meeting of the working group provided the grounds for the expansion. First, at the request of the Inuit representatives, the study area was stretched east to include the two inlets of Baie Qarliik. The two communities jointly asserted that the sector is important for their traditional activities. Shore landings are possible in the fjords of this bay, meaning the sector is more accessible. It was even suggested that the study area be extended beyond this bay, eastward, to include the most suitable sectors for shore landings and improve access to the territory. Secondly, there was a consensus to include in the study area certain sedimentary rock and marine deposit zones previously identified by geologists and expert botanists (Figure 1.3). The addition of these zones to the study area is of significant ecological importance since the nature of these deposits presents a strong potential for rich plant diversity. Thirdly, the working group decided to extend the boundary of the study area eastward to the Category I lands of Salluit following the drainage basin for the Rivière Guichaud. "Drainage basin" refers to a territory bounded by a watershed divide, i.e. over which all surface water flows towards a single point called an "outfall". Protected territory boundaries set according to drainage basins make it easier to manage risks associated with the qualitative and quantitative aspects of water, sediment, biological diversity preservation and recreational activities. All of these concerns are interrelated (Gangbazo, 2004). Accordingly, the inclusion of almost the entire Rivière Guichaud drainage basin (96.6%, with the remainder situated on the Category I lands of Salluit) was most consistent with the park protection objective (MDDELCC, 2016). West of the Parc national du Cap-Wolstenholme Reserve, a part of the drainage basin of the Rivière Narruniup Kuunga, which is not situated within the Category I lands of Ivujivik, was also added into the study area: the river is an important source of drinking water to the community. Therefore, when setting the study area, the working group decided to include the entire coastline between the Category I lands of Ivujivik and Salluit, to follow the boundary of the Parc national du Cap-Wolstenholme Reserve except for its marine sectors, and to include the Rivière Guichaud drainage basin and part of the Rivière Narruniup Kuunga drainage basin. The study area covers a total of 2,164.70 km^2 (Map 1.1).

FIELD WORK

A first extensive field work campaign was organized in the study area set by the working group from August 3 to 14, 2015. The field team consisted of a geomorphologist, expert botanists, archaeologists, MFFP and KRG professionals, as well as community representatives from Salluit and Ivujivik. The purpose of the field work was to characterize the territory and promote knowledge acquisition about the physical, biological and socio-economic environments. All the information collected during the field work is collated in this document.

Members of the research team during 2015 fieldwork
Credit: Marianne Ricard

Members of the research team during 2017 fieldwork
Credit: Alain Thibault

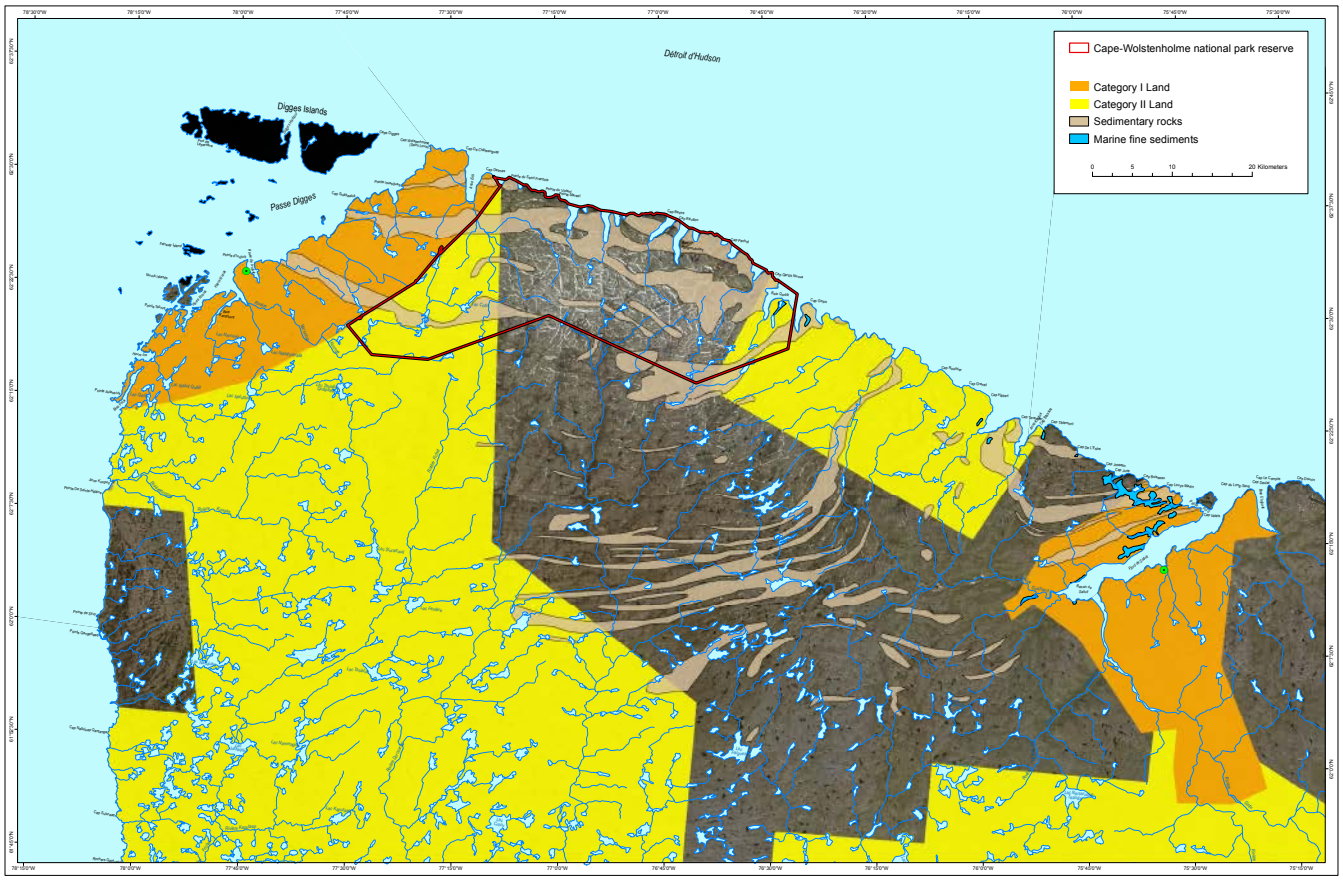


Figure 1.3 Areas of sedimentary rocks and marine deposits in the vicinity of Parc national du Cap-Wolstenholme Reserve
Cartographic data: MFFP (2015)

A second field work campaign was jointly conducted in the study area from August 9 to 21, 2017, by representatives of the MFFP, the KRG and the communities of Salluit and Ivujivik. The objective of this campaign was to evaluate recreational tourism potential in the study area in order to permit MFFP professionals to prepare the provisional master plan for the Parc national Iluiliq Project.

FROM "CAP-WOLSTENHOLME" TO "ILUILIQ"

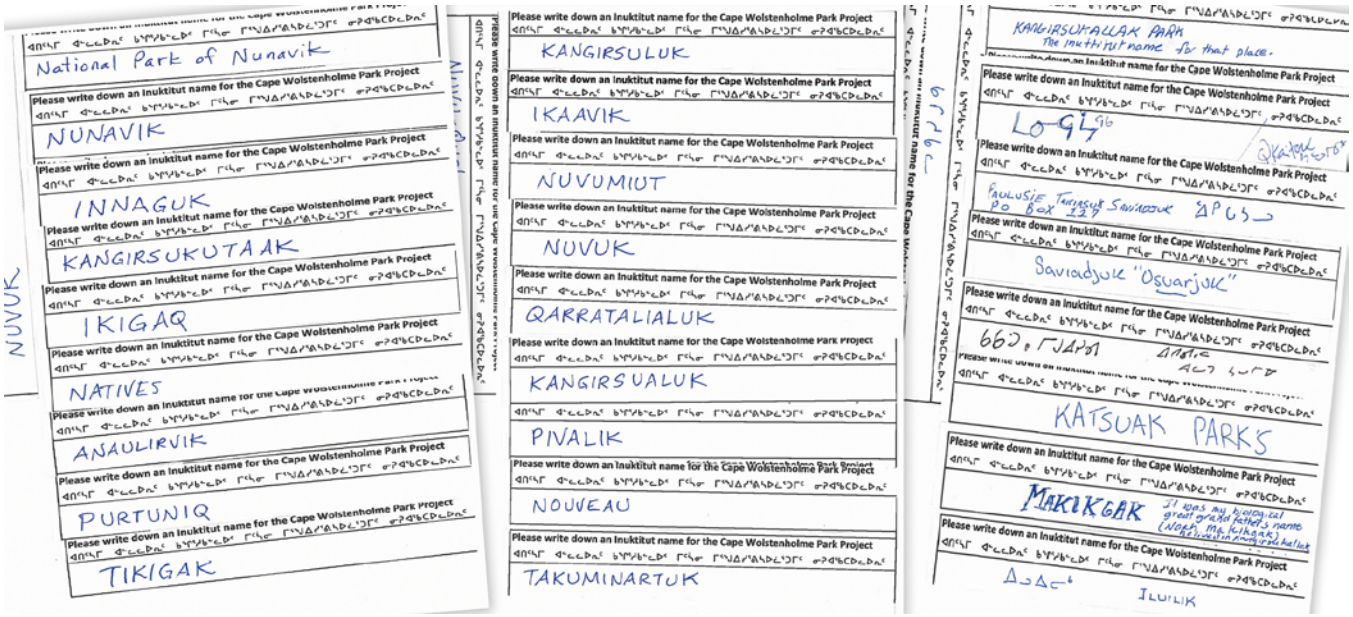
The navigator Henry Hudson gave this cape, which is the most northerly point of Québec, the name Wolstenholme in 1610 to honour the memory of Sir John Wolstenholme, who had sponsored his expedition to discover the Northwest Passage. Since the national park reserve encompasses the cape, it was called the Parc national du Cap-Wolstenholme Reserve. However, as Nunavik national parks are situated on Québec territory that has been occupied for thousands of years by Inuit and their ancestors, the official names of these parks are in Inuktitut to increase their appropriation by the region.

One of the first actions of the working group involved proposing an Inuktitut term to replace "Cap-Wolstenholme". After collecting suggestions from residents of Ivujivik and Salluit, the working group developed a final recommendation, obtained through consensus among all its members, that met the acceptance criteria of the Commission de toponymie du Québec (place names).

At a meeting held in Ivujivik on September 30, 2016, the working group agreed to recommend the name "Iluiliq" to replace "Cap-Wolstenholme" for the park project. Iluiliq refers to the mainland, i.e. a vast landmass, where there is no sea in sight. It offers a unique viewpoint of Nunavik, positioning us at the northern tip of Québec, looking southward over the immenseness of the continental landmass, instead of at the islands lying to the north.

GENERAL PRESENTATION OF THE STUDY AREA

The Parc national Iluiliq Project is situated at the northernmost point of Québec, separated from Nunavut (Baffin Island) by Hudson Strait. The study area extends from 62°40' to 62°01' north latitude and from 77°46' to 75°42' west longitude, covering approximately 2,165 km^2. It



Names suggested by the communities of Salluit and Ivujivik for the national park project
Credit: Working group on the Parc national Iluiliq Project

Landscape within the study area
Credit: Benoît Tremblay

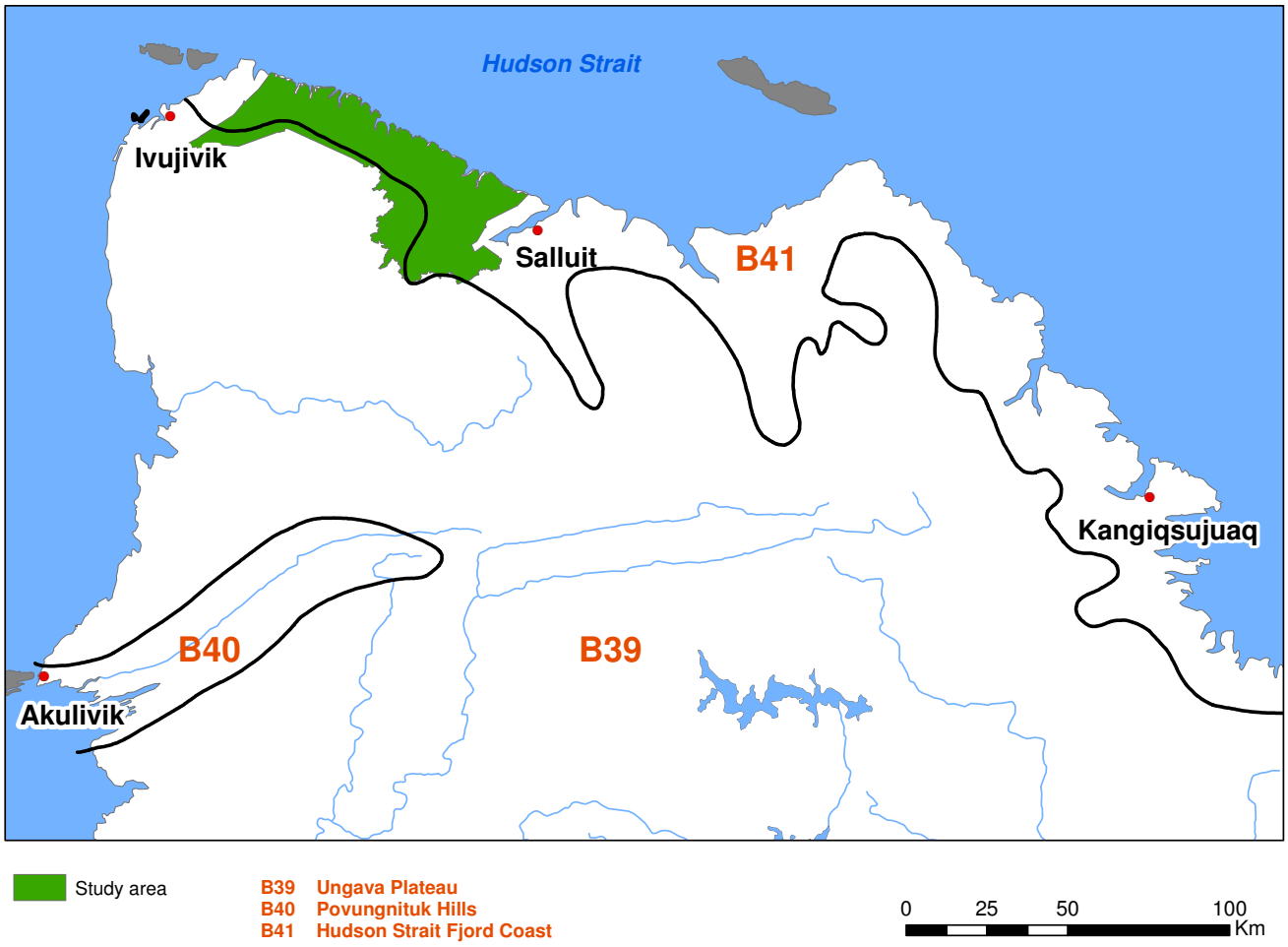


Figure 1.4 Natural Regions

Cartographic data: MLCP (1986)

covers the coastline between the Category I lands of Ivujivik and Salluit, and includes the rivière Guichaud drainage basin as well as the land portion of the Parc national du Cap-Wolstenholme Reserve (Map 1.1).

NATURAL REGION

Pursuant to the *Parks Act*, national parks in Québec are in particular intended to ensure the conservation and permanent protection of areas representative of the natural regions of Québec. The natural regions are homogeneous areas, divided according to topography, geology and bioclimatic domains. They are used to guide Québec national park network planning and ensure representativeness of the territory (MLCP, 1986). The purpose of the Parc national Iluiliq Project is to protect a representative portion of the Hudson Strait Fjord Coast natural region (B-41) (MLCP, 1986) (Figure 1.4). This natural region is defined as having a basement rock that developed through long phases of erosion that shaped a vast peneplain. The region is characterized by precipitous cliffs close to 400 m high, a raised plateau overlooking Hudson Strait and spectacular fjords that cut into the coastline. Three drainage basins are partially or fully included within the boundaries of the study area for the Parc national Iluiliq Project, as well as many small residual basins (for more information, refer to the Hydrology heading in Section 3: Physical Environment).

ECOLOGICAL REFERENCE FRAMEWORK

In addition to dividing the territory into natural regions, the Québec government also employs an ecological classification tool known as the Cadre écologique de référence du Québec (ecological reference framework, CERQ). The CERQ classifies the territory into cartographic units according to spatial structures produced through an interactive evolution over time of the geology, surface deposits, hydrographic network, living world and climate. The units are based on

a tiered system of interlocking levels, like Russian dolls. In other words, each level contains, in their entirety, the lower levels that form it (Bellavance, 2014). For example, a natural province (i.e. the highest CERQ level) comprises several natural regions in their entirety that, each in turn, comprise several physiographic units in their entirety, and so on (Figure 1.5) (MDDELCC, 2015b).

The study area is located in the natural province of the Ungava Peninsula, a broad, gently undulating plateau with a basement rock formed 4 billion years ago that encompasses the Hudson Strait Fjord Coast natural region (MDDELCC, 2015b). A geomorphological description of the study area according to lower CERQ levels is provided under the Geomorphology heading in Section 3: Physical Environment.

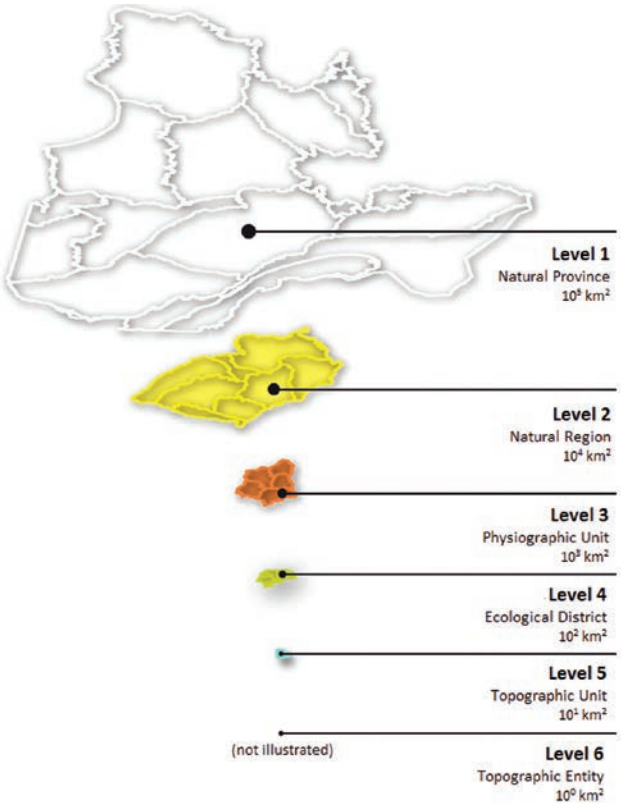
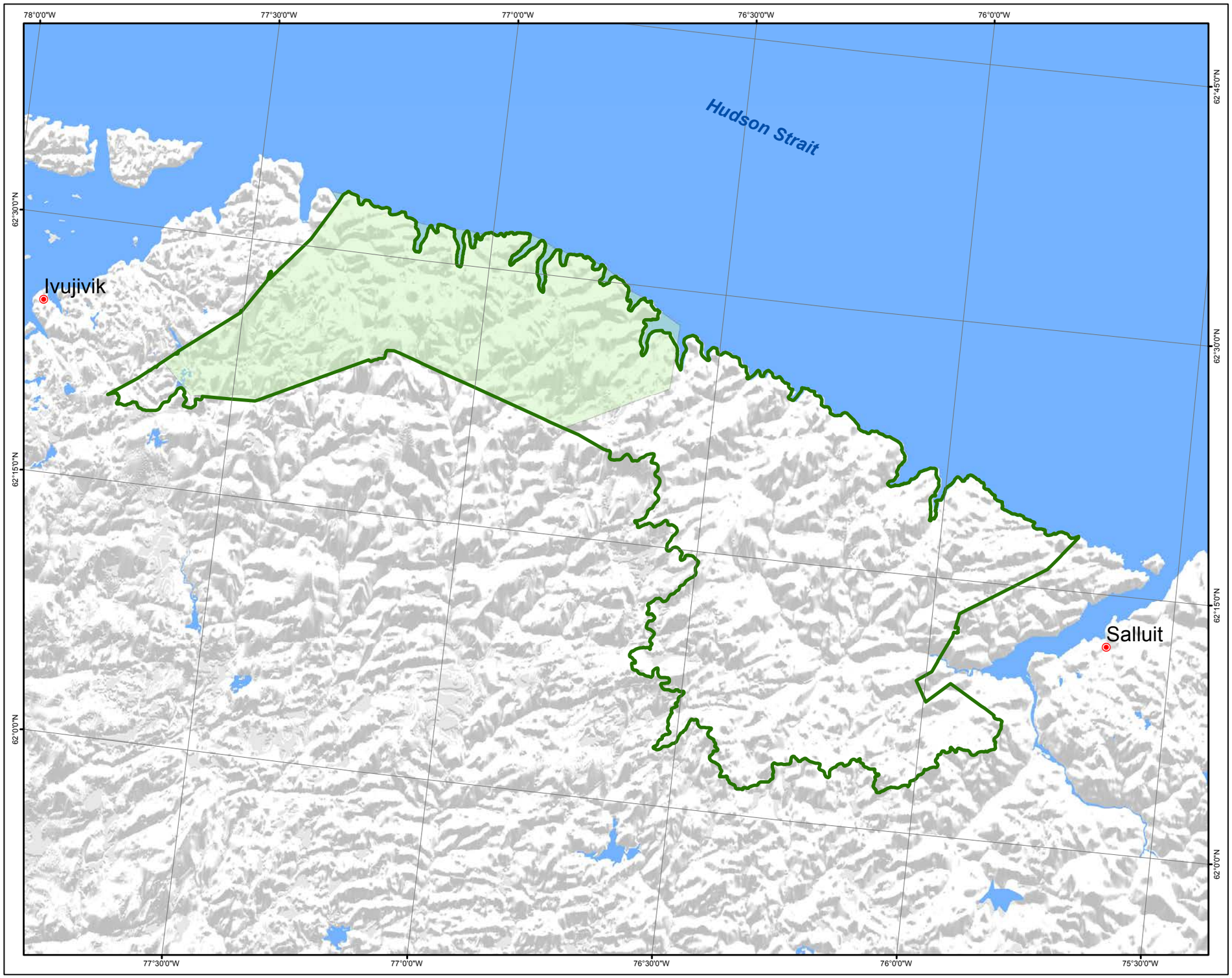


Figure 1.5 Division of the territory according to the Cadre écologique de référence du Québec (ecological reference framework, CERQ)

Source: MDDELCC (2015a)

STATUS REPORT

This report presents the status of knowledge about the study area for the Parc national Iluiliq Project. It is a synthesis of documentary research, traditional knowledge and field work conducted with view to gather as much information as possible on the socio-economic and cultural framework of the region, on the representative elements of the physical and biological environments, as well as on past and contemporary human occupation. This status report will not only serve to identify potential uses and constraints of the study area for the preparation of a provisional master plan in line with the Québec *Parks Policy* and Inuit culture, it also represents a valuable tool for all future decisions regarding land use planning in this area.



PARC NATIONAL
ILUILIQ PROJECT

Protected Areas

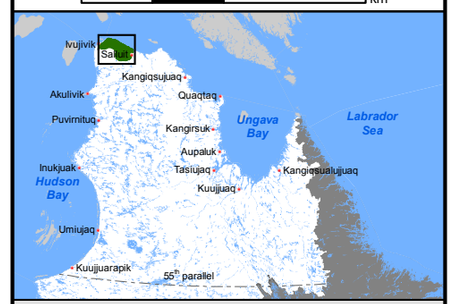
Study area

National park reserve

Source : MFFP (2017)

Map Scale 1:400 000

0 5 10 20 km



Geodetic datum : NAD 83
Coordinate system : Québec Lambert

KATIVIK

August
2018

Map 1.1

Protected Areas

Map 1.1

2 SOCIO-ECONOMIC FRAMEWORK

View of Salluit and the Community Boats Used for Traditional Activities
Credit: Alain Thibault

NUNAVIK AND THE NORTHERN VILLAGES

Situated in the province of Québec, Nunavik is the socio-cultural region north of the 55th parallel inhabited largely by Inuit (Figure 2.1). Nunavik covers the Kativik Region, created in 1975 pursuant to the *James Bay and Northern Québec Agreement* (JBNQA), and the Cree village of Whapmagoostui. The Kativik Region, Eeyou Istchee and Jamésie make up the Nord-du-Québec administrative region. (region no. 10). Covering roughly 500,000 km^2, i.e. close to a third of Québec, Nunavik is bordered to the east by Newfoundland and Labrador, to the north by Ungava Bay and the Hudson Strait, and to the west by Hudson Bay.

POPULATION

The population of the Kativik Region in 2016 was approximately 13,188 (Statistics Canada, 2017). This region has the highest population growth rate in the country:

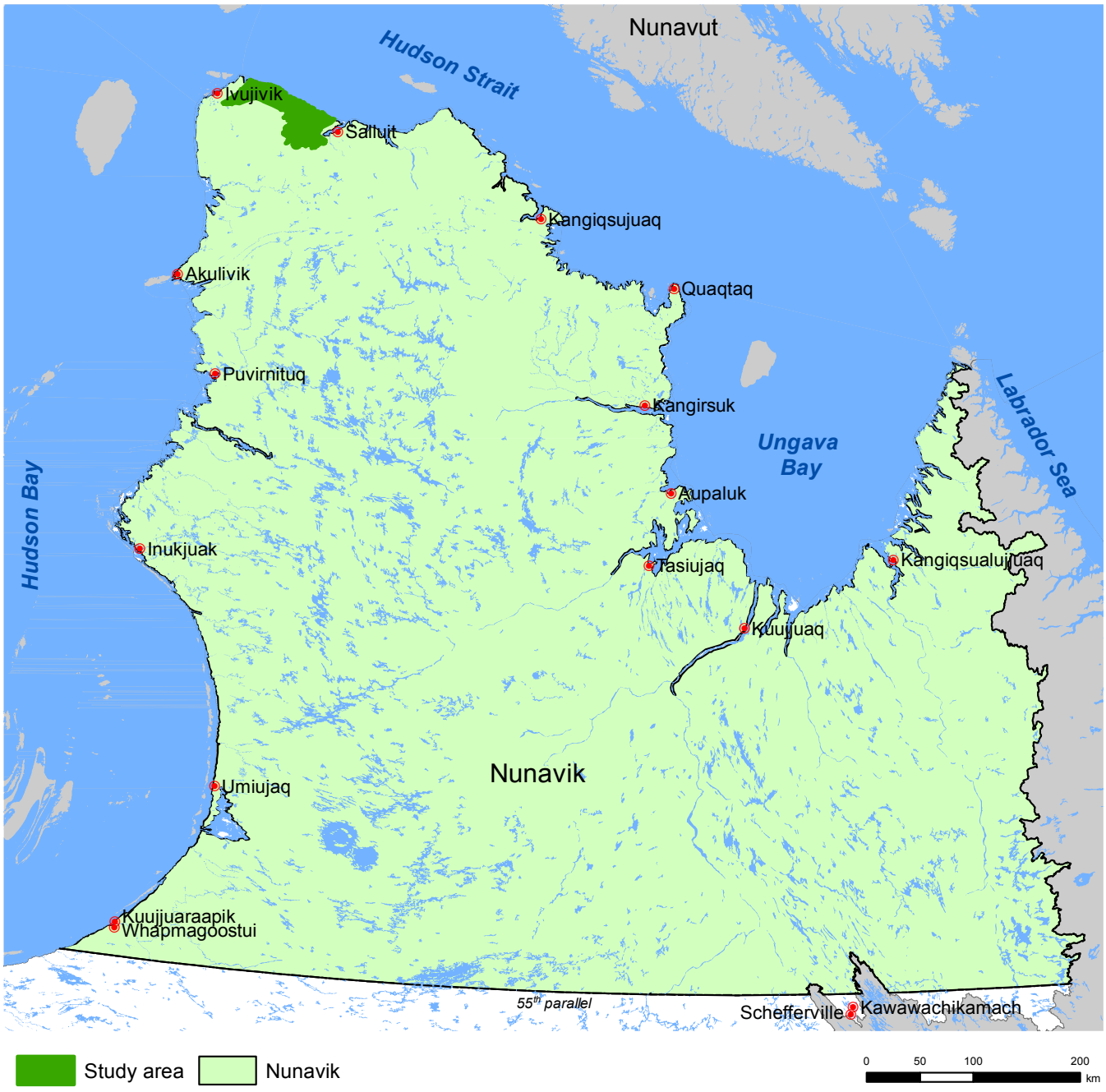


Figure 2.1 Localisation of Nunavik and of the Villages

between 1996 and 2011, the population grew by 25% (Statistics Canada, 2015). At the time of the 2016 census, community sizes varied between 209 residents (Aupaluk) and 2,754 residents (Kuujjuaq) (Table 2.1) (Statistics Canada, 2017). At the time of the 2016 census, the two communities mainly concerned by the park project, i.e. Ivujivik and Salluit, had populations of 414 and 1,483 respectively (*Ivujivimmiut* and *Sallumiut*) (Statistics Canada, 2017). Nunavik's population is generally younger than the populations of the other regions of Québec. The median age in 2016 was between 20 and 28, depending on the community, while the median age for Québec was 43. Only 60 to 73% of the population was aged 15 or older, compared with 84% for Québec as a whole (Table 2.2). Among the Inuit population, the average number of persons per family varied between 3 and 5, while the average for Québec was 2 (Statistics Canada, 2017).

In the Kativik Region, Inuktitut is the language most commonly spoken. In 2011, 99% of the population declared being able to hold a conversation in Inuktitut (Duhaime *et al*., 2015). The majority of Inuit are also able to communicate in either English or French. From kindergarten to grade 2, Inuktitut is the language of instruction. In higher grades, classes are delivered mainly in English or French, as decided by each child and his/her parents. During the 2014–2015 school year, roughly 2,770 students were enrolled in elementary and secondary schools (Kativik Ilisarniliriniq, 2018).

SERVICES

Public services are delivered in every northern village, along with telecommunication and television broadcasting services. Services are comparable with those delivered in municipalities elsewhere in Québec: drinking water, wastewater and solid waste management, road and land planning, power, elementary and secondary schools, nursing stations or local community service centres (CLSC), police stations, post offices, childcare centres, community radio stations, sports and community centres, and others.

Visitor pavilion for Parc national Tursujuq
Credit: KRG

Each of the park project's host villages possesses visitor infrastructure. Salluit and Ivujivik each possess a hotel and

Table 2.1 Community Populations

	2011	2016	POPULATION GROWTH BETWEEN 2011 AND 2016 (%)
Ivujivik	370	414	11.9
Salluit	1,347	1,483	10.1
Nunavik (total)	**12,090**	**13,188**	**9.1**

Source: Statistics Canada (2017)

Table 2.2 Family Characteristics in the Communities

	MEDIAN AGE	PERCENTAGE OF THE POPULATION AGED 15 OR OLDER	AVERAGE NUMBER OF PEOPLE PER FAMILY
Ivujivik	22.1	66.3	4.4
Salluit	21.7	66.3	4.4
Nunavik (average)	**22.8**	**65.9**	**3.8**
Nunavik (extremes)	**between 20 and 28**	**60 to 69**	**3 to 5**
Québec	**42.5**	**83.7**	**2.3**

Source: Statistics Canada (2017)

a general store operated by the Federation of Cooperatives of Northern Québec. The gateway to Nunavik, Kuujjuaq has two hotels, three restaurants, three general stores, a lounge, a bar with dance floor and a taxi service.

ACCESS AND TRANSPORTATION INFRASTRUCTURE

The future park will mainly be accessed by aircraft or by a combination of means of transportation (road, aircraft, watercraft, snowmobile). As the crow flies, the distances between various locations are:

- Montreal to Kuujjuaq: 1,445 km;
- Kuujjuaq to Salluit: 580 km;
- Salluit to Ivujivik: 120 km;
- Montreal to Ivujivik: 1,905 km.

Air Transportation

Nunavik is accessed mainly by air and each village possesses an airport. For the Ungava coast, First Air offers daily flights between Montreal and Kuujjuaq, while Air Inuit offers regular flights between Quebec City or Montreal and Kuujjuaq via Schefferville. Air Inuit offers regular flights between Kuujjuaq and the other villages, as well as between Montreal and the villages of the Hudson coast.

To reach the future Parc national Iluiliq by air, visitors will select one of the two host communities. To reach Salluit, visitors will first travel to Kuujjuaq and then transfer to a scheduled flight to Salluit. To reach Ivujivik, visitors will travel on a scheduled flight from Montreal to Ivujivik making stops at every village on the Hudson coast.

After arrival in a host community, the park may be accessed by watercraft, snowmobile or charter flight (Twin Otter, Dash-8, floatplane or helicopter). The air carriers Air Inuit and Nunavik Rotors offer these services in the region.

Twin Otter in the study area for Parc national Iluiliq
Credit: Marianne Ricard

Travel by Watercraft

In summer, visitors to the park may travel by watercraft from Salluit or Ivujivik using local guide services. Many Nunavik residents, especially Inuit JBNQA beneficiaries, make use of watercraft for their subsistence harvesting activities or to travel to other villages. It is nonetheless important to mention that the waters of Hudson Strait can sometimes be troubled. As well, the coastline comprises many precipitous cliffs with few spots to make shore landings. These elements will necessarily influence transportation by watercraft in this region.

Marine Transportation

Marine transportation to the communities of Nunavik is especially important for the supply of non-perishable goods, heavy and bulky cargo, and fuel. It takes place during the summer when coastal waters are ice free. This means of transportation, however, cannot be used by visitors to the park.

Land Transportation

In Nunavik, no roads connect the villages to one another or to the provincial road network. There are only a few kilometres of roads in each village. Snowmobile trails in winter and all-terrain vehicle trails during other seasons, however, provide a link between certain villages and access to harvesting areas for Inuit JBNQA beneficiaries. There is no road access to the study area from Salluit or Ivujivik. However, the study area can be accessed by snowmobile in winter when weather conditions permit. An inland snowmobile trail also links Ivujivik and Salluit.

ECONOMIC ACTIVITY

Markets

Over the last 15 years or so, Nunavik's economy has demonstrated a certain vitality. Job creation is a good indicator of this situation. From 1995 to 2005, the number of regular, full-time jobs almost doubled and, from 2005 to 2011, the number of jobs in Nunavik increased by 31%, rising from 1,747 in 1995 to 3,189 in 2005 and to 4,179 in 2011 (KRG, 2011). The labour force participation rate, i.e. the percentage of the population aged 15 and older holding employment during the week, also grew from 66 to 69% (Duhaime *et al*., 2015).

Employment, Unemployment and Income

Population growth, the transfer of new responsibilities to the Kativik Regional Government (KRG), as well as the creation of new organizations such as the Kativik Municipal Housing Bureau (KMHB) and the regional network of childcare centres (CPE) have had a meaningful impact. The development of a national park network has also created new jobs and opportunities for neighbouring villages. Public services clearly play a major role in the Nunavik economy.

More generally, economic activity is especially strong in the tertiary sector, representing 76% of Nunavik's gross domestic product (GDP) (Duhaime, 2008). The primary sector is also very important, representing 20% of the region's GDP. However, this sector is exploited by a few large companies that make up only 5% of the institutions in the region. In 2011, 1,008 jobs relied on the mining sector (KRG, 2011).

According to Statistics Canada (2017), the unemployment rate in Québec was 7.8% in 2011 and 4.9% in 2016. In the Nord-du-Québec region, the rate was much higher at 13.0% in 2016. It was 8.2% in Kuujjuaq, 15.1% in Salluit and 19.4% in Ivujivik. In 2016, median after-tax income was approximately $24,244 in Nunavik and approximately $29,535 in Québec. Kuujjuaq is the Nunavik village with the highest median income, i.e. approximately $42,396 (Table 2.3).

Tourism Industry

According to the *Tourism Trends and Opportunities Report* (KRG, 2007), Nunavik is ideally suited to become a leading destination for travellers from around the world searching for an authentic arctic tourism experience.

Nunavik's tourism industry, which since the 1950s had mainly been oriented towards the hunting and fishing outfitting sector, is slowly transforming. In 2002, Nunavik received 51,000 sport hunters and anglers. Of these visitors, 80% originated from Québec (Jacobs *et al*., 2009, in Lemelin, 2012). According to the Nunavik Tourism Association in 2007, the outfitting industry attracts 2,000 to 2,500 visitors annually (ACCORD Nord-du-Québec, 2009). The main outfitting markets are Québec, Ontario and the eastern United States. Outfitters generally offer black bear and small-game hunting packages, as well as arctic char, Atlantic salmon, brook trout and lake trout fishing packages. This seasonal sector currently faces a number of challenges: changes in the size of caribou herds and migration routes, currency fluctuations, high operating and transportation costs, as well as a shrinking client base in recent years (ACCORD Nord-du-Québec, 2009). With the aging of the traditional outfitting clientele, older infrastructure and the moratorium on caribou hunting by non-beneficiaries of the JBNQA due to a decline in caribou populations, the revenue of some outfitters has been substantially reduced. In this context, only outfitters that diversify their activities are maintaining an adequate volume of clients (Jean-Michel Perron, PAR Conseils et Stratégies, pers. comm.).

Tikaagulli,(foreground, Ivujivik community boat) and *MS Explorer* (background) at Ivujivik Harbour (1991). The *MS Explorer* struck submerged ice in 2007 and sunk.
Credit: Adamie Kalingo

In addition to sport hunters and anglers, approximately 1,000 individuals travel to Nunavik annually for business and another 1,000 visitors travel for cultural or outdoor activities, for example as cruise ship passengers (ACCORD Nord-du-Québec, 2009).

In 2017, 688 individuals visited national parks in Nunavik: there were 244 visitors to Parc national des Pingualuit, 259 to Parc national Kuururjuaq and 185 to Parc national

Table 2.3 Unemployment Rate and Median Income

	UNEMPLOYMENT (2011) (%)	MEDIAN INCOME OF EMPLOYED INDIVIDUALS ($)
Ivujivik	19.4	20,448
Salluit	15.1	26,603
Nunavik (average)	**17.8**	**24,245***
Nunavik (extremes)	**8.2 – 23.7**	**22,507 – 42,396**
Québec	**7.2**	**29,535**

* Aupaluk not included (data not available)
Source: Statistics Canada (2017)

Tursujuq. The number of visits to national parks in Nunavik has doubled in recent years. Specifically, in 2015 there were 107 visitors to Parc national des Pingualuit, 97 to Parc national Kuururjuaq and 140 to Parc national Tursujuq, for a total of 344 visitors. The Parc national Iluiliq Project will expand Nunavik's outdoor and cultural tourism supply. In brief, Nunavik's tourism industry is relatively limited although, under the Plan Nord, the Québec government plans to adopt a northern tourism development strategy with a view to making Northern Québec a world-class destination. This strategy will be implemented over ten years and involve total investments of $70 million (Secrétariat du Plan Nord, 2015).

Staff of Parc national Tursujuq
Credit: KRG

DEVELOPMENT PLANS

Plan Nord

In 2011, the Québec government announced the Plan Nord (Gouvernement du Québec, 2011), describing it as the biggest economic, social and environmental project of our time. Over a 25-year period, the Plan Nord was to produce over $80 billion in investments and generate an average of 20,000 jobs annually. It focused on the development of the north's energy, mineral, forest, wildlife and tourism resources. In 2012, it was also announced that the Québec government intended to reserve 50% of the Plan Nord territory for environmental protection, the safeguard of biodiversity, as well as natural heritage development and various other kinds of development not involving industrial activities. The Plan Nord territory is situated north of the 49th parallel and covers more than two thirds of Québec, i.e. close to 1.2 million km^2 (Gouvernement du Québec, 2014).

In 2012–2013 further to a change of government, the Plan Nord was replaced by *Le Nord pour tous* (the north for all) project. Following new elections, the *Plan Nord* was reactivated in 2014. In *The Plan Nord toward 2035, 2015–2020 Action Plan*, the Québec government reiterates its intention to reserve 50% of the *Plan Nord* territory for conservation purposes (Secrétariat du Plan Nord, 2015). Moreover, it undertakes to establish protected areas over 20% of the Plan Nord territory by 2020 (Secrétariat du Plan Nord, 2015). The government asserts it is continuing work on several park projects that will lead to the creation of national parks in the Plan Nord territory (Secrétariat du Plan Nord, 2015).

Plan Nunavik: Parnasimautik

In response to the Plan Nord, the KRG and the Makivik Corporation published *Plan Nunavik* in 2011 (KRG and Makivik Corporation, 2010). This document presents the challenges, objectives and priorities of *Nunavimmiut* over a 25-year horizon in various fields: health, housing, education, tourism and several others. It was also used as the basis for discussions and consultations conducted under the Parnasimautik process in 2013 and 2014 in each of the 14 communities of the Kativik Region, as well as in Chisasibi, Kawawachikamach and Montreal. The consultations allowed all regional residents to express their opinions essentially on the sectors covered in *Plan Nunavik* and generated an acceptable sustainable development model in line with the realities of *Nunavimmiut* (Makivik Corporation *et al*., 2014).

The consultation process, the largest ever carried out in Nunavik communities, led to the publication of the *Parnasimautik Consultation Report* (Makivik Corporation, 2016). Following up on this report, a formal declaration by Nunavik Inuit was presented to the general assembly of the Makivik Corporation in March 2015. The declaration defines the fundamental issues and priorities of Nunavik Inuit. The adoption of the declaration opens the door to further steps under the Parnasimautik process (Makivik Corporation, 2016).

Inuit cabin at *Anngiit*
Credit: Alain Thibault

ADMINISTRATION AND LAND REGIME IN NUNAVIK

Nunavik's administrative and land regime structure is prescribed in the JBNQA and the *Northeastern Québec Agreement*[8] (NEQA), as well as their attendant laws and agreements. The JBNQA and the NEQA were signed in 1975 and 1978 respectively by the Québec government, the Government of Canada, the James Bay Energy Corporation, the James Bay Development Corporation, Hydro-Québec, as well as Cree and Inuit (in the case of the JBNQA) and the Naskapi of Kawawachikamach (in the case of the NEQA).

The JBNQA provides a good deal of political and administrative autonomy for the concerned Aboriginal communities, as well as exclusive hunting, fishing and trapping rights in designated zones, and financial compensation. In return, the Québec government is entitled to develop hydraulic, mineral and forest resources in Northern Québec. The following subsections describe the specific administrative characteristics and land regime that derive from the JBNQA.

ADMINISTRATIVE STRUCTURES

In addition to the federal and provincial governments, other organizations and stakeholders are involved in land management and administration in Nunavik.

Makivik Corporation

The Makivik Corporation was legally constituted in 1978[9]. It has the mandate to protect the rights and interests of Nunavik Inuit and to administer the financial compensation deriving from the JBNQA and the *Nunavik Inuit Land Claims Agreement* which entered into force in 2008. As well, Makivik participates in the region's economic development through various companies. For example, its subsidiary companies include the air carriers First Air, Air Inuit and Nunavik Rotors that provide scheduled and charter air services throughout the region. Makivik is a signatory to the *Partnership Agreement on Economic and Community Development in Nunavik* (Sanarrutik Agreement) that includes an objective concerning park development in Nunavik (refer to the Editor's Note).

Kativik Regional Government

The KRG is a public, non-ethnic organization created in 1978 pursuant to Section 13 of the JBNQA and the *Act respecting Northern Villages and the Kativik Regional Government*[10] (Kativik Act). The KRG has its head office in Kuujjuaq and offices in each of the other 13 northern villages. The KRG is led by a 17-member Council, comprising a chairperson, a vice-chairperson, one elected representative from each northern village and the mayor of the Naskapi Village of Kawawachikamach.

The KRG has jurisdiction over the Kativik Region, i.e. all the territory situated north of the 55th parallel, except for the Category IA and IB lands of the Cree community of Whapmagoostui. Its role is to deliver public services to *Nunavimmiut* and technical assistance to the region's 14 communities in several fields related to municipal management and infrastructure construction. The KRG also acts as a municipality in any part of the region that is not organized as a municipality. In this respect, it is responsible for land use planning and management in accordance with the *Master Plan for Land Use in the Kativik Region* (KRG, 1998). The KRG also has several responsibilities regarding park development and management in Nunavik pursuant to an agreement signed with the Société de la faune et des parcs du Québec (wildlife and parks) in 2002 that was subsequently integrated as a mandate into the *Agreement concerning Block Funding for the Kativik Regional Government* (Sivunirmut Agreement) signed by the KRG and the Québec government in 2004 (refer to the Editor's Note).

Northern Villages

The 14 northern villages are municipalities pursuant to the Kativik Act. The powers and obligations of these villages are comparable to those of municipalities elsewhere in Québec.

The Inuit communities of Ivujivik and Salluit are involved in the development of the Parc national Iluiliq Project. Salluit was incorporated as a municipality in 1979, and Ivujivik in 1981 (MAMROT, 2016). The study area runs along the northern coast of Québec between these two communities.

Landholding Corporations

In Inuit territory, landholding corporations are private entities that represent the beneficiaries of a given community for the management of Category I (owned exclusively by the JBNQA beneficiaries) and Category II (public lands where the JBNQA beneficiaries have an exclusive subsistence harvesting right) lands. For the Parc national Iluiliq Project, the concerned entities are the Nuvummi Landholding Corporation of Ivujivik and the Qaqqalik Landholding Corporation of Salluit.

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[8] *Northeastern Québec Agreement*, CQLR, c. C-67.1.

[9] *Act respecting the Makivik Corporation*, CQLR, c. S-18.1.

[10] *Act respecting Northern Villages and the Kativik Regional Government*, CQLR, c. V-6. 1.

Community of Salluit
Credit: Alain Thibault

LAND REGIME

Pursuant to the JBNQA and the *Act respecting the Land Regime in the James Bay and New Québec Territories*[11], a land regime comprising three categories, which govern use as well as management conditions and responsibilities, is applicable in the Kativik and James Bay regions (Map 2.1).

Category I lands, with the exception of subsurface rights, are collectively owned by the Inuit JBNQA beneficiaries of the concerned community. These lands extend beyond municipal boundaries and include influence zones where subsistence harvesting is practised intensively by the Inuit JBNQA beneficiaries. No Category I lands are part of the study area for the Parc national Iluiliq Project.

Category II lands are public lands in the domain of the State where, as is the case with Category I lands, the JBNQA beneficiaries have exclusive hunting, fishing and trapping, commercial hunting and fishing, as well as outfitting rights. Category II lands cover areas where resources are present and accessible to JBNQA beneficiaries for the exercise of their harvesting right.

During the negotiation of the JBNQA, the Inuit communities of Puvirnituq, Ivujivik and 49% of *Sallumiut* voted against signing the document. This represented about a third of Nunavik Inuit at that time. Based on the opinion that Inuit should form their own government, the communities of Puvirnituq and Ivujivik did not sign the JBNQA in 1975, and formed instead the Inuit Tungavinga Nunamini movement with certain members of the community of Salluit (Mitchell, M., 2014; Makivik Corporation, 2015). However, in a referendum conducted in 2006, the community of Ivujivik clearly indicated its intention to ratify the JBNQA and to undertake the selection of Category I and II lands as prescribed therein. The ceremony transferring these lands to the Nuvummi

[11] *Act respecting the Land Regime in the James Bay and New Québec Territories*, CQLR, c. R-13.1.

Aerial view of the community of Ivujivik
Credit: Alain Thibault

Landholding Corporation of Ivujivik on July 20, 2015, marked this community's formal concurrence with the JBNQA (Secrétariat aux affaires autochtones, 2015).

A little more than a third of the study area, i.e. 792.9 km^2, covers Category II lands (Map 2.1): Salluit Category II lands comprise 26.7% of the study area and Ivujivik lands 9.93%.

Category III lands are also public lands where JBNQA beneficiaries may exercise their harvesting right; however, this right is not exclusive. Category III lands make up roughly 63% of the study area.

HARVESTING RIGHT

The harvesting right of JBNQA beneficiaries, which is subject to the principle of conservation, is set out in the JBNQA[12] and in the *Act respecting Hunting and Fishing Rights in the James Bay and New Québec Territories*[13]. This right extends throughout the territory covered by the JBNQA, regardless of the land category. It allows JBNQA beneficiaries to hunt, fish and trap any species of wildlife.

The JBNQA also stipulates the principle of priority harvesting by JBNQA beneficiaries. Primary and common interest zones for Cree, Inuit and Naskapi are defined in Section 24 of the JBNQA. The entire study area is situated in an area of Inuit primary interest (Map 2.2).

The creation of a park does not conflict with subsistence harvesting activities, which is to say JBNQA beneficiaries may exercise their harvesting right inside a park[14]. Regarding non-beneficiaries of the JBNQA, the *Parks Act* is applicable and, among other things, stipulates under subsection 7*(a)* that, notwithstanding any provision of law, "hunting or

[12] JBNQA, subsection 24.3.

[13] *Act respecting Hunting and Fishing Rights in the James Bay and New Québec Territories*, CQLR, c. D-13.1, s. 2.

[14] JBNQA, paragraph 24.3.6.

trapping of every kind is prohibited in a park". The *Parks Act* permits the regulation of fishing in a park and the setting of applicable conditions (subsection 9*(g)*).

LICENCES ISSUED BY THE QUÉBEC GOVERNMENT

Outfitters

The study area for the Parc national Iluiliq Project does not overlap the operating territory of any outfitter.

Mining Titles

The study area lies in the geological province of Churchill, i.e. a formation of Precambrian rocks dating from the Archeozoic to the Proterozoic (2.9 billion to 1.1 billion years) (refer to Section 3: Physical Environment – Economic Geology). Fieldwork carried out in and around the study area in the summer of 2017 determined that there is currently little or no known economic potential in or around the study area. At the time of the writing of these lines, however, the eastern portion of the study area had not yet been analyzed.

Since 1992, staking, map designation, mineral exploration and mining have been prohibited in the territory reserved for park purposes which covers 3,850 km^2, as shown on Map 1.1. An application for the temporary suspension of the granting of mining titles in the eastern portion of the study area has been submitted to the Ministère de l'Énergie et des Ressources naturelles (energy and natural resources, MERN) (Refer to the Map 3.3 Economic Geology in Section 3: Physical Environment). The MERN will only be able to respond after studying the mineral potential of this sector. To date, no mining titles have been issued in the study area for the Parc national Iluiliq Project.

LAND USE IN THE STUDY AREA

LAND USE BY INUIT

The traditional subsistence activities of Inuit are complex, strategic and opportunistic. Harvesting activities, such as hunting, are dependent on several factors including wildlife behaviour, the relationship between the environment and resources, and environmental disturbances (Strata360, 2007). Due to this complexity, land use will be covered broadly in this document.

The coastal region of the study area is rich in wildlife resources and is used intensively by Inuit for their subsistence activities. Resources such as seal, beluga, geese and ducks are highly popular among the Inuit of Salluit and Ivujivik (Figure 2.2). The inland region of the study area is more important for arctic char, caribou and geese.

Travel routes in the region of the park project are limited by the rugged topography. The Rivière Guichaud is a natural winter route for both snowmobiles and dogsleds. It ensures a link between Salluit and Ivujivik. In summer, the study area is mainly accessed by freighter canoes and other motorized watercraft along the coast. Opportunities for shore landings along the coast are limited due to the precipitous cliffs and the strong currents of Hudson Strait. Freighter canoes are also only able to enter the Rivière Guichaud for a short distance at low tide (Figure 2.3).

The study area includes a few hunting and fishing camps, essentially around the bays at *Anngiit*, Qarliik and *Kangirsukallak* where shore landings can be made. In fact, a majority of the camps in the region are concentrated around the communities of Salluit and Ivujivik (Figure 2.4).

Figures 2.2 through 2.4 are based on interviews conducted towards the end of the 1970s. The data on traditional ecological knowledge was subsequently archived by the Makivik Corporation in the Land Use and Ecological Database.

URBANIZED AREA

Land occupancy is concentrated on Category I lands, i.e. within community boundaries where residents, infrastructure and municipal services are found. Beyond community boundaries, access is more difficult although resource use is intensive and subsistence activities are carried out year round according to wildlife migrations.

MASTER PLAN FOR LAND USE

The *Master Plan for Land Use in the Kativik Region* identifies land uses in the region (KRG, 1998). Taking into account the rules applicable to Category I, II and III lands, the Master Plan designates essential subsistence harvesting areas and important subsistence harvesting areas, as well as areas of interest. The Parc national Iluiliq Project is designated in the Master Plan as a sector of archaeological and aesthetic interest as well as a potential national park site.

Subsistence Harvesting Areas

Subsistence harvesting areas were identified by the Makivik Corporation in a study concerning traditional and current land use by Nunavik Inuit (Makivik Corporation, 1992). These areas are necessary for hunting, fishing, trapping and gathering activities, and are used regularly by beneficiaries. Essential subsistence harvesting areas make up about 14% of the study area and important subsistence harvesting areas make up a little more than 70% (Map 2.5).

The objectives for these areas may be summarized as follows:

- promote and ensure the continuation of subsistence harvesting activities;

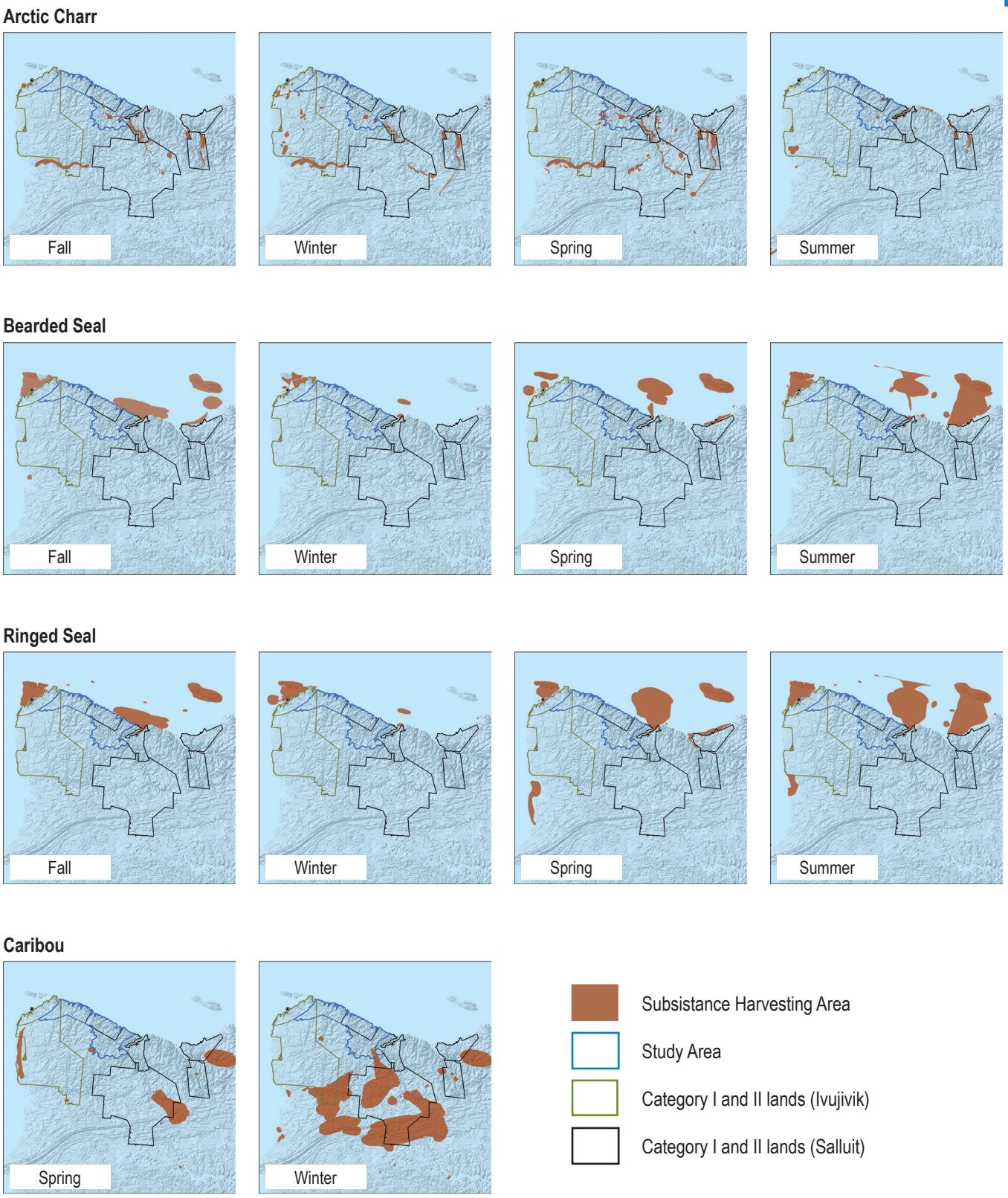


Figure 2.2 Overview of Inuit Land Use for Subsistence Harvesting According to Season and Wildlife Species

Source: Makivik Corporation

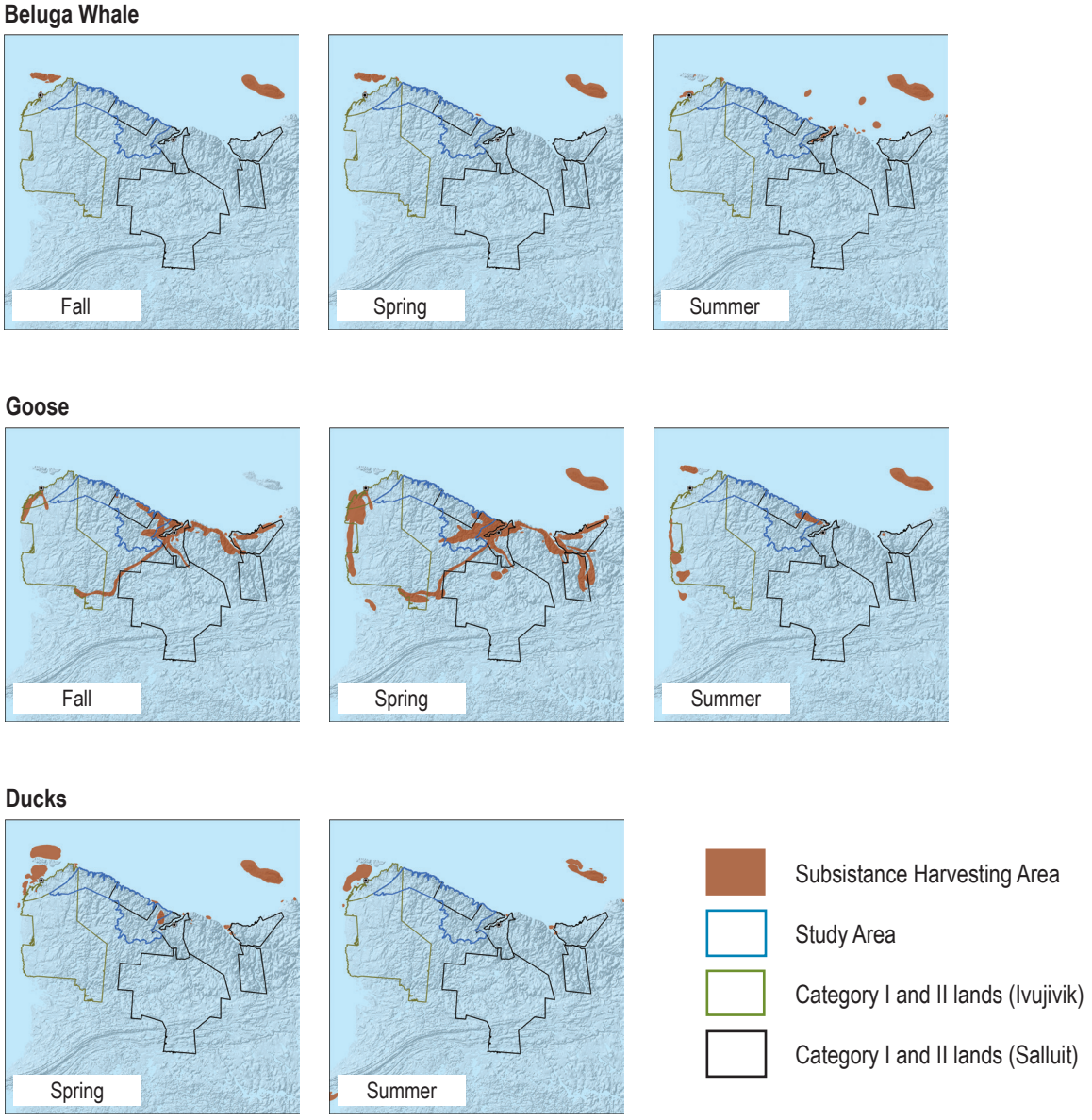


Figure 2.2 (cont'd) Overview of Inuit Land Use for Subsistence Harvesting According to Season and Wildlife Species
Source: Makivik Corporation

- allow economic development projects to proceed, taking into account the characteristics of these areas to ensure their continuation.

In addition to subsistence harvesting activities, other activities permitted in these areas include:

- archaeological activities;
- scientific, cultural, educational and tourist activities;
- activities related to the conservation and protection of resources;
- other activities that do not compromise representative elements, biological resources and the practice of subsistence activities.

The main directives concerning land use in these areas stipulate that any project, other than those related to subsistence harvesting activities, could involve specific agreements between the parties concerned. As well, all project proponents must submit to the KRG comprehensive development plans, and they must comply with conservation and environmental protection regulations.

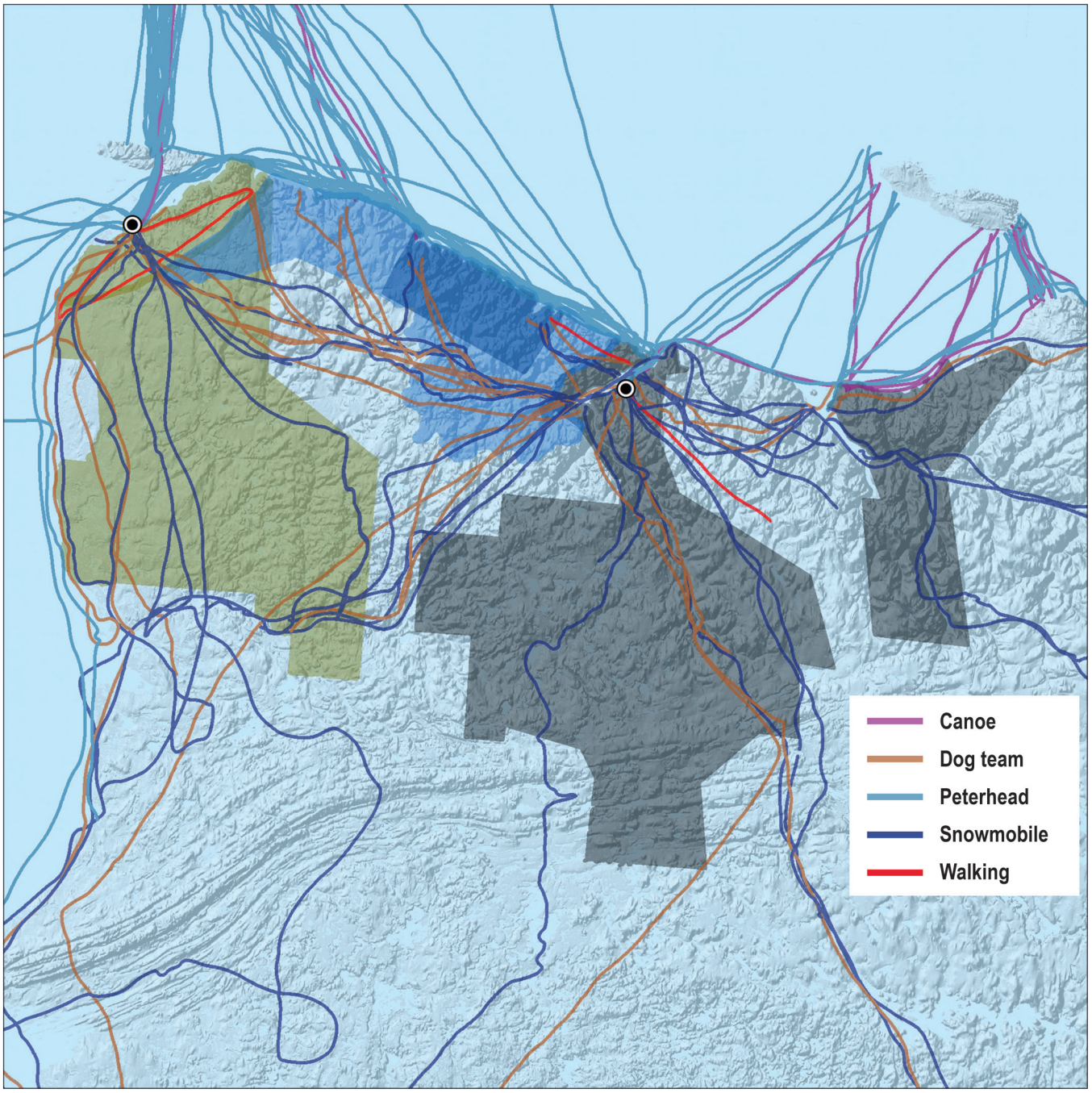


Figure 2.3 Overview of Inuit Territory Access

Source: Makivik Corporation

Areas of Interest

The Master Plan lists the parts of the territory that have historical, cultural, aesthetic and ecological interest. The Cap Wolstenholme area is identified as an area of archaeological and aesthetic interest. It is here that the Hudson's Bay Company established a trading post at the beginning of the 1900s. The area is therefore considered of historical interest and could potentially contain Inuit sites from the prehistoric and historic periods. Located between the communities of Ivujivik and Salluit, the study area for the Parc national Iluiliq Project possesses huge cliffs, cirques and fjords. It is also a nesting site for one of the largest colonies of thick-billed murre (*Uria lomvia*). The area therefore has historical, archaeological, cultural and ecological value, as well as outstanding natural features.

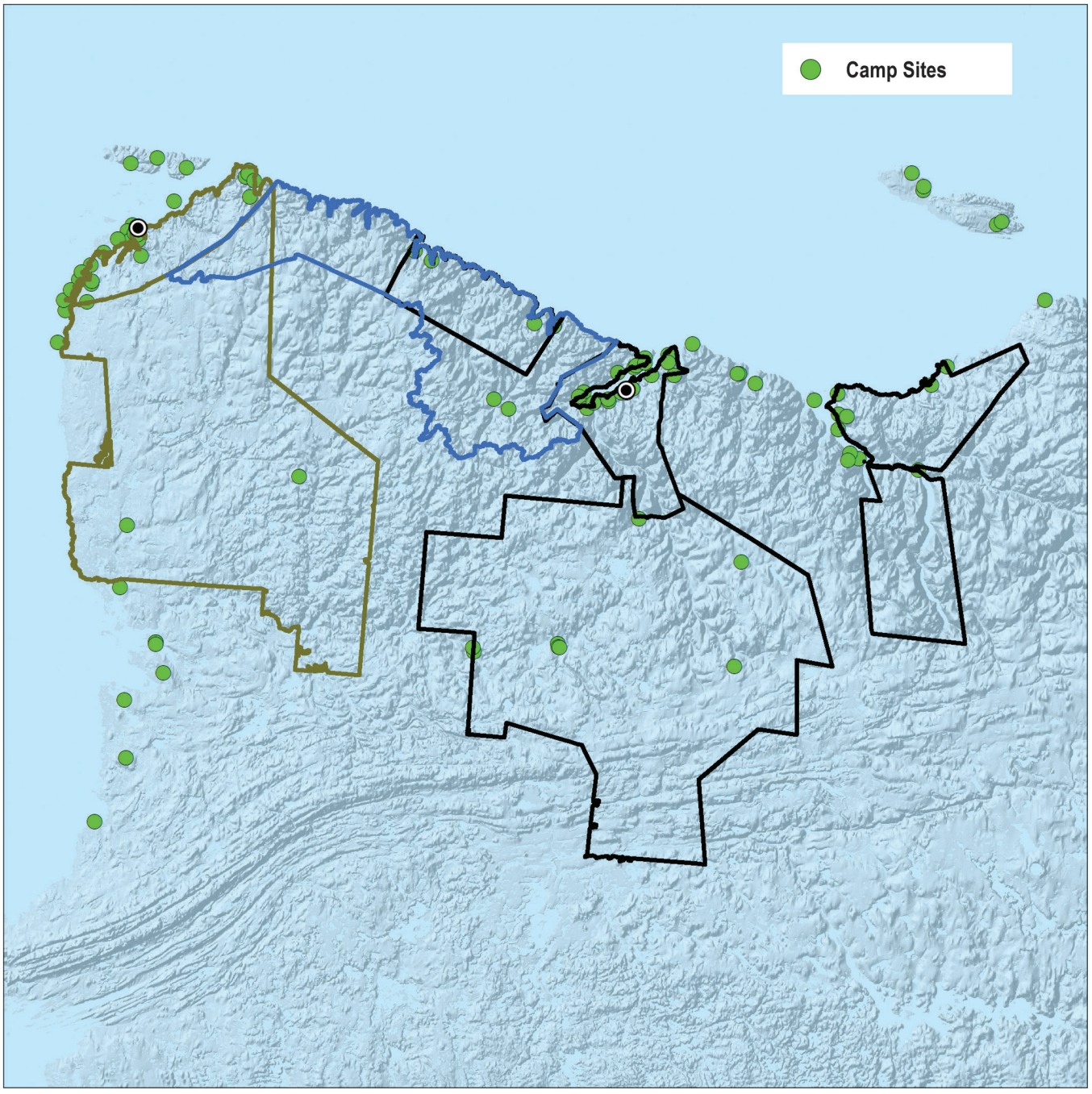


Figure 2.4 Inuit Camps in the Study Area

Source: Makivik Corporation

The Master Plan also places emphasis on important traditional harvesting areas according to four groups of wildlife resources: birds, fish, marine mammals and land mammals. Map 2.6 shows these territories in the study area according to the number of wildlife groups harvested.

PROTECTED AREAS

Parc national du Cap-Wolstenholme Reserve

Areas of interest recognized by the Québec government were reserved for park purposes in 1991 and 1992[15]. These areas are representative of the natural regions of Québec

[15] Ministerial orders 91-92 and 92-170, concerning the withdrawal from staking, map designation, mineral exploration and mining on lands north of the 49th parallel in Northern Québec (*Gazette officielle du Québec*, August 7, 1991, and July 15, 1992).

Beluga hunting shelter on a point in the community of Ivujivik, facing towards *Anaulirvik*
Credit: Camille Le Gall-Payne

or possess outstanding natural features. These areas were approved by the residents of the Kativik Region and appear in the Master Plan (KRG, 1998).

The Parc national Cap-Wolstenholme Reserve covers 1,263 km^2, and was reserved from mining by Ministerial Order 91-92 dated August 7, 1991 (Map 1.1).

In 2012, Order-in-Council 639-2012 authorized the community of Ivujivik to select Category I and II lands. The transfer of Category I lands totalling 515.32 km^2 was formalized under Order-in-Council 407-2015 dated May 13, 2015.

Further to this process, the Québec government adjusted the size of the Parc national Cap-Wolstenholme Reserve to exclude Category I lands, thereby reducing the total area of the reserve to 777.49 km^2.

Map 1.1 shows the national park reserve established in 1991 and as modified further to the selection of Category I lands by the community of Ivujivik in 2015, as well as the study area defined by the working group in 2015. The study area covers a total 2,164.70 km^2.

Caribou Calving Grounds

A caribou calving ground is an area where the females of a herd congregate and give birth. They remain in the area for several weeks until their calves grow strong enough to join the species' long migration. As calves are particularly vulnerable during this period, the Québec government has adopted regulations to protect caribou calving grounds (Hamann, 2011).

North of the 52nd parallel, there exist caribou calving grounds defined by the Ministère des Forêts, de la Faune et des Parcs (forests, wildlife and parks) as "a territory frequented by at least five caribou cows per square kilometre from May 15 to July 1". These territories are designated in the *Regulation respecting Wildlife Habitats*[16] and Chapter IV of the *Act respecting the Conservation and Development of Wildlife*[17] (MDDEP, 2010). Any activity identified in the Regulation as a potential disturbance for caribou is prohibited in the designated wildlife habitat from May 15 to July 31.

The study area does not overlap any portion of a protected calving ground according to existing legislation, which currently situates a protected calving ground southeast of the study area for the Parc national Iluiliq Project. Notwithstanding, the calving ground determined with telemetry-positioning data produced by satellite telemetry collars worn by some female caribou, and therefore different from legally designated calving ground, overlaps an eastern section of the study area (Figure 4.4). Protected calving grounds will nonetheless need to be redefined in the coming years as their locations shift over time (Vincent Brodeur, MFFP, pers. comm.).

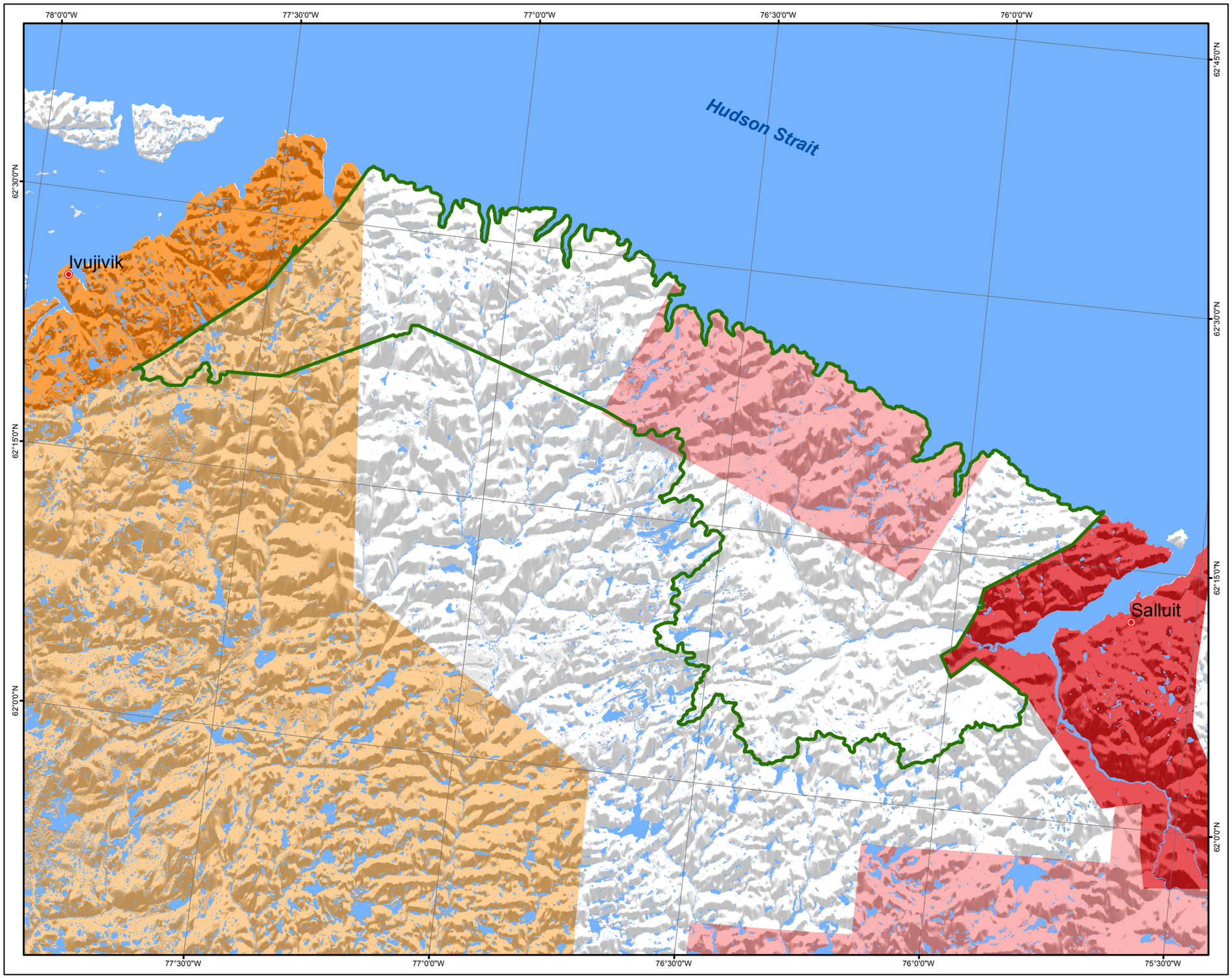
Inuit family seal hunting in the study area
Credit: Alain Thibault

[16] *Regulation respecting Wildlife Habitats*, CQLR, c. C-61.1, r. 18.

[17] *Act respecting Conservation and Development of Wildlife*, CQLR, c. C-61.1.

PARC NATIONAL ILUILIQ PROJECT

Land Regime



Study area

Ivujivik

Category I lands

Category II lands

Salluit

Category I lands

Category II lands

Source : MERN (2014)

Map Scale : 1:400 000

0 5 10 20 km

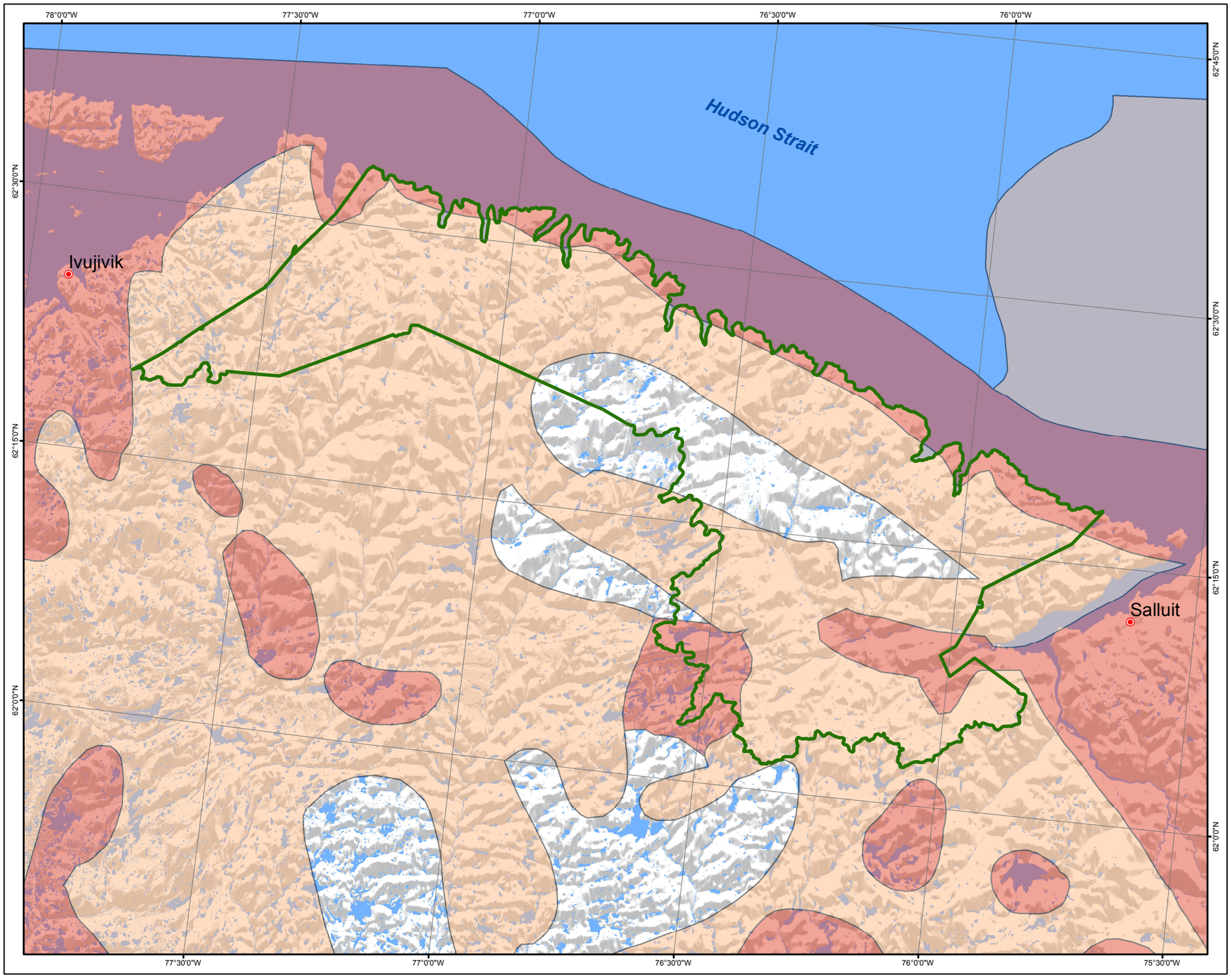
Geodetic datum : NAD 83
Coordinate system : Québec Lambert

August 2018

Map 2.1

Land Regime

Map 2.1



PARC NATIONAL
ILUILIQ PROJECT

Subsistence Areas

- Study area
- Essential subsistence areas
- Important subsistence areas

Source : ARK (1998)

Map Scale : 1:400 000

0 5 10 20 km

Geodetic datum : NAD 83
Coordinate system: Québec Lambert

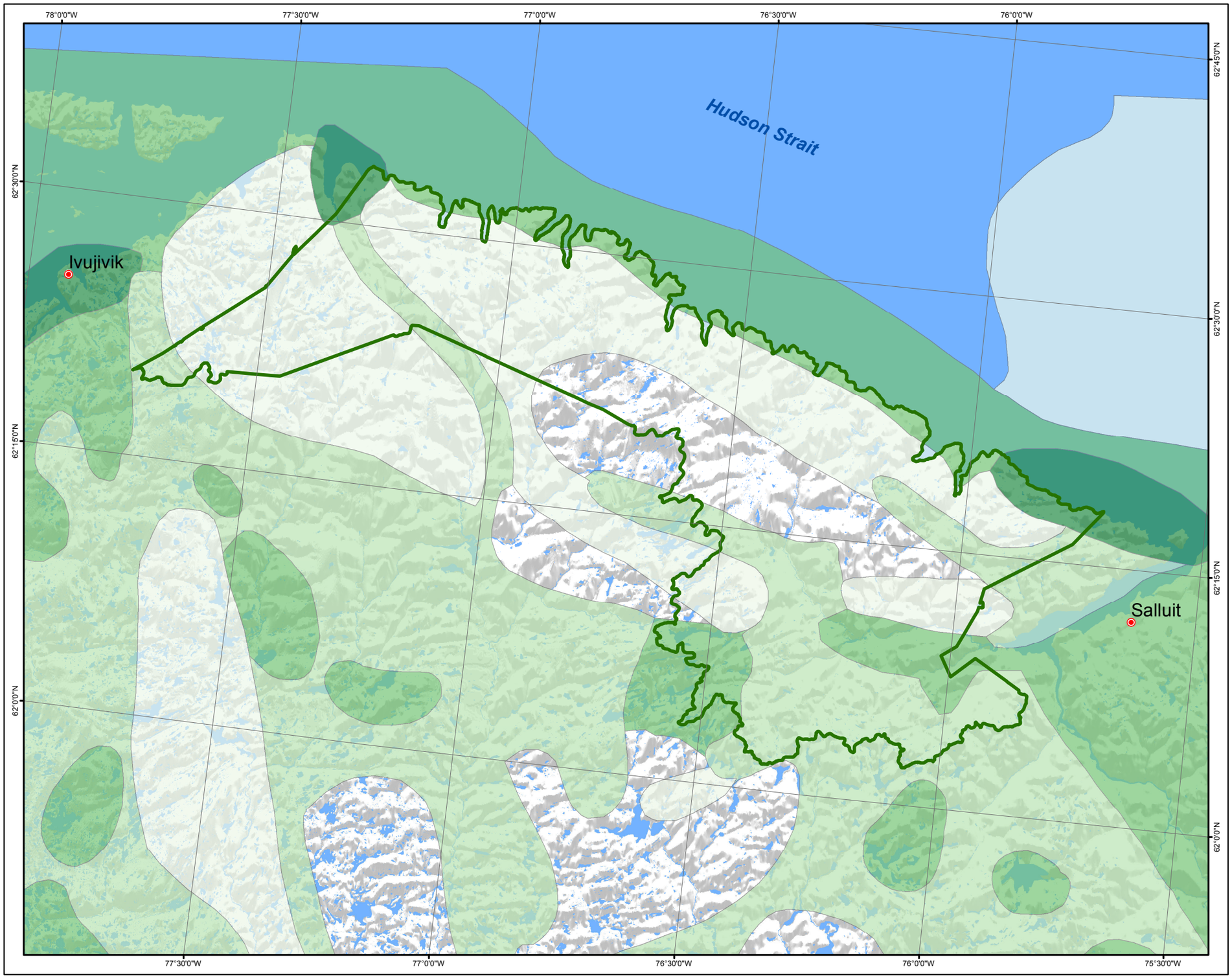
KATIVIK

August
2018

Map 2.2

Subsistance Areas

Map 2.2



PARC NATIONAL
ILUILIQ PROJECT

Harvested Wildlife Groups

Study area

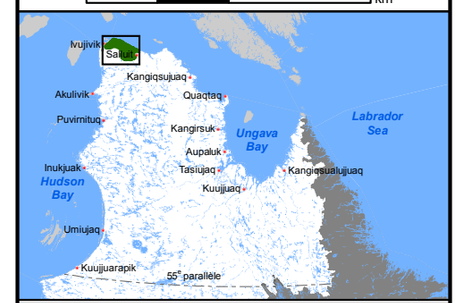
Harvested wildlife groups number among the following: birds, fishes, sea mammals and terrestrial mammals

1
2
3
4

Source : ARK (1998)

Map Scale : 1:400 000

0 5 10 20 km



Geodetic datum : NAD 83
Coordinate system: Québec Lambert

August 2018

Map 2.3

Harvested Wildlife Groups

Map 2.3

3 PHYSICAL ENVIRONMENT

Kangirsukutaak
Credit: Alain Thibault

CLIMATE

Climate is influenced by various factors, such as elevation, latitude and continentality (distance from large water bodies) (Gerardin and McKenney, 2001; Gouvernement du Québec, 2017). The climate of Québec is cold and humid and is largely determined by its northern position and the maritime influence (Gouvernement du Québec, 2017). The province is divided into five climatic zones and is characterized by wide gradients in temperature and precipitation (Figure 3.1) (Rizzo and Wilken, 1992; Gouvernement du Québec, 2017). Temperatures warm according to a north–south gradient, while precipitation increases from northwest to southeast. Nunavik has two climatic zones: subarctic in the south and arctic in the north. The subarctic climate is marked by long, frigid winters, and short, cool summers. It occurs mainly between the 50th and 58th parallels. Precipitation is scant. The arctic climate affects the northernmost areas of Québec and is characterized by harsh, cold and dry winters, and a short thawing period. The region records the lowest level of precipitation in Québec (Gouvernement du Québec, 2017). The boundary between these two climatic zones corresponds to the transition between the boreal coniferous forest and the arctic tundra, further detailed under the Vegetation heading in Section 4: Biological Environment.

Fog entering the study area
Credit: Benoît Tremblay

CLIMATE IN NUNAVIK

Marked by cold, harsh winters, followed by a short thawing period, Nunavik's climate is highly influenced by polar air masses that originate predominantly in the northwest. The presence of these polar air masses contributes, among other things, to low humidity, giving the region the lowest level of precipitation in the province (Gouvernement du Québec, 2014). Total annual precipitation in Nunavik is between 292 and 850 mm, while it is closer to between 989 and 1,547 mm in southern Québec (Figure 3.2). The climate is also deeply influenced by low solar radiation in winter as well as long periods of sunshine in summer. Mean annual temperatures in Nunavik range between −10.8 and −5°C (Figure 3.3). The mean temperatures of the three hottest months (June, July and August) range from 1.3 to 11.6°C, and those of the three coldest months (December, January and February) range from −25.4 to −19.5°C (Figures 3.4 and 3.5). Low mean temperatures make the growing season very short, i.e. between 100 and 125 days (Figure 3.6) (MDDELCC, 2014b).

Fog entering the study area and snow lasting until August
Credit: Benoît Tremblay

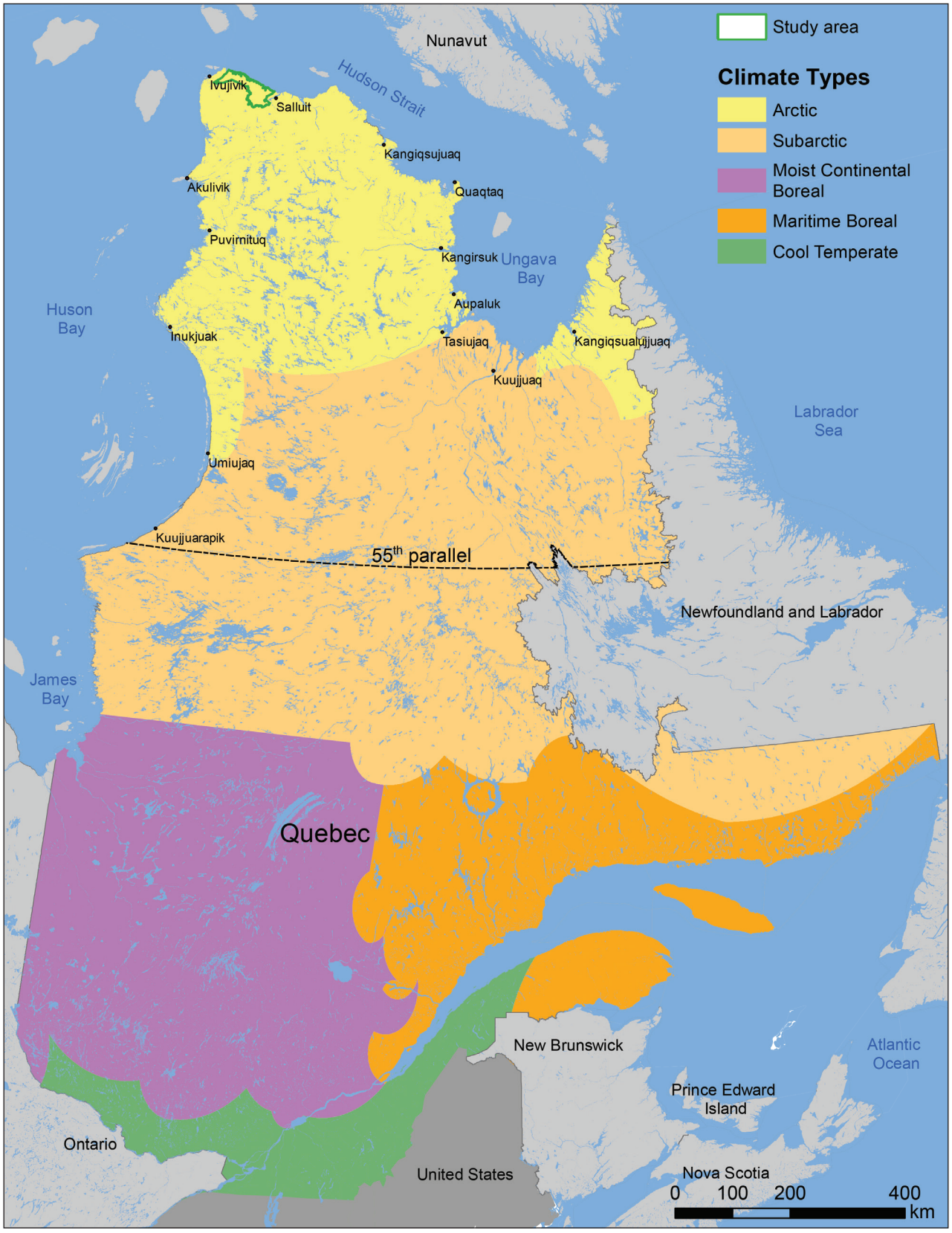


Figure 3.1 Climate Types of Québec

Source: adapted from Rizzo and Wilken (1992)

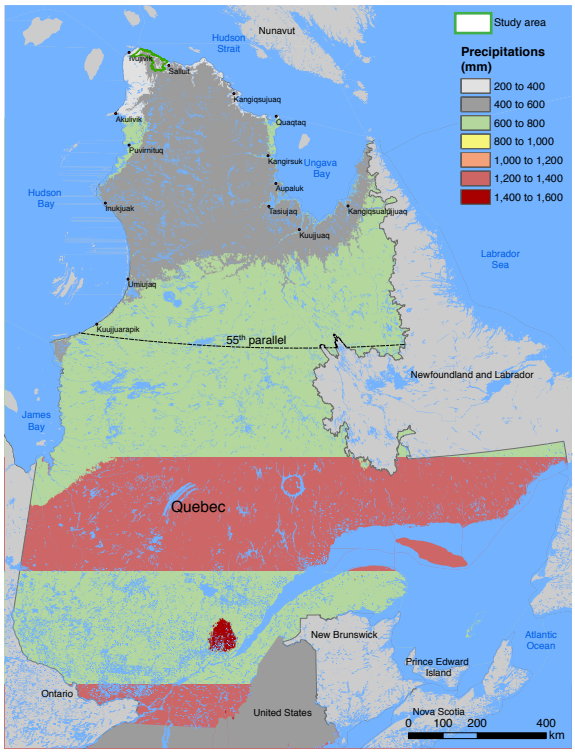


Figure 3.2 Mean Annual Precipitation (1966-1996)

Source: Gerardin and McKenney (2001)

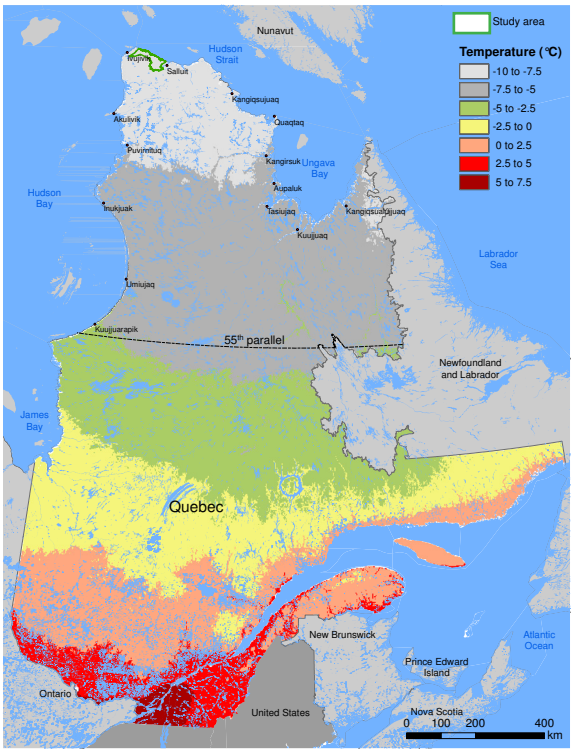


Figure 3.3 Mean Annual Temperature (1966-1996)

Source: Gerardin and McKenney (2001)

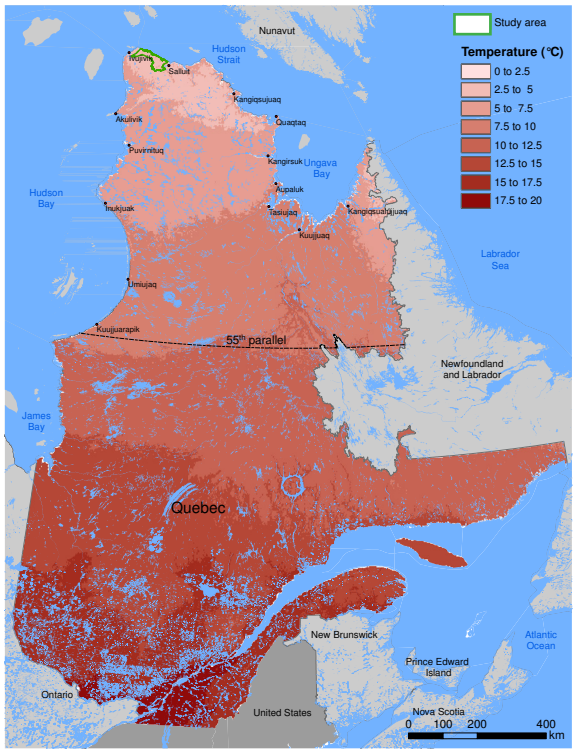


Figure 3.4 Mean Annual Temperature for the Three Warmer Months (1966-1996)

Source: Gerardin and McKenney (2001)

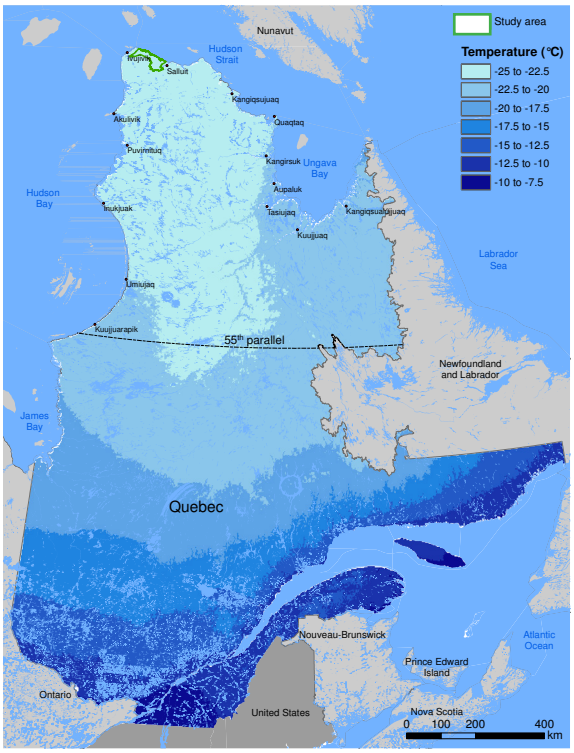


Figure 3.5 Mean Annual Temperature for the Three Coldest Months (1966-1996)

Source: Gerardin and McKenney (2001)

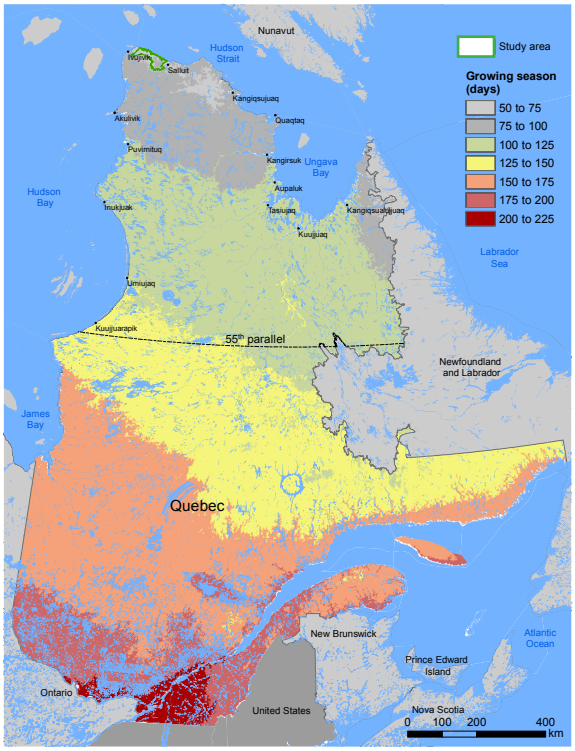


Figure 3.6 Mean Annual Length of the Growing Season (1966-1996)

Source: Gerardin and McKenney (2001)

CLIMATE OF THE STUDY AREA

Located on the northern tip of the Ungava Peninsula, the study area for the Parc national Iluiliq Project has a semi-arid polar climate with a very short growing season, typical climate of northern coastal environments (Gerardin and McKenney, 2001; Charron, 2015). Situated between the northern villages of Ivujivik and Salluit, the climate of the study area is highly influenced by the proximity of Hudson Bay, Hudson Strait and the Labrador Sea, which are major sources of humidity. These masses of open water moreover have a strong impact on the regional climate when their ice cover are at their lowest point, around mid-September (Barrette *et al.*, 2016). Precipitation data for the period between 1981 and 2010 indicate total monthly maximums of 70 mm near the end of summer, i.e. in August and September. This is the period when mean monthly temperatures are relatively high, running between 2.8 and 6.5°C. Ice cover in Hudson Strait forms around December and precipitation decreases (Barrette *et al.*, 2016).

The following section outlines the climate profile of the study area based on a report prepared by the Centre d'études nordiques at Université Laval combining data on climate trends and variability in the region of the Parc national Iluiliq Project (Barrette *et al*., 2016). It is important to note that, despite being located between two communities, the area has been little studied and little environmental data over space or time has been recorded. The small number of meteorological stations, the short durations of recorded time series and the many discontinuities inherent in these data sets are limits to consider when characterizing the climate of the region. This characterization is based on a combination of several climate data sets, sporadic time series observations and re-analyses of climate data (Barrette *et al.*, 2016).

Recent Climate Variability and Trends

Day Length

Given its northerly latitudes, day length varies widely in Nunavik according to the season, with profound impacts on radiation balance. In Ivujivik for example, daytime was 20 hours and 59 minutes long on the 2017 summer solstice (the longest day of the year, recorded on June 21, 2017): the sun rose at 2:14 a.m. and set at 11:13 p.m. Eastern Standard Time (EST). On the 2017 winter solstice (the shortest day of the year, recorded on December 21, 2017), daytime lasted only 4 hours and 59 minutes: the sun rose at 9:40 a.m. and set at 2:39 p.m. EST (The Weather Channel, 2018a). At Salluit (62°12' N), located a little further south than Ivujivik (62°25' N), daytime on the 2017 summer solstice was 20 hours and 50 minutes: the sun rose at 2:09 a.m. and set at 10:59 p.m EST. On the winter solstice, daytime was 5 hours and 5 minutes: the sun rose at 9:28 a.m. and set at 2:33 p.m. EST (The Weather Channel, 2018b).

Growing Season

As northern Québec possesses weak radiation balance and mean annual temperatures below the freezing point, the growing season is very short. By definition, the growing season begins when mean daily temperatures are equal to or above 5°C for at least five consecutive days after March 1. It ends after August 1 when minimal daily temperature is below −2°C (MDDELCC, 2002). For the region of the study area, the growing season is roughly 96 days (±2.5 days) long, beginning on June 28 (±4.5 days) and ending on October 3 (±2.5 days) (Table 3.1) (Barrette *et al*., 2016).

Growing degree-days is an index of the total heat, superior to 5°C, available for plants on a daily basis during the growing season. Growing degree-days for a given day is a measure of the difference in degrees Celsius between the mean daily temperature and 5°C. This value is often used in agriculture as an index for crop growth. In the study area, the annual total of growing degree-days is 239 (±45 growing degree-days) (Table 3.1), while it is 2,184 in Montreal (Environment Canada, 2014a). This index illustrates the shortness of the growing season in Nunavik, and especially in the region of the study area.

Table 3.1 Summary of Indices Calculated with Air Temperature Data

Index	Average
Mean annual temperature	-8.4°C (±0.9)
Length of the thawing season	94 (±4.17) days
Start of the frost-free period	June 20 (±2.7 days)
End of the frost-free period	September 22 (±1.8 days)
Number of freezing degree-days	3707 (±231 FDD)
Number of thawing degree-days	718 (±80 TDD)
Number of growing degree-days	239 (±45 GDD)
Length of the growing season	96 (±45 GDD)
Start of the growing season	June 28 (±4.5 days)
End of the growing season	October 3 (±2.5 days)
Mean temperature (Dec.-Jan.-Feb.)	-24.5°C (±1.9)
Mean temperature (March-April-May)	-12.43°C (±1.2)
Mean temperature (June-July-Aug.)	6.14°C (±0.6)
Mean temperature (Sept.-Oct.-Nov.)	-3.13°C (±0.5)

(Standard deviation was calculated using values from each grid point for the average of the four reanalyses covering the region of the Parc national Iluiliq Project, and mean error was determined according to the standard deviation between the values of the four reanalyses.)

Source: Barrette *et al.* (2016)

Air Temperature

Mean annual air temperature in the study area is −8.4°C (±0.9) (Table 3.1). Since this value affects a number of components of the cryosphere and is associated with an array of processes, air temperature is an important variable in northern regions (Derksen *et al.*, 2012). It can be influenced by many factors such as latitude, elevation, proximity to the coasts and the presence or absence of sea ice cover (Brown *et al.*, 2018). As well, the temperature contrast between the land, which warms up more quickly in early summer and cools down faster in fall, and the sea is clearly illustrated in Figure 3.7.

The mean temperature for the months of June, July and August is 6.14°C (±0.6), resulting in a relatively short summer lasting an average of 94 (±4.17) days. The mean temperature of the coldest quarter, which runs from the beginning of December to the end of February, is −24.5°C (±1.9). In this region, temperatures remain consistently below 0°C for about eight months of the year. The frost-free season runs on average from June 20 to September 22 (Table 3.1 and Figure 3.8).

The region around the study area for the Parc national Iluiliq Project is experiencing an increasing temperature trend that is among the highest in the Northern Hemisphere: a winter-month temperature surge of 2.5°C per decade between 1993 and 2012. Regarding mean annual temperatures, the increase recorded since 1993 for the study area is approximately 1.03°C per decade (Barrette *et al.*, 2016).

Wind Chill

The wind chill index expresses the loss of body heat for an average person due to wind speed. For example, when the outdoor temperature is −20°C and wind speed is 20 km/h, according to the wind chill index the temperature feels like −30°C (Ganem *et al.*, 2006; Environment Canada, 2014b). Moreover, when wind chill temperatures drop under −27°C, the risk of frostbite increases significantly (Table 3.2) (Ganem *et al.*, 2006). Given that the mean temperature of the coldest months in the study area is −24.5°C (±1.9), the risk of frostbite may be considerably higher, depending on wind speed.

Precipitation

Precipitation is an important climate variable because it acts directly on the availability of water resources, the thermal dynamics of permafrost, which affects ground stability, and impacts on a number of biological factors inherent to northern environments. Data for the region of the Parc national Iluiliq Project show little precipitation. In fact, annual precipitation is estimated to be 531 mm (±145), half of which falls in solid form (Table 3.3). Within one year, August, September and October receive the highest rate of precipitation, with monthly average totals of 75, 77 and 63 mm, respectively. The lowest rates of precipitation occur in January and February with average monthly totals of less than 20 mm (Figure 3.9) (Barrette *et al.*, 2016).

Total annual amounts of precipitation show a significant inter-annual variability: since the 1950s, they have increased by 6 mm per decade. Although the trends observed are positive for all seasons, a smaller increase is noted for the summer months (June to August). The trend for total precipitation during this summer quarter shows an increase of 2.8 mm per decade (Barrette *et al.*, 2016). The trend for the same period during the winter quarter (December, January and February) shows an increase in total precipitation of 5.4 mm per decade, which is significant (Barrette *et al.*, 2016).

Snow Cover

Some of the topographic and environmental characteristics of the study area, such as the precipitous coastline of Hudson Strait, moisture supply and wind conditions, are likely to cause wide variations in snow cover thickness over relatively short distances (Barrette *et al.*, 2016). The assessment of this weather variable and its temporal characterization continue to be a challenge in northern regions, and more specifically in the study area since the closest meteorological station

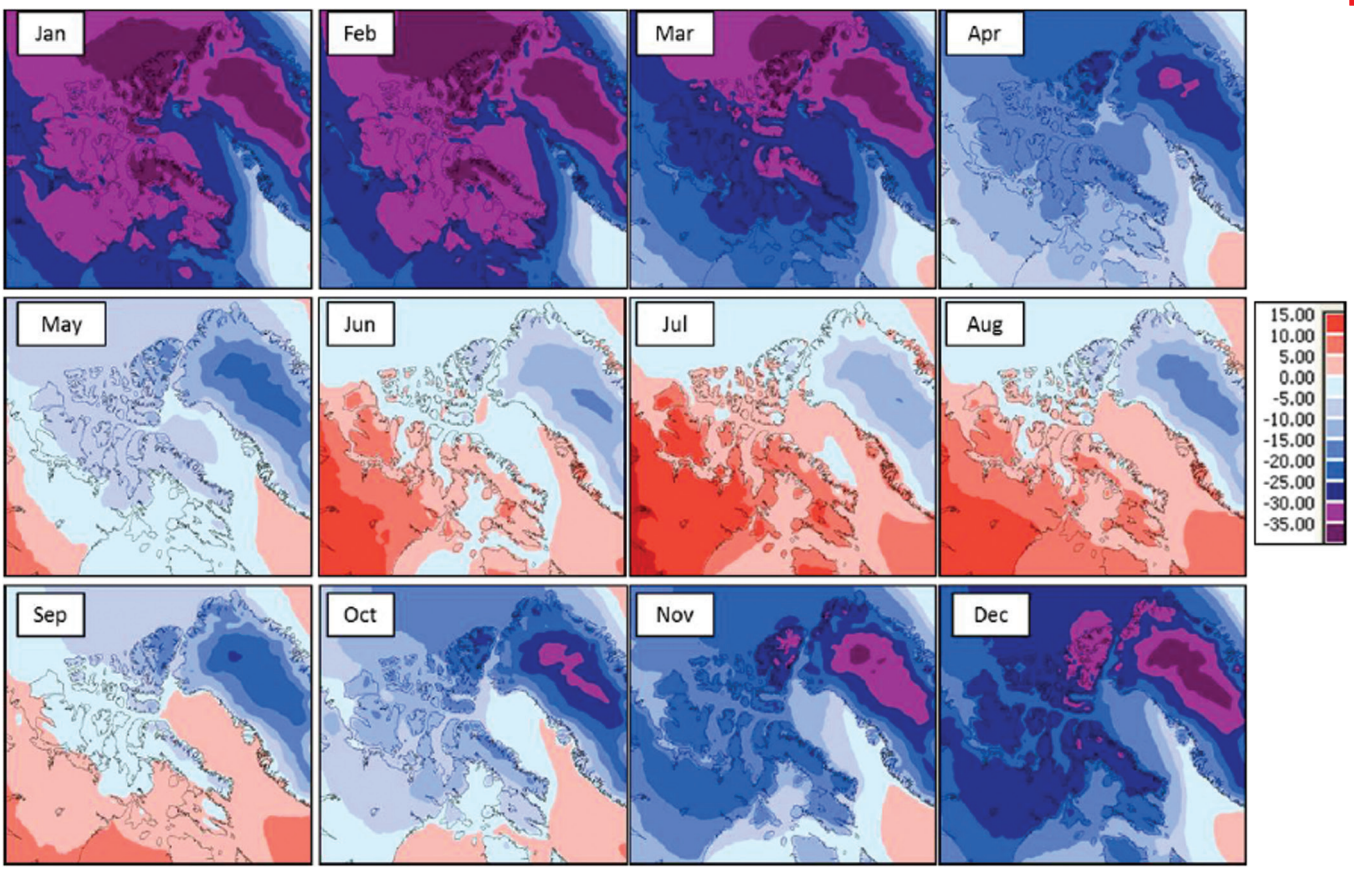


Figure 3.7 Mean Monthly Surface Air Temperature (°C) for the 1989-2009 period

Source: Brown *et al.* (2016)

is at Quaqtaq, about 450 km southeast of the study area. Moreover, snow data were recorded there only between 1943 and 1980. To provide a general profile of climate data concerning snow, its variability over time and recent trends, use of reconstructed data sets pertaining to the Cap Wolstenholme area is necessary.

Snow cover highly influences permafrost, vegetation and wildlife. Typically, snow cover in the northern Ungava Peninsula forms between the end of September and mid-October (60 to 75 days after August 1) and disappears near the end of June (315 to 330 days after August 1). It is estimated that snow cover in the Cap Wolstenholme region

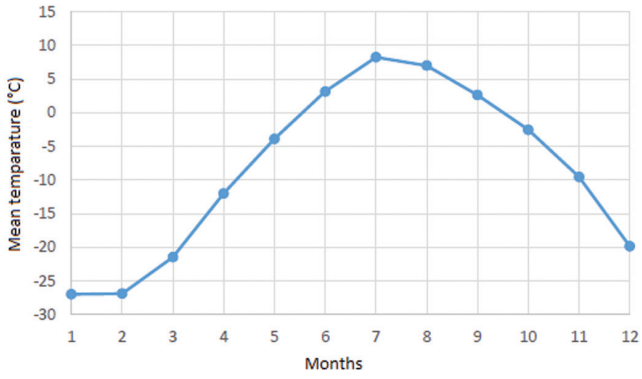


Figure 3.8 Mean Monthly Temperature Climate Normal (°C) for the 1981-2010 period

Source: Charron (2015)

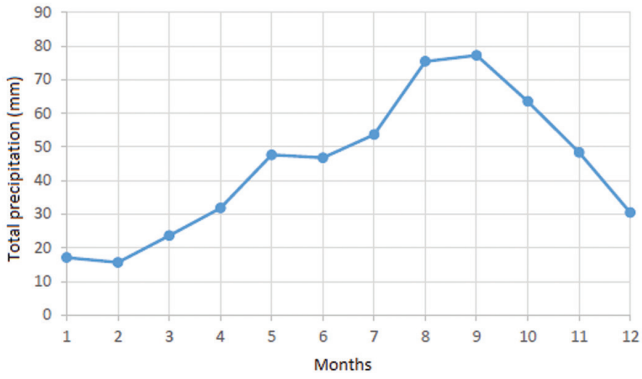


Figure 3.9 Mean Monthly Precipitation Climate Normal for the 1981-2010 period

Source: Charron (2015)

Table 3.2 Wind Chill Calculation

V^{10} (km/h)	T^{AIR} (°C)											
	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

Risk of frostbite during exposure to cold

Low risk	Moderate	High risk	Danger

T^{air} = Actual air temperature in °C **V^{10} = Wind speed at 10 m elevation in km/h**

1. For a given combination of temperature and wind speed, the wind chill index corresponds to the temperature that an individual would feel. For example, with a wind of 20 km/h and a temperature of 25°C, it would feel to a person more like 37°C.
2. Wind chill does not affect objects and does not lower the actual temperature. It only describes how a human being would feel in the wind at the ambient temperature.
3. The wind chill index does not take into account the effect of sunshine. Bright sunshine can reduce the effect of wind chill (making the temperature feel warmer) by 6 to 10 units.

Source: adapted from Ganem *et al.* (2006) and Environment Canada (2014b).

lasts about 250 days (Figure 3.10), i.e. a lengthy period of nine months per year. It would also be reasonable to assume that the Hudson Strait coast has the heaviest snowfall rate in Nunavik, estimated by snow water equivalent. The snow cover analysis provided in Barrette *et al.* (2016) nonetheless shows annual snow cover trending downward at the rate of 7.5 days per decade between 1979 and 2013.

On the Ungava Peninsula, including in the study area, snow displaced by wind and piled up against topographic features can last for a considerable part of the summer, and even until the end of August, according to Lauriol *et al.* (1984). A mass of snow heaped up by the wind and deposited along an obstacle or an irregularity of the terrain is called a snowdrift (World Meteorological Organization, 1992). On a local scale, snowdrifts contribute to variations in the ground's thermal regime and in the hydrological regime, and have ecological repercussions on wildlife and vegetation. In recent decades, snowdrift persistence in summer has been trending downward in the Canadian Arctic Archipelago, in correlation with the increasing number of degree-days above zero (Woo and Young, 2014). It is highly likely that this trend is observable across Nunavik.

Permafrost

Permafrost is defined as a layer of ground (or rocks) in which the temperature remains at or below 0°C for at least two consecutive years, regardless of the lithology, texture or ice content of the ground. This phenomenon is ubiquitous in cold regions of the planet (high latitudes and elevations).

Table 3.3 Summary of Indices Calculated with Precipiation Data (mm)

Indicator	Average (mm)
Total annual precipitation	531 (±145)
Annual solid precipitation	269 (±107)
Annual liquid precipitation	261 (±44)
Total precipitation (Dec.-Jan.-Feb.)	63 (±25)
Total precipitation (March-April-May)	103 (±34)
Total precipitation (June-July-Aug.)	175 (±33)
Total precipitation (Sept.-Oct.-Nov.)	189 (±58)

(Standard deviation was calculated using values from each grid point for the average of the four reanalyses covering the region of the Parc national Iluiliq Project, and mean error was determined according to the standard deviation between the values of the four reanalyses.)

Source: Charron (2015)

In Québec, permafrost is found mostly north of the 52nd parallel (Allard and Séguin, 1987).

The main factor governing the formation of permafrost is climate. When the mean annual temperature is sufficiently cold, permafrost can form in any type of terrain. Under milder climate conditions with more abundant precipitation, the development and distribution of permafrost depend on local conditions (discontinuous permafrost). Figure 3.11 shows a latitudinal gradient of permafrost distribution across Québec. In the southern portion, permafrost only forms in isolated sectors at high elevations or sporadic patches in peat bogs. Moving northward, it occurs in discontinuous patterns until it becomes continuous in the north of the province. The study area is situated in the zone of continuous permafrost, where the mean annual temperature is estimated to be −5 to −10°C at the depth of zero annual amplitude (ZAA) (Allard and Lemay, 2012; Brown *et al.*, 2014; Romanovsky *et al.*, 2015). It is defined as the depth at which the ground's seasonal temperature fluctuations are not observed, generally between 10 and 20 m, depending on the type of deposit. It should be noted that observations across the Arctic reveal warming trends in permafrost temperatures at the depth of the ZAA (Barrette *et al.*, 2016). Moreover, the warming trend observed in Salluit, which is very close to the study area, is a pan-cryospheric trend resulting from the direct effects of warmer air temperatures. A trend of near-constant increases in permafrost temperature of 0.53°C per decade was noted in the Canadian Arctic between 2002 and 2015 (Derksen *et al.*, 2012).

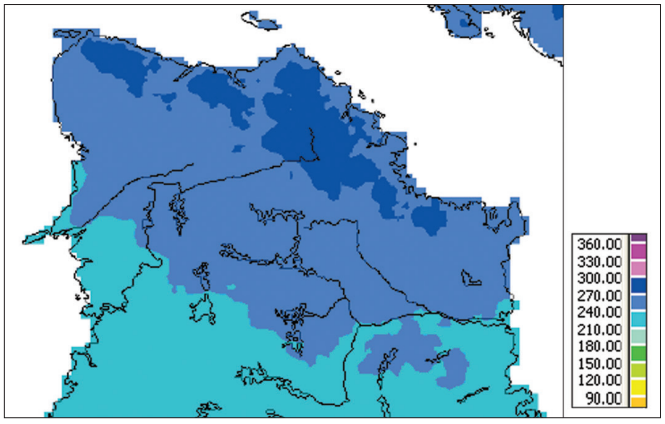


Figure 3.10 Mean Annual Snow Cover Duration (days) for the period between 2004/2005 and 2014/2015

Source: Barrette *et al.* (2016)

The layer of ground that freezes and then thaws each summer on the surface of the permafrost is called the active layer (Figure 3.12). Its thickness varies according to summer temperatures, ground thermal conductivity, the particle size of unconsolidated materials, albedo, water content and vegetation cover. Climate warming in Nunavik, and consequently ground temperature, is increasing the thickness of the active layer and the proportion of free water (not frozen) present on the surface of the permafrost. For example, data measured in rock at a site in Salluit show that the active layer deepened from 3.3 to 4.5 m between 2002 and 2010 (Barrette *et al.*, 2016). The increase in temperatures is causing greater instability in surface layers made up of unconsolidated materials, and leading to increased ground movements.

Ice Cover

Ice cover influences the coastal climate significantly and determines in large part the level of humidity in summer as well as in winter. Ice cover also contributes to reducing the erosion effect of strong waves along coastline formed by unconsolidated deposits. In northern environments, ice cover also directly affects individuals' ability to travel for hunting or to get to another community, as well as commercial shipping and sea fishing (Barrette *et al.*, 2016).

According to the Canadian Ice Service, between 1981 and 2010, ice in Hudson Strait formed on average at the beginning of December and broke up near the beginning of July (Figure 3.13). Ice cover melt continued until mid-August, by which time the quantity of ice was relatively stable, i.e. below 5% (Figure 3.14) (Barrette *et al.*, 2016).

Since the 1970s, the extent and thickness of sea ice have decreased considerably between May and October, a phenomenon that will no doubt result in economic impacts, especially on marine transportation. It will also affect surrounding ecosystems and environments (Barrette *et al.*, 2016).

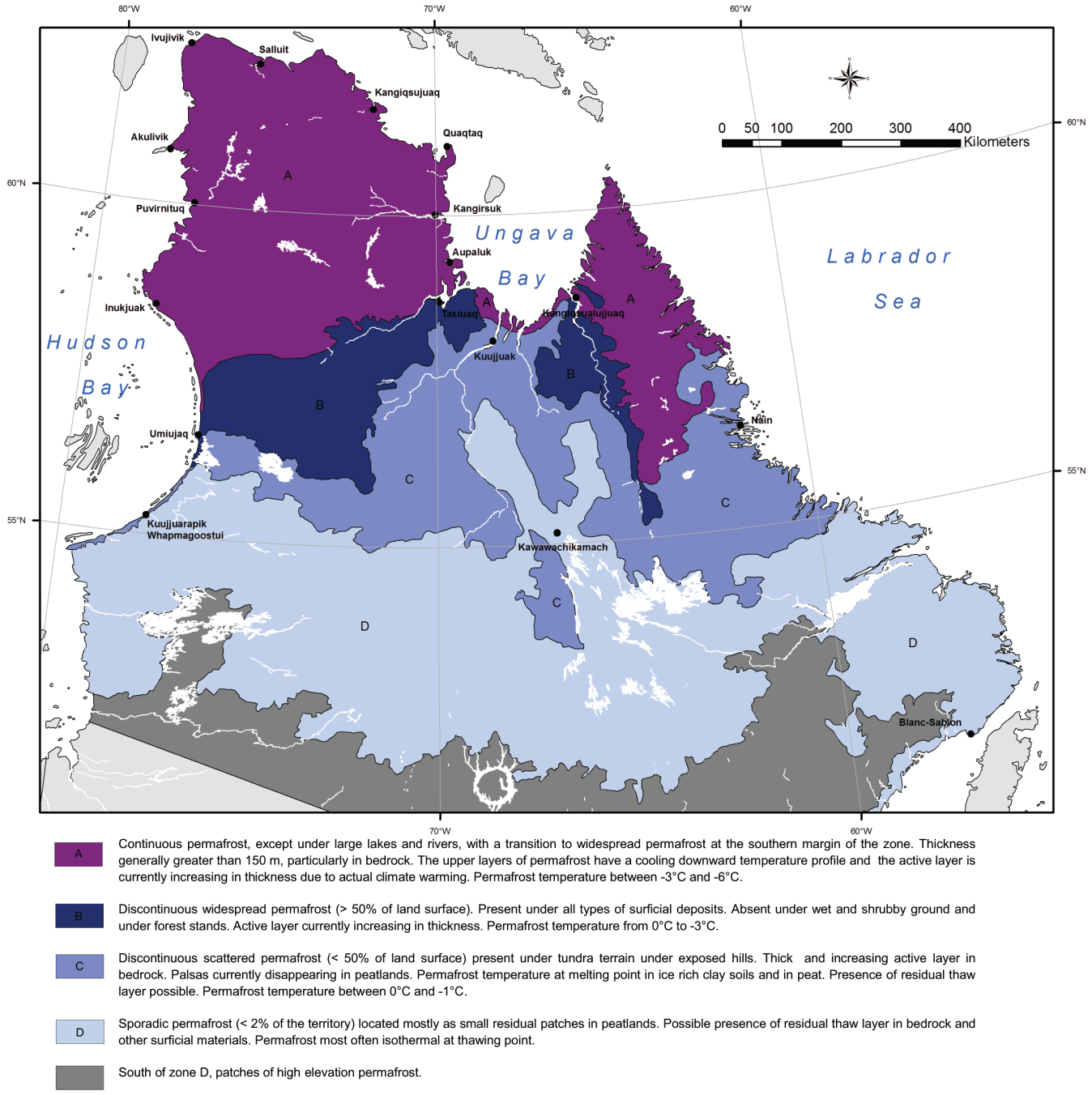


Figure 3.11 Distribution of Permafrost in Northern Québec

Source: Allard *et al.* (2012)

Cyclones, waves and storm surges

As the study area includes a coastal sector, wave patterns are an important climate variable. The study area is influenced by a mainly northwest-north wave pattern having a cyclone centre, i.e. a local low-pressure centre, located over the Labrador Sea. A second cyclone centre, located over central Hudson Bay, is also likely to affect the region of the study area. Whereas very strong depressions are rather rare in the Hudson Bay region (one or two per year), the Labrador Sea is one of the stormiest regions in the Northern Hemisphere (Savard *et al.*, 2014).

The formation of storms in the region results from thermal contrasts between land and sea. These contrasts are very

pronounced during the period when there is no sea ice. This contrast is strongest at the end of summer and in fall because of the warmer water temperature and a baroclinic zone, i.e. a contrast zone between warmer temperatures from the south and colder temperatures from the north, which contributes to the formation of cyclones with considerable impacts on wave patterns. The period between August and December is particularly conducive to the formation of slow-moving storms (Barrette *et al*., 2016).

In recent decades, anticyclonic circulation patterns have become more frequent (Overland *et al.*, 2012). These patterns are associated with typical summer conditions and sea ice decline (Petrie *et al.*, 2015) and are related to steadier and more abundant snow and ice melt (Bezeau *et al.*, 2014; Sharp *et al.*, 2014). Some studies have shown longer and less regular alternating periods between cyclonic and anticyclonic patterns, and that these changes are associated with higher freshwater input from the melting of the Greenland Ice Sheet (Bamber *et al.*, 2012; Proshutinsky *et al.*, 2015). A trend toward later ice freeze-up and earlier break-up has also been observed across Canada (Lacroix *et al.*, 2005).

The combination of high tides, low atmospheric pressure and strong winds can generate storm surges, i.e. water levels above predicted tides. Wave patterns can thus have significant effects on coastal erosion and may damage coastal infrastructure. Storm surges are more likely to happen when there is no sea ice, an increasingly frequent occurrence in the sector (Atkinson, 2005).

Climate Change Forecasts

There is no question that the Arctic has seen the highest climate warming trends of any region on earth in recent decades. Major impacts have been noted on the cryosphere, vegetation as well as terrestrial and aquatic wildlife as a result of amplification, a phenomenon involving interaction between atmospheric and oceanic processes and feedback effects (Brown *et al.* 2018). The analysis of climate trends in northern regions thus presents a steep challenge.

The impact of temperature on biodiversity in Québec is very important and temperature is the climatic component undergoing the greatest change in the 21st century (Berteaux *et al.*, 2014). Phenology and the distribution of some species have already been affected by climate change (Walther *et al.*, 2002; Berteaux *et al.*, 2014). Isotherms and isohyets in Québec will shift northward (Figure 3.15), likely impacting significantly on biodiversity (Berteaux *et al.*, 2014). The rise in temperatures will probably affect the growing season in Nunavik. North of the 55th parallel, it is estimated that the growing season will be extended by roughly 14 days/100 years (McKenney *et al.*, 2006).

By 2050, air temperature in the region of the study area is forecast to change by about 2.01°C in summer and 4.3°C in winter (Table 3.4). According to various studies, the

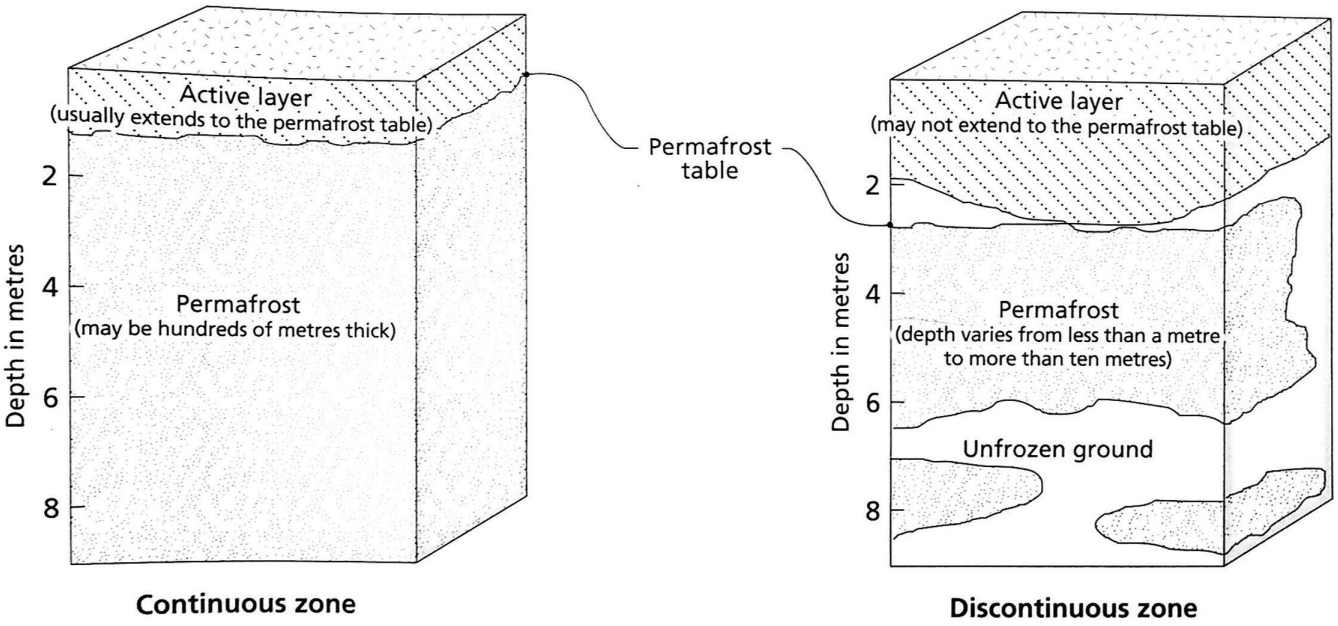


Figure 3.12 Soil Profile in Continuous and Discontinuous Permafrost Zones

Source: Brown (1970)

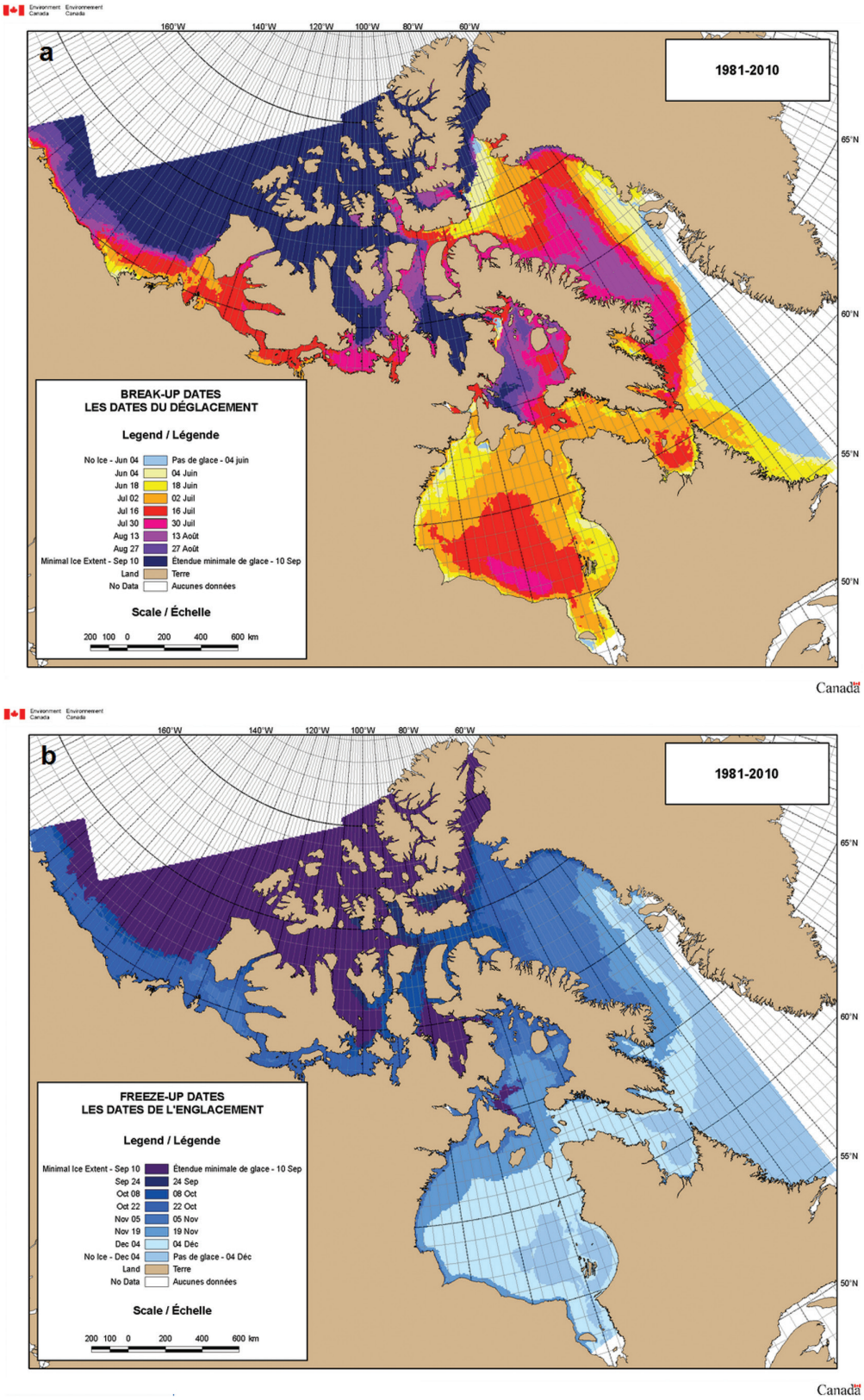


Figure 3.13 Canadian Arctic Sea Ice Freeze-up a) and Break-Up b) dates for the 1981-2010 period

Source: adapted from Canadian Ice Services (2018)

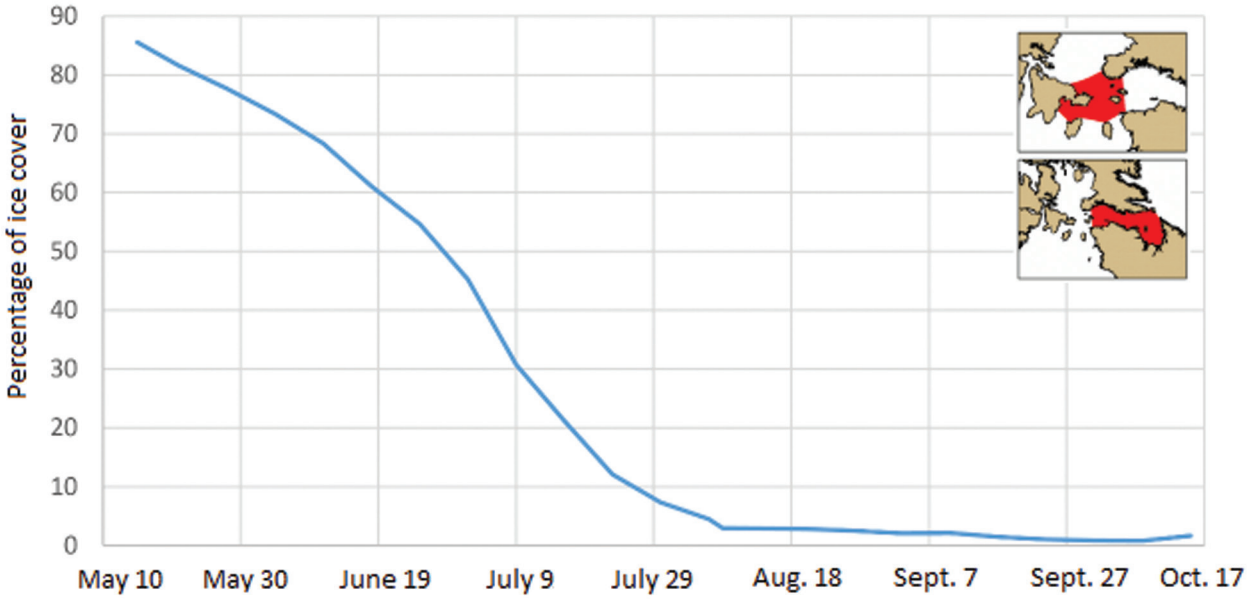


Figure 3.14 Mean Percentage of Hudson Channel and Hudson Strait Seasonal Ice Cover for the 1981-2010 period
Source: Barrette *et al.* (2016)

highest mean annual temperature change in the Nunavik and Nunatsiavut regions will occur in the Cap Wolstenholme area, i.e. a rise of 3.35°C for the period 2041 to 2070 compared with the period from 1971 to 2000. A warming temperature gradient running southeast to northwest has been clearly observed across these regions (Figure 3.16).

Although mean temperature changes during the warm season (May to September) will be less pronounced than during the cold season (October to April), forecasts suggest that the warm season will be about 20 days longer due to starting roughly 10 days earlier and ending roughly 10 days later (Table 3.4) (Barrette *et al.*, 2016).

Total annual precipitation is forecast to increase by roughly 18.4%, and solid precipitation by 10% (Table 3.4). The snow cover period is expected to decrease by about 17 days, and will start roughly nine days later and end roughly eight days earlier (Table 3.4) (Barrette *et al.*, 2016). The results of hemispheric studies show a clear trend of reduced snow cover extent in May and June between 1979 and 2012 (Derksen and Brown, 2012; Vincent *et al.*, 2015). This dramatic reduction in snow cover in June and the decrease in the number and extent of snowdrifts in summer is consistent with observations about sea ice decline in September. These indicators clearly illustrate the impacts of climate change on all the components of the cryosphere. These effects are expected to continue over the coming decades, given that some already exceed the results of climate models (Dersken and Brown, 2012).

It is important to note that permafrost forecasts generated by models are general and do not adequately represent the heterogeneity of thermal and geotechnical ground characteristics on a local scale. General conclusions can nonetheless be drawn for the region of the study area. The results of simulations for the Cap Wolstenholme area indicate that between 2016 and 2035, the permafrost will be 1.04 to 1.8°C warmer at a depth of 5 m than it was between 1985 and 2000 (Barrette *et al.,* 2016). Other simulations for the period from 2085 to 2100 suggest a possible 3 to 7°C increase in ground temperature at a depth of 5 m. In accordance with this forecast increase in ground temperature, the active layer is likely to deepen. Compared to the period between 1985 and 2000, the active layer may increase by 0.09 to 0.17 m between 2016 and 2035 and by 0.4 to 3.4 m between 2080 and 2100 (GIEC, 2007).

Forecast sea ice changes are also consistent with observations made in recent decades. Trends noted in the extent and thickness of annual sea ice are expected to continue in the future. Some studies (Wang and Overland, 2012; Paquin *et al.*, 2013; Döscher and Koenigk, 2013) estimate that the Arctic could experience an ice-free summer by 2030 to 2040 (although other studies show that the ice will likely continue until the end of the century [Hu and Myers, 2014]). Results produced by Joly *et al.* (2010) demonstrate that Hudson Strait and Foxe Basin are particularly sensitive to climate warming, a factor that may result in a significant reduction in the concentration of sea ice in early winter.

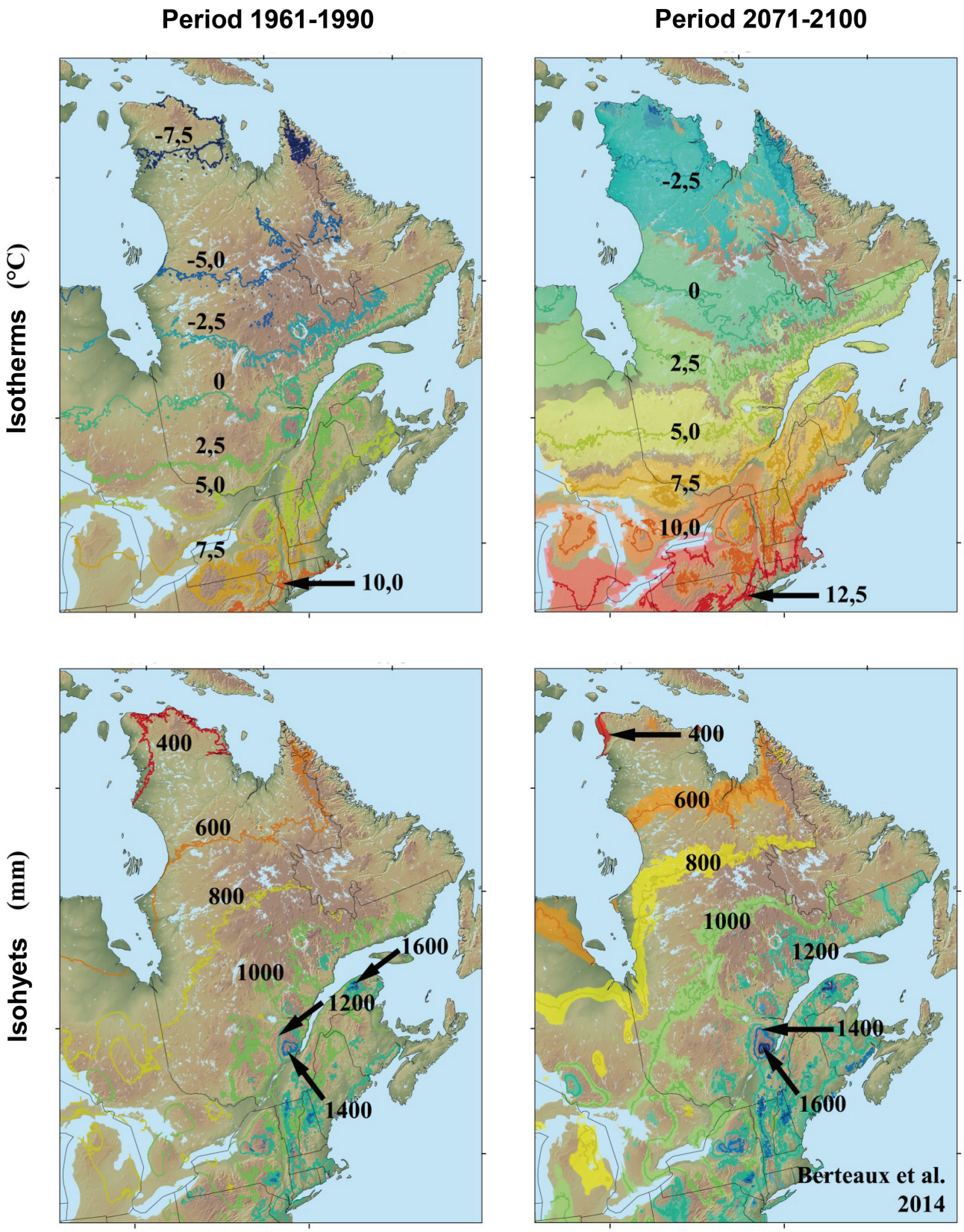


Figure 3.15 Annual Isotherms and Isohyets for 1961-1990 and 2071-2100 for Québec and its Periphery

Source: Berteaux *et al.* (2014)

Forecasts for ice on lakes and rivers suggest equally dramatic changes in Nunavik and Nunatsiavut, with freeze-up beginning later in the fall (14 to 20 days) and break-up earlier in the spring (8 to 12 days) (Dibike *et al.*, 2011; 2012; Brown and Duguay, 2011; Brown *et al.*, 2012).

Forecasts for storm pattern changes for the period from September to May show a weak but nonetheless significant trend of intensifying cyclones at the end of the century (between 2080 and 2099) (Finnis *et al.*, 2007). Conversely, a separate study shows a slight reduction in cyclones and wind intensity in the Hudson Strait region for the period from December to February (Zappa *et al.*, 2013). A further investigation linking the lengthening of the ice-free period, the intensification of cyclones and the increase in cyclone persistence in the Hudson Bay region shows that the period of intense cyclones will grow longer (Savard *et al.*, 2014). Finally, a 15 to 20% increase in the number of cyclones possibly leading to storm surges on the coasts of Hudson Bay and, more notably, in the north of Nunavik is also forecast.

The foregoing information provides a general profile of the climate in the study area. Information on regional climate is an invaluable decision-making tool for regional planning, given that the creation of a protected area and the development of measures to conserve and promote a sensitive environment greatly depend on this knowledge.

Table 3.4 Synthesis of Forecast Climate Changes based on Six Canadian Regional Climate Model (CRCM) Outputs for the period 2041–2070 Compared with the Period 1971–2000

Indicator	Value
Change in mean annual temperature	3.35°C (±0.4)
Change in mean temperature from May to September	2.01°C (±0.2)
Change in mean temperature from October to April	4.3°C (±0.6)
Thawing day degrees	197°C (±30)
Growing day degrees	87°C (±23)
Start of summer	-9.5 days (±1.8)
End of summer	9.5 days (±1.3)
Mean total precipitation	18.4% (±3.3)
Maximum solid precipitation	10% (±5.1)
Start of the snow cover period	9.22 days (±2.9)
End of the snow cover period	-8.3 days (±2.8)

(The data in brackets represents the standard deviation between the outputs.)

Source: Barrette *et al.* (2016)

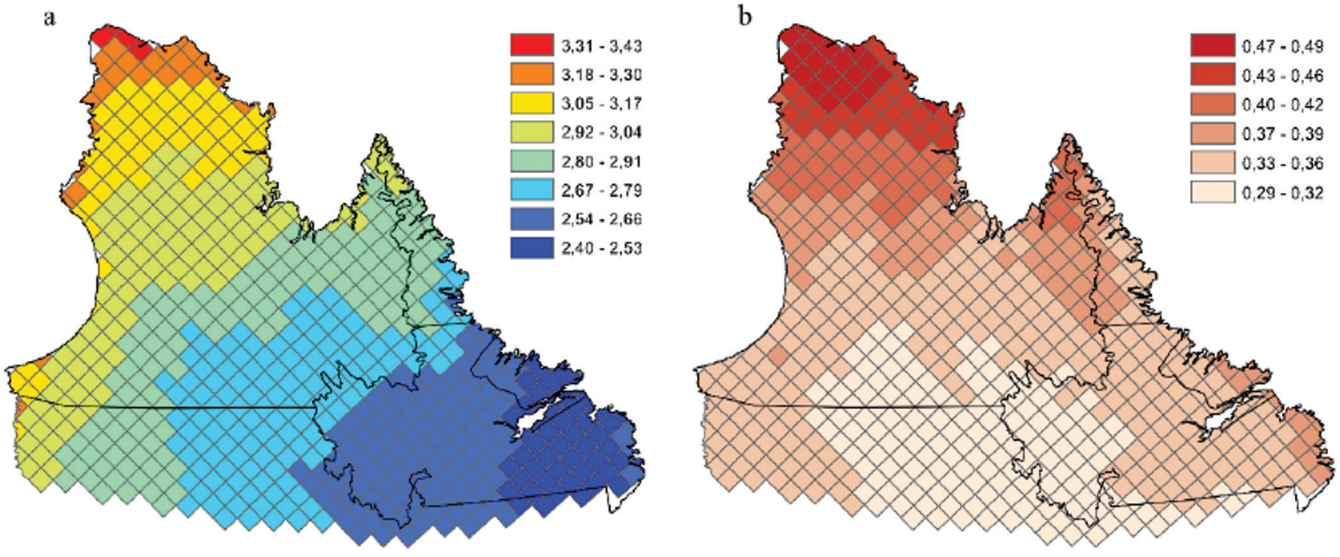


Figure 3.16 a) Projection of change in mean annual air temperature at 2 m (°C) for 2050
b) Standard deviation of projected change in annual mean air temperature (°C)

Source: Barrette *et al.* (2012)

HYDROLOGY

Although the Parc national Iluiliq Project is a terrestrial park project, it nonetheless possesses an aquatic component having a major influence on its study area, its climate, its landscapes and the species that live there. More specifically, while Hudson Strait and the aquatic portion of the fjords and many glacial valleys are not part of the study area of the park project, they remain central elements of its hydrology. The study area is situated in the hydrographic regions of Ungava Bay as well as of James Bay and Hudson Bay, which locally may be divided into drainage basins. Map 3.1 and Table 3.3 present the drainage basins of the study area. More than half of the study area is covered by minor drainage basins (50.7% of the study area, covering 1,111.6 km^2), i.e. they consist of small watercourses that empty into Hudson Strait. Three drainage basins described as primary are also part of the study area: the Rivière Guichaud which is almost entirely included within the boundaries of the part project (96.6%), as well as sections of the heads of the drainage basins of the Rivière Frichet and the Rivière Kovik which are included to a smaller degree, i.e. these drainage basins cover only 2.1 and 2.2%, respectively, of the study area (Table 3.3).

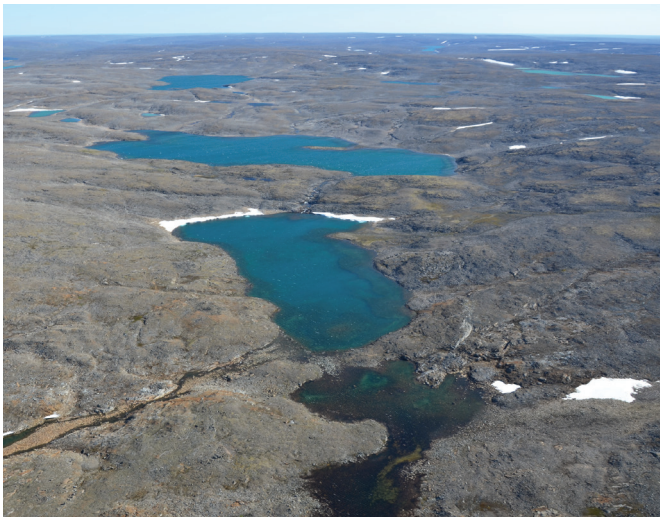
GENERAL HYDROLOGY OF THE STUDY AREA

Generalities

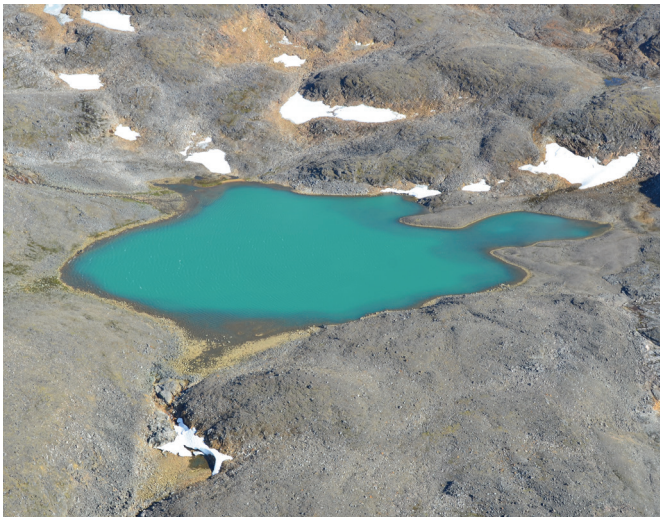
A vast rocky plateau covers a large part of the study area of the Parc national Iluiliq Project. On the plateau, water flow mainly occurs through connecting shallow lakes and, in clogged areas, may sometimes seep through boulder fields. The watershed divide in the northwest part of the Ungava Peninsula runs across this plateau. To the southwest, water flows and combines to form the tributaries of the Rivière Frichet and the Rivière Kovik in a poorly defined hydrographic network. The watercourses cross fairly homogeneous terrains with imprecise and shallow widenings (fluvial lakes) and clogged areas where water flow sometimes becomes indefinite (Tremblay, 2016). This phenomenon may be explained by the presence of permafrost that prevents water from cutting into the ground materials and generally results in lateral development and a poorly defined network.

A remarkable phenomenon of the plateau in the study area relates to the presence of ferric ions. These ions are transported by water bodies from enclaves of ferruginous rock located nearby and clearly visible along their beds. They produce a remarkable phenomenon: these water bodies take on a turquoise or deep blue colour when struck by sunlight (Tremblay, 2016).

To the north of the watershed divide, water flows through simple catchment areas that empty into Hudson Strait. For example, water is fed into the upstream sections of the glacial valleys via falls or cascades that drain small drainage basins. Then, in the narrow and deep glacial valleys, in places where talus slopes meets along the lowest point of the valley floor, called the thalweg, water seeps through the boulder fields formed by the talus slopes (Tremblay, 2016).



Hydrographic network on the rocky plateau that covers a large portion of the study area
Credit: Benoit Tremblay



Water body (turquoise lake) influenced by ferric ions
Credit: Benoit Tremblay

Hydrographic Network

The hydrographic network of the study area is characterized by small, shallow lakes. Several of these lakes may have been produced by differential permafrost thawing, in which case the hydrographic network is defined as "thermokarstic". Several lakes however were formed by overdeepening of the bedrock during glaciation. The estimated depth of the 3,775 lakes identified in the study area averages between 0.01 to

Narrow and deep glacial valley with talus slopes meeting along the thalweg and through which a stream flows
Credit: Benoit Tremblay

Valley of the Rivière Guichaud, wide with gentle slopes
Credit: Benoit Tremblay

15 m, and a little less than 64% of these lakes are isolated from the hydrographic network (Table 3.5) (MDDELCC, 2016). In addition, these lakes are mostly (92.7%) very small, i.e. less than 5 ha. The largest lake covers 341.5 ha (Table 3.7) (MDDELCC, 2016). A majority of the lakes of the study are described as having a simple sinuosity (69%), i.e. lakes with perimeters that are fairly circular, often without any bays. In limnology, the more complex the shorelines of a lake, the greater its potential for diversified wildlife habitat. In fact, 30.7% of the lakes in the study area have a slightly more developed shape. These lakes offer better habitat potential (MDDELCC, 2016).

East Sector of the Study Area: Rivière Guichaud

The eastern sector of the study area comprises the drainage basin of the Rivière Guichaud. It covers close to 860 km^2 of the study area. In this drainage basin, the main watercourse and its tributaries have cut a dendritic pattern into the plateau. It flows southward first, then eastward to the Fjord de Salluit. The valley of the Rivière Guichaud, which contains the largest river in the study area, is roughly 1 km wide in its downstream section and has gentle slopes compared to the fjords and glacial valleys along the coast (Tremblay, 2016).

Table 3.5 Proportion of Lakes in the Study Area connected to the Hydrographic Network

TYPE	NUMBER	%
Isolated lakes	2,403	63.7
Lakes connected to the network	1,372	36.3
Total	**3,775**	**100**

Source: MDDELCC (2016)

Sector Situated North of the Study Area: Hudson Strait

Adjacent to the study area for the Parc national Iluiliq Project, Hudson Strait runs across the north of Québec. It abuts Hudson Bay to the southwest, Foxe Basin to the northwest, and the North Atlantic Ocean (Labrador Sea) to the east. It is a long (roughly 400 km) and narrow (roughly 100 km) channel that provides a fundamental connection between two major water masses, namely the Hudson Bay complex and the North Atlantic Ocean (Straneo and Saucier, 2008a). The Hudson Bay complex comprises four marine regions in Arctic Canada: Hudson Bay, James Bay, Foxe Basin and Hudson Strait. It is the largest water mass on earth to completely freeze and thaw over a few months (Figure 3.17). The complex covers approximately 1 million km^2, equivalent to a fifth of the area occupied by the Arctic Ocean (Straneo and Saucier, 2008a). Unlike the Arctic Ocean, the Hudson Bay complex is essentially a closed basin. For its part, the Arctic Ocean has major exchanges with Bering Strait (between Alaska and Russia) and Fram Strait (east of Greenland) (Straneo and Saucier, 2008a). Although Hudson Strait is not part of the study area of the Parc national Iluiliq Project, the significant role it plays between Hudson Bay and the North Atlantic Ocean is nonetheless noteworthy and has an influence that greatly exceeds the study area. Among other reasons, it influences freshwater exchanges, the productivity and climate of the Labrador Sea, as well as marine transportation.

Characteristics of Hudson Strait

Generally speaking, the bathymetry (sea depths) of the Hudson Bay complex is relatively shallow for such an enormous water mass, except for Hudson Strait. The strait reaches a depth of approximately 1,000 m to the east, north of Ungava Bay. This depth diminishes towards the west,

Table 3.6 Drainage Basin Area in the Ungava Bay Hydrographic Region in the Study Area

DRAINAGE BASIN	AREA INSIDE THE STUDY AREA (km^2)	PERCENTAGE OF THE STUDY AREA OCCUPIED BY THE DRAINAGE BASIN (%)	TOTAL AREA OF THE DRAINAGE BASIN (km^2)	PERCENTAGE OF THE DRAINAGE BASIN PROTECTED BY THE STUDY AREA (%)
Rivière Frichet	29.85	1.4	1,411.75	2.1
Rivière Guichaud	859.77	39.2	889.99	96.6
Rivière Kovik	190.20	8.7	8 591.61	2.2
Minor drainage basins	1,111.60	50.7	-	-

Source: MDDELCC (2016)

reaching 400 m west of Hudson Strait. These decreasing depths continue further westward into Foxe Basin, where the depth of the basin's eastern edge is less than 20 m (Figure 3.18) (Straneo and Saucier, 2008a; Steward and Howland, 2009). Within Hudson Strait, two ledges, at opposite ends, limit bottom water exchanges with adjacent water masses. The first ledge, at 400 m deep at the strait's far east end, limits water exchange between Hudson Strait and the Labrador Sea. The second ledge, at 185 m deep, is located at the northeast outlet from Hudson Bay into Hudson Strait (Steward and Howland, 2009).

The tides in Hudson Strait are generally strong, with elevations varying between 3 and 6 m. More specifically, they are roughly 7.9 m at the entrance of the strait, 12.5 m along the north shore of the strait and 4.9 m west of Nottingham Island (Drinkwater, 1988; Steward and Howland, 2009). These tides create strong current in the vicinity of the eastern entrance of Hudson Strait: a speed of 2 m/s has been measured at this point (Steward and Howland, 2009). Eddies in the vicinity of the eastern entrance of Hudson Strait, i.e. at its mouth, where the current is strong and turbulent, are caused by high tidal elevations and many channels between the islands (Straneo and Saucier, 2008a; Straneo and Saucier, 2008b). The tides of the Hudson Bay complex exert a major influence on the climate of the region (covered in Section 3: Physical Environment under the Climate heading) (Saucier *et al.*, 2004).

Table 3.7 Size of the Lakes in the Study Area

SIZE CATEGORY	NUMBER	%
Very small (< 5 ha)	3,500	92.7
Small (5-25 ha)	231	6.1
Medium (25-125 ha)	44	1.2
Total	**3,775**	**100.00**

*1 hectare is equivalent to 0.01 km^2

Source: MDDELCC (2016)

Circulation and Freshwater Exchange in Hudson Strait

Freshwater input into Hudson Strait has several sources: the cold water of Baffin Island flowing south and deep water, the warm water flowing from the west of Greenland, and the even warmer low-salinity water flowing from Hudson Bay and Foxe Basin (Figure 3.19) (Drinkwater and Harding, 2001). The cold water flows along the north coast of the strait, from east to west, while the warmer low-salinity water flows along the south shore, from west to east (Straneo and Saucier, 2008a). The convergence of these three currents and the high tidal elevations at the eastern entrance of Hudson Strait produce intense vertical mixing. Consequently, an increase in the concentration of nutrients has been noted in Hudson Strait (Drinkwater and Harding, 2001). In Hudson Bay, the surface currents are described as cyclonic, i.e. they rotate counter-clockwise, at an average speed of 0.04 m/s (Figure 3.19) (Déry *et al.*, 2005). When this water reaches Hudson Strait it accelerates along the Québec coast to reach a speed of about 0.15 m/s (Déry *et al.*, 2005).

Freshwater Exchange

Hudson Strait provides the third largest freshwater contribution to the North Atlantic Ocean, after Fram Strait and Davis Strait from the Arctic Ocean. Its freshwater output is the net equivalent of two thirds the output of Davis Strait, i.e. roughly 2,460 to 2,780 km^3/year (Straneo and Saucier, 2008a; Sutherland *et al.*, 2011). In fact, 15% of the volume and 50% of the freshwater transported by the Labrador current originates from Hudson Strait (Straneo and Saucier, 2008a). The output of the hydrographic network of the Hudson Bay complex equals 18% of the total output of freshwater into the Arctic Ocean, representing a greater quantity of freshwater than any other major river basin in Eurasia or North America (Déry *et al.*, 2005). The current along the south of Hudson

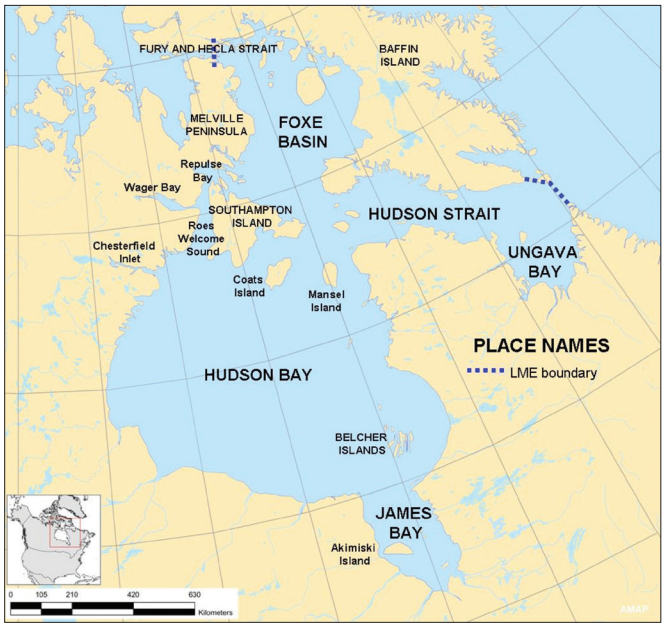


Figure 3.17 Key Place Names in the Hudson Bay complex

Source: Steward and Howland (2009)

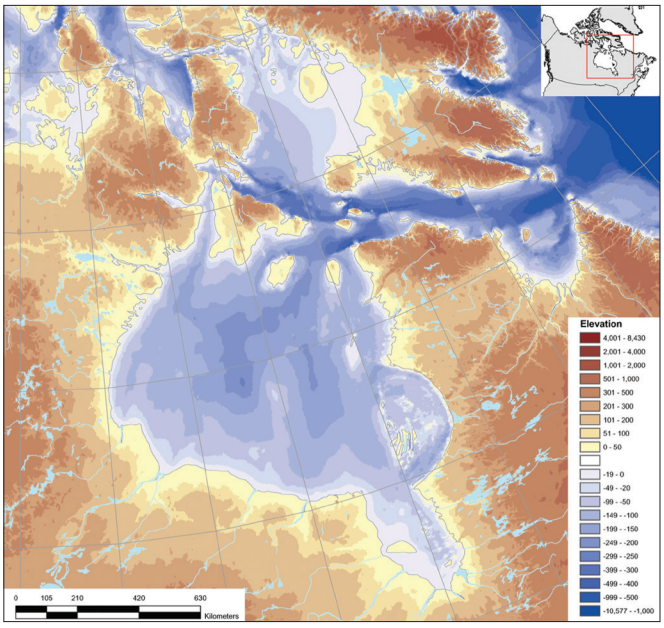


Figure 3.18 Topography and Bathymetry (m) of the Hudson Bay Complex

Source: Steward and Howland (2009)

Strait, along the Québec coast, is described as a "density" current, i.e. gravity causes it to flow due to the difference in density with another current in the strait. (Sutherland *et al.*, 2011). This current is roughly 30 km wide by 120 m deep (Sutherland *et al.*, 2011). Its structure is mainly the result of the freshwater output of rivers in the Hudson Bay complex, which have a volume of approximately 900 km^3/year (Déry *et al.*, 2005; Sutherland *et al.*, 2011). The seasonality of freshwater output from Hudson Strait is, for its part, due to the freeze and melt cycle of sea ice and river input (Sutherland *et al.*, 2011). In fact, freshwater is removed from surface water due to freeze-up and evaporation, while a certain quantity of freshwater is added through ice melt, runoff and precipitation. Quantitatively, in the northern part of Hudson Strait, freshwater mainly originates from ice melt while, in the southern part of the strait, in Ungava Bay and in the northeast part of Hudson Strait, freshwater mainly originates from precipitation and runoff (Steward and Howland, 2009).

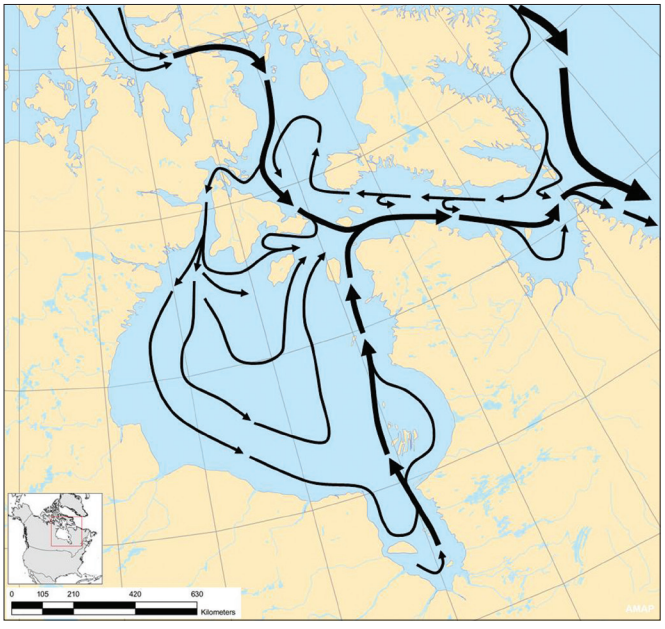


Figure 3.19 Summer Circulation of Water in the Hudson Bay Complex

Source: Steward and Howland (2009)

The mechanism responsible for freshwater export is a series of pulses occurring once every 4.4 days. The mechanism is associated with anticyclonic surface eddies. These eddies are responsible for 50% of the freshwater outputted from Hudson Strait (Sutherland *et al.*, 2011). The eddies cause the water to preserve its properties for longer periods, i.e. it mixes less and the nutrients from rivers, as well as any pollutants, can move as far as the Labrador Shelf higher in the water column (Sutherland *et al.*, 2011). Most freshwater exports occur between June and March, with a peak between November and December (Straneo and Saucier, 2008a). The outflowing current from Hudson Strait plays an important role in the high-latitude freshwater budget and is a major conduit of high nutrient water. This nutrient output contributes to the high productivity and abundance of fish on the Labrador Shelf (Sutherland *et al.*, 2011). The arctic

properties of the freshwater merging with the Labrador Current (low salinity and low temperature) and carried southward also have an influence on the climate in Atlantic Canada (Steward and Howland, 2009). More specifically, the stream flow of high-latitude oceans has a major effect on the salinity and the stability of upper ocean level. And in turn, this influences ice formation and global thermohaline circulation (Déry *et al.*, 2005).

Navigation

Given its high tides and strong winds, Hudson Strait is a hazardous marine transportation route, practicable almost exclusively when ice free (Steward and Howland, 2009). In fact, Hudson Strait is almost completely ice covered from January to April. Ice formation typically begins in the west, where Foxe Channel and Hudson Strait meet, and expands eastward. Ice ridges and rafts form in places where the ice converges and is under pressure, causing one layer of ice to slide over another. Ice ridges are several layers of ice piled together. Generally, the term ice ridge is used, instead of ice raft, when the thickness is greater than 15 cm (Mussells *et al.*, 2016). Ice ridges and rafts present some of the most hazardous navigational conditions in the Arctic (Mussells *et al.*, 2016). The ice in Hudson Strait is constantly shifting throughout the winter, frequently opening and closing, so that, by March, Hudson Strait is densely covered with ice ridges (Mussells *et al.*, 2016). The pressure required to create such phenomena is the result of convergent forces from winds, currents and tides (Mussells *et al.*, 2016). Such phenomena may therefore be produced wherever ice is in movement, although ice ridges vary greatly from year to year (Mussells *et al.*, 2016). Ice drifts from west to east. As is the case with the net export of water from Hudson Strait, it is therefore forced through a funnel in the vicinity of the entrance of the strait (Mussells *et al.*, 2016). The ice reaches its maximum thickness towards the end of April or beginning of May: it ranges from 125 cm thick in the eastern part of Hudson Strait and Ungava Bay to 150 cm thick in the western part of Hudson Strait. For their part, ice ridges can reach up to 3.5 m in height (Prinsenberg, 1988; Steward and Howland, 2009). In Hudson Strait, open water among the ice is frequent and of vital importance for marine mammals that winter in the region. They are in particular caused by strong currents, winds and tides. In the region, recurring polynyas form near Digges Islands, near the study area (Steward and Howland, 2009).

Although navigation in Hudson Strait can be perilous, the route has been used for many years and its use is growing. In fact, a course along the Québec coast of Hudson Strait, to take advantage of strong west-to-east currents, has been followed by vessels since the mid-18th century. At that time, the route was travelled mainly to deliver supplies to trading posts along the coasts (Drinkwater, 1988). Marine transportation in Canadian Arctic waters has increased significantly since 2007, and is expected to continue to increase in the future as this method of transport becomes more and more viable (Mussells *et al.*, 2016). While some of the interest in marine transportation is due to the decline in sea ice, other factors, such as tourism, northern community resupply needs, as well as increasing resource exploration and extraction activities, are also important drivers contributing to the recent increase in related activities in this region (Mussells *et al.*, 2016). Hudson Strait is also an important transportation link between Canada and Russia, more specifically between Churchill and Mourmansk, which has been called the "Arctic bridge", due to its open waters four months of the year (Mussells *et al.*, 2016). The port of Churchill is the only deepwater port in the Hudson Bay complex (Figure 3.20).

Pursuant to the *Ballast Water Control and Management Regulations* (P.C. 2011-237), a vessel may exchange its ballast water only in the sector of Hudson Strait east of 70° west longitude where water depth is at least 300 m. Vessel ballasts are in fact empty reservoirs designed to receive a large quantity of water, and generally situated around the outside of vessel hulls (Steward and Howland, 2009). Management of the ballast water that is added to and extracted from these reservoirs is very important, since it helps with vessel stability and manoeuvrability and crew comfort, to mention only a few reasons (Steward and Howland, 2009). When ballast water is exchanged, all the water previously contained in the ballasts is extracted and replaced with new water. It should be noted that, still pursuant to the *Ballast Water Control and Management Regulations*, most vessels perform these exchanges more than 200 nautical miles from shore where water depth is at least 2,000 m. Notwithstanding, weather conditions or other unforeseen events may sometimes make it impossible to perform ballast water exchanges before entering Canadian waters. For this reason, some ships may make use of alternative zones to exchange ballast water. For example, a cargo ship may contain more than 200,000 m^3 of water in its ballasts (Steward and Howland, 2009). This ballast water inevitably contains some sort of biota, i.e. a collection of plankton and nekton originating from the environment of the source of the water (Steward and Howland, 2009). There is therefore a risk that, during an exchange of ballast water, species in the ballast water could be introduced into, survive and become established in the new environment (Steward and Howland, 2009). Notwithstanding, most of the marine traffic in Hudson Strait during the period of open water, especially vessels bringing supplies to the 14 Inuit communities of Nunavik, transporting cargo and conducting Arctic cruises, does not exchange ballast water in the strait (Mussells *et al.*, 2016). Since supply vessels to Nunavik communities are filled with cargo, they do not require ballast water for their voyages to the communities. Only when returning south do

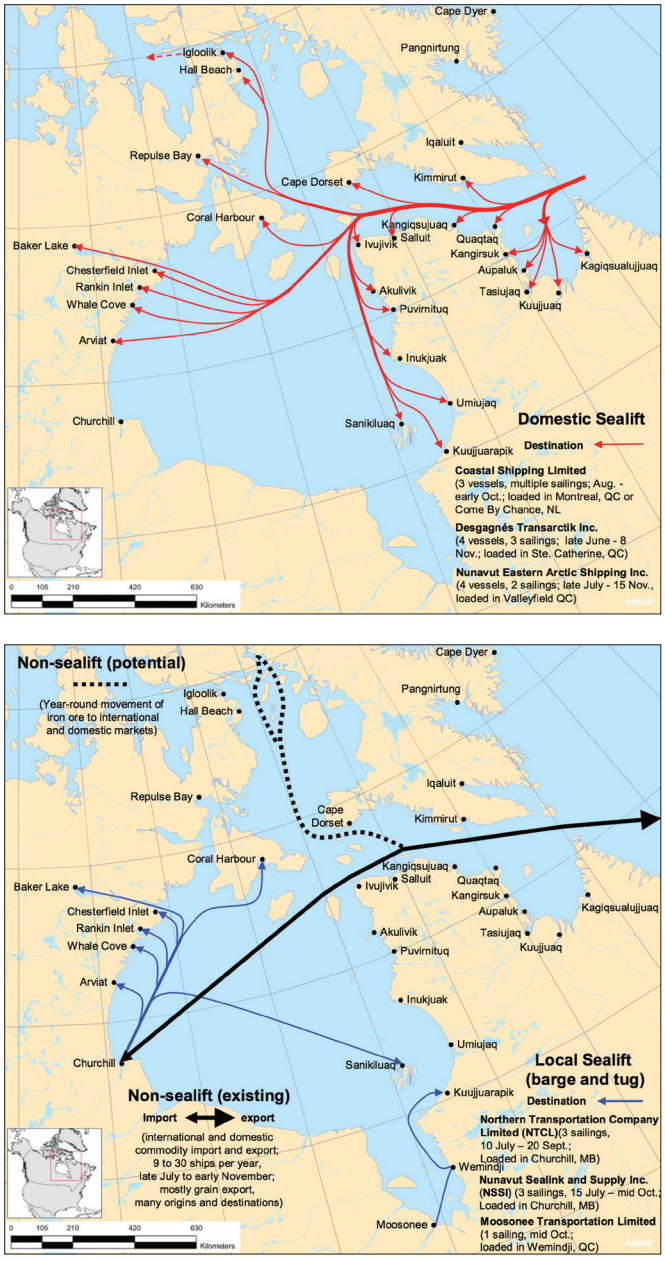


Figure 3.20 Annual Shipping Activity in the Hudson Bay Complex Related to the Sealift (domestic top and local bottom) and to Non-Sealift Import and Export (bottom).

Source: Steward and Howland (2009)

these vessels fill their ballasts in order to provide stability, these vessels are then much lighter (Steward and Howland, 2009). The consequences of species introduced into Canadian Arctic waters through ballast water exchanges have not been well studied to date. Fortunately, Hudson Strait possesses certain obstacles that prevent the establishment of new species, such as strong current, high tides and relatively cold water (Steward and Howland, 2009). This factor nonetheless poses a risk that should be monitored in the coming years, all the more so as climate change could significantly impact on the Hudson Bay complex. A study that measured river discharge into the Hudson Bay complex from 1964 to 2000 recorded a decrease of 96 km^3 during this period. The same study noted that the period of maximum spring output had come to occur eight days earlier during the same period (Déry *et al.*, 2005). This result demonstrates that the impacts of climate change are significant on this scale.

GENERAL GEOLOGY

Poly-Géo inc. was contracted by the Kativik Regional Government (KRG) to review literature on the geology of the study area for the Parc national Iluiliq Project. The following section presents in part the results of the report produced (Poly-Géo inc., 2017), which derive largely from data extracted from regional synthetic studies by Lamothe (2007 and 1994) and St-Onge *et al.* (1992).

TECTONIC EVOLUTION

Tectonic evolution is an essential element for understanding the geology of a region. The study area for the Parc national Iluiliq Project, which is situated in the Churchill Province, was subject to a unique tectonic evolution (Poly-Géo inc., 2017). In fact, several events prior to its formation influenced the geology of this province.

Formation of the Superior Province

The formation of the Superior Province (also known as the Superior Craton) took place over more than a billion years and in particular involved volcanism, sedimentation, plutonism, deformation and metamorphism (Simard *et al.*, 2008). The main stages may be summarized as follows:

3.6–2.8 billion years (Ga) before the present (BP): Ancient magmatic events of which only a few rare remnants still exist.

2.8–2.68 Ga BP: Series of magmatic and tectonic processes (series of orogens).

2.6–2.5 Ga BP: Cratonization of the Archean rock of the Superior Province.

Trans-Hudson Orogen

The Trans-Hudson Orogeny (THO), which occurred during the Paleoproterozoic in North America, was one of the earliest orogens on earth, evolving during a complete Wilson cycle, which divides the evolution of continents and ocean basins into three phases: continental rift and the opening of oceans, ocean closure and continental convergence, followed by the collision of continents and

the formation of mountain ranges. The THO covers a period of roughly 150 million (Ma) years (approximately 1.92 to 1.80 Ga BP) that included the opening of the Manikewan Ocean, i.e. the oceanic plate that existed between the Superior and Rae cratons, and its closure (Figure 3.21a) (Corrigan *et al*., 2009). The THO marks precisely the point of closure of this ocean (Stauffer, 1984) and the outcome of the collision between the Superior Craton (the current Ungava Peninsula region), the Reindeer Zone and a microcontinental amalgamation zone that had previously merged north of the Manikewan Ocean (Figure 3.22). At least three microcontinents have been identified in this ocean: the Sask and Sugluk blocks and the Meta Incognita-Core Zone (Figure 3.21a). The Sugluk block, which is mainly exposed along the margin of the Ungava Peninsula, and therefore within the study area for the Parc national Iluiliq Project, is also known as the Narsajuaq Arc (Corrigan *et al*., 2009).

The main stages of the THO may be summarized as follows:

1.92 to 1.89 Ga BP — Closure of the Manikewan Ocean: The complete closure of the Manikewan Ocean occurred about 1,905 Ma and led to the creation of the THO (*sensu stricto*). In fact, the period 1.92 to 1.89 Ga BP marks the start of the closure of the Manikewan Ocean, which at that time covered an expanse of at least 5,000 km (Figure 3.21b) (Corrigan *et al*., 2009).

1.88 to 1.865 Ga BP — Pericratonic accretion: Subsequently, from 1.88 to 1.865 Ga BP, pericratonic accretion occurred along the margins of various cratons, arcs and microcontinents (Figure 3.21c). Various arcs were formed during this period, i.e. chains of volcanic islands along the zone of contact between tectonic plates. The latest part of this period was marked by decreasing phases of oceanic arc-type magmatic activity in the assembly of these arcs (Corrigan *et al*., 2005), while the early part was marked by the intrusion of continental arc-type magmas (Van Schmus *et al*., 1987). At that time, nearly the entire margin of the Superior Craton facing the Manikewan Ocean was again extended, probably due to the pull of the Manikewan oceanic plate then undergoing subduction (Corrigan *et al*., 2009).

1.865 to 1.85 Ga BP — Development of wide magmatic continental arc: The period from 1.865 to 1.85 Ga BP represents another fundamental stage in the evolution of the THO. Several subduction events occurred between the plates to produce a wide magmatic continental arc (Figure 3.21d). Around 1.865 Ga BP, subduction took place between the Sugluk block and the Meta Incognita microcontinent that, when associated with subsequent events, led to the formation of the Narsajuaq Arc (Figure 3.21e) (Corrigan *et al*., 2009).

1.84 to 1.82 Ga BP — Final magmatic accretion, Narsajuaq Arc (*sensu stricto*): The period from approximately 1.84 to 1.82 Ga BP was the final phase of magmatic accretion that created the Narsajuaq Arc (*sensu stricto*). The Narsajuaq Arc specifically comprises plutons derived from the continental arc about 1.84 to 1.82 Ga BP, which were located along the exposed southeast margin of the Sugluk block, and from the plutonic suite dating from about 1.842 to 1.821 Ga BP found along the southern margin of the Meta Incognita microcontinent, and have been correlated to the plutons of what is today known as the Narsajuaq Arc on the Ungava Peninsula (Corrigan *et al*., 2009).

1.83 to 1.80 Ga BP — Final collision: The final collision of the THO (Figure 3.21f) began when the Superior Craton entered into contact with the Reindeer Zone about 1.83 to 1.80 Ga BP, completely closing the Manikewan Ocean (Corrigan *et al*., 2009).

Churchill Province

The Churchill Province, which followed the formation of the THO, is characterized in Québec by two large zones (Figure 3.23). The first zone, known as the New Québec Orogen, stretches from Schefferville to Ungava Bay in a roughly 350-km band westward from the Labrador border; Ungava Bay is in fact abutted by this geological province. The second zone, to which the bedrock of the study area for the Parc national Iluiliq Project is attached, is the Ungava Orogen. It makes up the entire northern tip of Québec, forming a roughly 40,000-km^2 triangle between Cap Wolstenholme and an approximate straight line from Akulivik to Kangiqsujuaq. It abuts the Superior Province, which covers practically the entire western part of Québec and in particular the Ungava Peninsula.

Comprising ancient mountain ranges (or orogens), the Churchill Province includes Precambrian rock formations from the Archean to the Proterozoic (2.9 to 1.1 Ga BP [Figure 3.24]).

REGIONAL GEOLOGY: UNGAVA OROGEN

An assemblage of Archean and Paleoproterozoic rock, the Ungava Orogen comprises several geological domains of the Churchill Province extending into the Ungava Peninsula. About 1.8 Ga BP, these domains were involved in the formation of a mountain range, the THO, during the tectonic collision of a portion of the continental crust at that time, i.e. the Superior Province, and a chain of volcanic islands.

The Ungava Orogen is therefore bordered to the south by the Superior Province, the oldest and most expansive part of the Canadian Shield. This ancient massif (or craton)

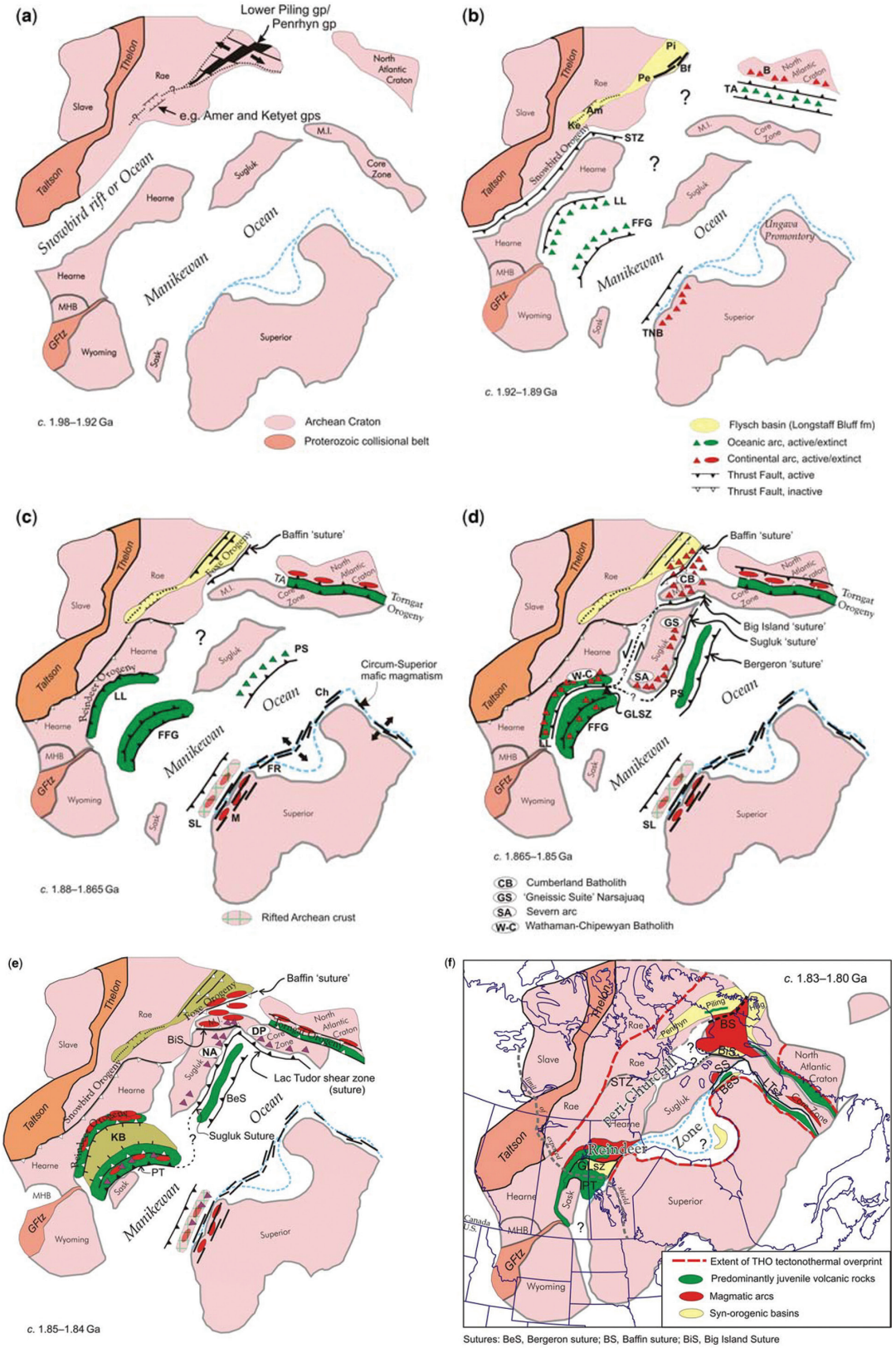


Figure 3.21 Geological evolution of the Trans-Hudson Orogen (HTO)

Source: Corrigan *et al.* (2009)

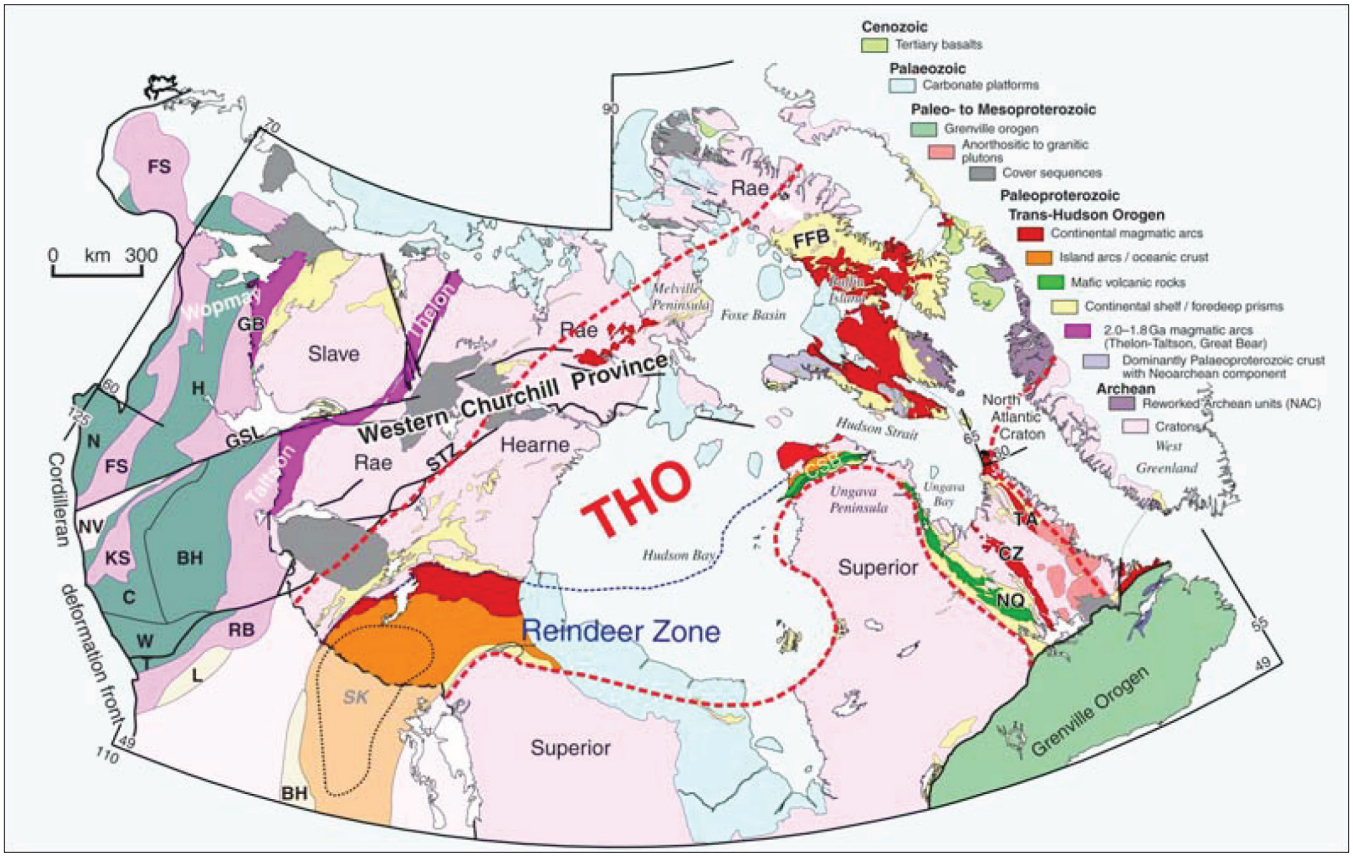


Figure 3.22 Simplified Geological Map of the Canadian Shield and West Greenland
Source: Corrigan *et al.* (2009)

of plutonic and metamorphic rock formed between 2.5 to 3 Ga BP, constitutes the continental basement below the Ungava Orogen.

Tectonostratigraphic Domains

Although displaced, faulted, deformed and metamorphosed following its emplacement, the rock that initially formed the chain of islands that collided with the Superior Province is still present in the Ungava Orogen. It is represented by three main tectonostratigraphic domains: the South and North domains, the Narsajuaq Arc and the Kovik Antiform (Figure 3.25). The specific rock sequences and deformations of each of these domains are briefly described below and Table 3.8 provides a synthesis of the main geological events associated with the Ungava Orogen and the formation of the rock substrate in the study area. It should first be noted that the volcanic-sedimentary rock of the Parent Group, which is attached to the North domain (Map 3.2) constitutes the volcanic (extrusive) part of the islands from the pre-contact period. The plutonic rock suites of the Narsajuaq Arc (Map 3.2) comprise their plutonic roots. The rock of the Sugluk Group (Map 3.2), originally deposited in a marine environment, i.e. in the Manikewan Ocean, on the margin of these volcanic islands, was recycled, i.e. covered, deformed and metamorphosed in the Narsajuaq Arc during a subduction episode.

The **South and North domains** (figures 3.25 and 3.26 and Map 3.2) form a band more than 50 km wide comprising mainly volcanic and sedimentary rock of the Paleoproterozoic extending for over 370 km along a west-southwest/north-northeast axis between Akulivik and Kangiqsujuaq. This band is a section of the Ungava Trough, sometimes still called the Cape Smith Belt (Figure 3.23). The rock that make up these domains provides evidence of the opening of a rift in the continental basement at that time (the Superior Province), of the widening of an ocean basin (the Manikewan Ocean) and then a reverse movement, i.e. convergence, collision and suturing of the two tectonic plates (THO). These events took place over 200 million years, from 2.04 to 1.82 Ga BP. The rock was fragmented, displaced along multiple thrust faults and finally injected with intrusive rock, of which some is recognized for its economic value.

Situated at the northern tip of the Ungava Peninsula, the **Narsajuaq Arc** constitutes the deep roots of a volcanic

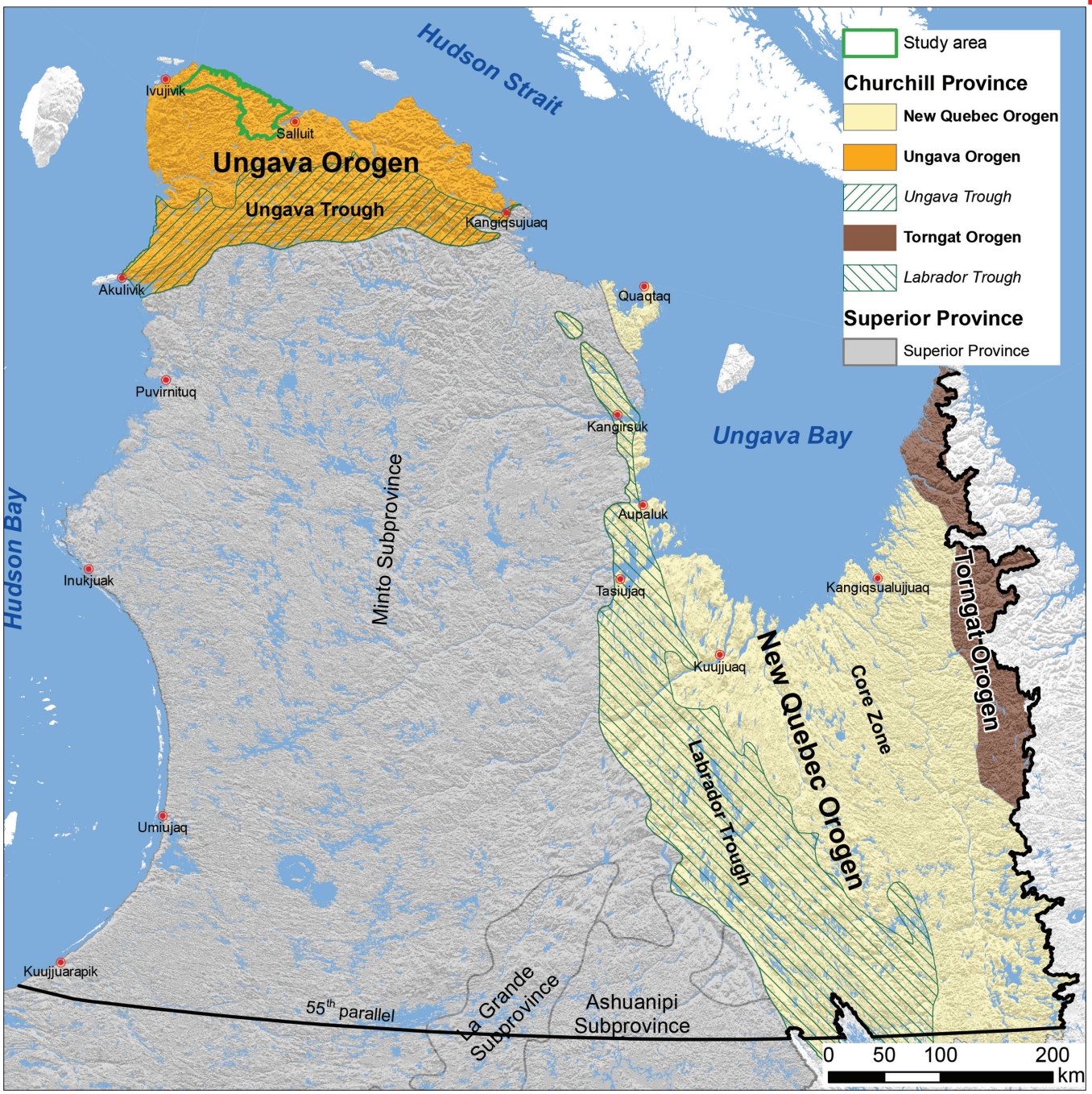


Figure 3.23 Nunavik Geological Units

Source: data from MRN (2011)

arc formed between 1.86 and 1.74 Ga BP. This geological domain forms the bedrock of the study area (figures 3.25 and 3.26 and Map 3.2). It comprises metasedimentary and plutonic rock that was metamorphosed following its emplacement. Three main plutonic suites, referred to as "ancient", "recent" and "late", have been identified, but only the first two are present in the study area. The ancient plutonic suite, which dates from 1.86 to 1.85 Ga BP, existed before the collision between the volcanic arc and the Superior Craton. For its part, the recent suite is linked to subduction phenomena that occurred at the time of the collision, between 1.84 and 1.82 Ga BP. The Sugluk Group comprises sedimentary rock deposited in deep water, next to the volcanic islands, that were deformed and embedded in the plutonic rock a few million years after their sedimentation.

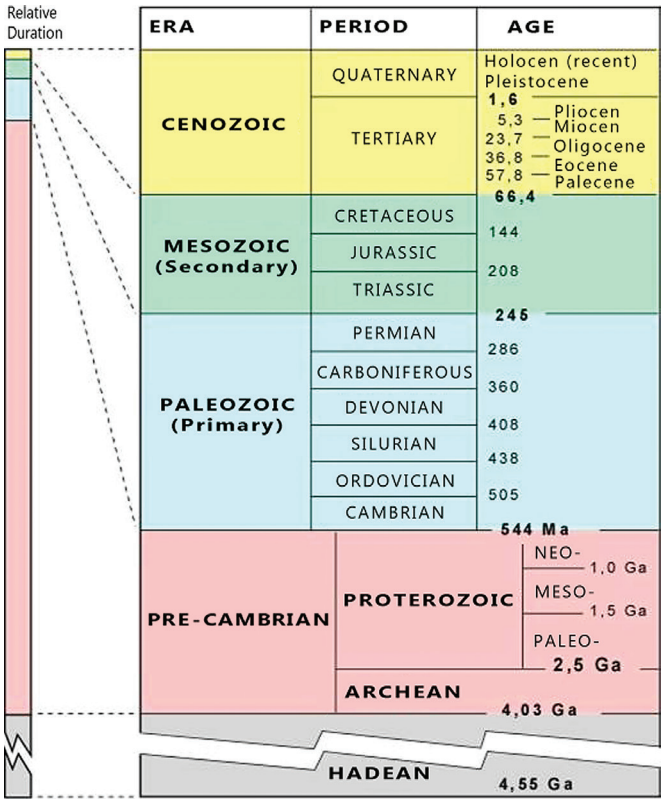


Figure 3.24 Main Geological Eras

Source: adapted from Bourque (1997-2007)

Wedged between the volcanic-sedimentary belt to the south (South and North domains) and the Narsajuaq Arc to the north, the **Kovik Antiform** is a discontinuous band of plutonic Archean rock, formed 3.22 to 2.74 Ga BP (figures 3.25 and 3.26 and Map 3.2). The rock of this domain was lifted and pushed towards the surface during deformations of the earth's crust at the end of the orogeny, after the suture between the Narsajuaq Arc and the Superior Craton had been produced.

Finally, in Hudson Strait, which is to the north of the Ungava Orogen and the study area, the sea floor comprises mainly carbonate sedimentary rock (limestone, dolomite) of the Ordovician and Silurian (about 505 to 408 Ma BP), therefore more recent than the rock described above (MacLean *et al.*, 1986; Sanford *et al.*, 1979).

It is important to recall that the breakdown of the Ungava Orogen into tectonostratigraphic domains reflects accepted expert opinion contained in literature to date. Notwithstanding, in the summer of 2017, the northwestern part of the Ungava Orogen was mapped at a scale of 1:100,000. This latest geological survey has redefined the Narsajuaq Arc, establishing new limits for this tectonostratigraphic domain. According to the preliminary results of this latest mapping work, two large regional deformation corridors separate the Paleoproterozoic units of the Narsajuaq Arc from more ancient rock (Archean): the existence of an additional domain in the northern sector was therefore demonstrated in 2017. Distinct in terms of lithologies and tectonometamorphic evolution, this domain may be separated from the units of the Narsajuaq Arc, situated further south, by a regional shear zone, called the Naujaat shear zone, making it the **domain located north of the Naujaat shear zone**. This newly identified assemblage is in fact separated from the Narsajuaq Arc by a zone of mylonite measuring a few kilometres (the Naujaat shear zone) (Figure 3.27). Its geological composition (tonalitic to dioritic gneiss, paragneiss, gabbro and porphyritic-structured quartziferous monzonite) suggests that this assemblage could represent an exotic block of the Narsajuaq Arc remobilized during the final collision with the Superior Province (Charrette and Beaudette, 2017).

Furthermore, the mapping work conducted in the summer of 2017 also made it possible to define, in terms of deformation and metamorphism, the Sugluk suture between the Kovik Antiform and the Narsajuaq Arc (Figure 3.27). It comprises a significant regional deformation corridor that separates amphibolite-facies metamorphosed rock from upper granulite- and amphibolite-facies metamorphosed rock (Charrette and Beaudette, 2017).

GEOLOGY OF THE STUDY AREA

It should be recalled that the study area for the Parc national Iluiliq Project is situated at the northern margin of the Narsajuaq Arc, a lithostratigraphic unit consisting of two main suites of plutonic intrusive rock injected into and mixed with the sedimentary rock of the Sugluk Group (Map 3.2).

Broad Geological Features of the Study Area

More than 90% of the Narsajuaq Arc is composed of plutonic rock; 10% is metasedimentary rock (Map 3.2). The ancient plutonic suite created from 1.86 to 1.85 Ga BP covers the largest portion of the study area. This suite comprises tonalitic gneiss, quartzitic diorite and biotite granodiorite. For its part, the recent suite, which was formed from 1.84 to 1.82 Ga BP, is less extensive, but distributed throughout the study area. It consists of quartzitic diorite, tonalite, granodiorite and monzogranite. Finally, the Sugluk Group comprises mainly semipelite, as well as quartzite, iron-rich sediments, marble, calco-silicate rock and amphibolite.

As mentioned above, all the rock of the Narsajuaq Arc was metamorphosed after emplacement. The rock of the plutonic suites generally has a gneissic or foliated texture, characterized by minerals separated into alternating parallel

Figure 3.25 Main Tectonostratigraphic Domains of the Ungava Orogen

Source: data from Géologie Québec (2007) in Poly-Géo inc. (2017)

bands. These comprise either dark ferromagnesian minerals or of clearer quartz and feldspar minerals. Scattered through the Narsajuaq Arc, the sedimentary rock of the Sugluk Group forms bands less than one kilometre thick, but running for tens of kilometres (Map 3.2). This rock has frequently been brought into contact with intrusive rock suites through tectonic displacement along thrust faults.

Specific Geological Features of the Study Area: Cliffs

Unquestionably, one of the spectacular and characteristic features of the coastline of the study area for the Parc national Iluiliq Project is the series of majestic cliffs that stand a few hundred metres high, overlooking Hudson Strait and connecting it to the Salluit plateau. By definition, a cliff is an escarpment of variable height, created by marine erosion

Table 3.8 Chronology of the Main Geological Events associated with the Formation of the Ungava Orogen

CHRONOLOGICAL SEQUENCE	MAJOR GEOLOGICAL EVENT	PERIOD (IN BILLIONS OF YEARS [GA])	CORRESPONDING GEOLOGICAL FORMATION[1]	CHARACTERISTIC LITHOSTRATIGRAPHIC UNITS[2]
1	Formation of the Superior Province by major metamorphosed plutonic rock massifs in the northern part of the Ungava Peninsula. The Superior craton is the very ancient and stable basement against which the Ungava Orogen will be formed.	Archean (>2.5 Ga)	Superior Province	Variety of plutonic suites and metamorphic intrusive rock complexes
2	Long period lasting more than 500 million years for which no regional geological archives exist.	Paleoproterozoic (between 2.5 and 2.04 Ga)	n/a	n/a
3	Opening of a rift in the Superior craton (continental crust) that will grow to form an oceanic basin, the Manikewan Ocean. Sedimentary and volcanic rock sequences provide evidence of these events.	Paleoproterozoic (between 2.04 and 1.82 Ga)	Churchill Province: South domain	Povungnituk Group Chukotat Group
4	Tectonic movements displace and fragment the rock of a more ancient oceanic crust (roughly 2 Ga) and juxtaposes it with the younger rock of the South domain.		Churchill Province: North domain	Watts Group
5	Geological archives provide evidence of a reversal in tectonic movements. Now, the oceanic plate and the continental plate forming the Superior craton begin to converge. Magmatic activity leads to the formation of a chain of volcanic islands (volcanic arc) next to the oceanic plate.		Churchill Province: North domain and Narsajuaq Arc	Watts Group (oceanic plate) Parent Group (volcanic islands) Ancient plutonic suite of the Narsajuaq Arc forms the roots of the volcanic islands
6	Prior to the collision of the converging plates, there is an accumulation of sediment and volcanic rock in the basins (marine) next to the chain of volcanic islands.		Churchill Province: North domain and Narsajuaq Arc	Spartan Group Sugluk Group
7	Collision of the two plates, subduction-associated phenomena with magmatic activity and formation of the Ungava Orogen. Emplacement in subduction zones of the recent plutonic suite of the Narsajuaq Arc and incorporation of metasedimentary rock of the Sugluk Group into the two plutonic suites of the Narsajuaq Arc.		Superior Province and Churchill Province: North and South domains and Narsajuaq Arc	In the study area for the Parc national Iluiliq Project: Ancient and recent plutonic suites, Sugluk Group
8	Very ancient Archean rock (3.22 to 2.74 Ga), underlying Paleoproterozoic rock, was lifted and pushed to the surface by tectonic movements towards the end of the Ungava Orogeny.		Churchill Province: Kovik Antiform	Kovik Antiform
9	Final accretion of the different tectonostratigraphic domains involved in the Ungava Orogeny.	Paleoproterozoic (between 1.82 and 1.76 Ga)	Superior Province and Churchill Province: North and South domains and Narsajuaq Arc	The juxtaposition of these major geological units is proven by the intrusive rock injected into each unit about 1.76 Ga

The above data is a synthesis of the reconstruction work by St-Onge *et al*. (1992). The periods have been updated, where possible, according to more recent work by Lamothe (2007).

[1]: The figures 3.23 and 3.25 illustrate the distribution of these major geological formations and/or domains in the northern part of Ungava Peninsula.

[2]: Consult Map 3.2 for further details on the distribution of these units.

Source: Poly-Géo inc. 2017

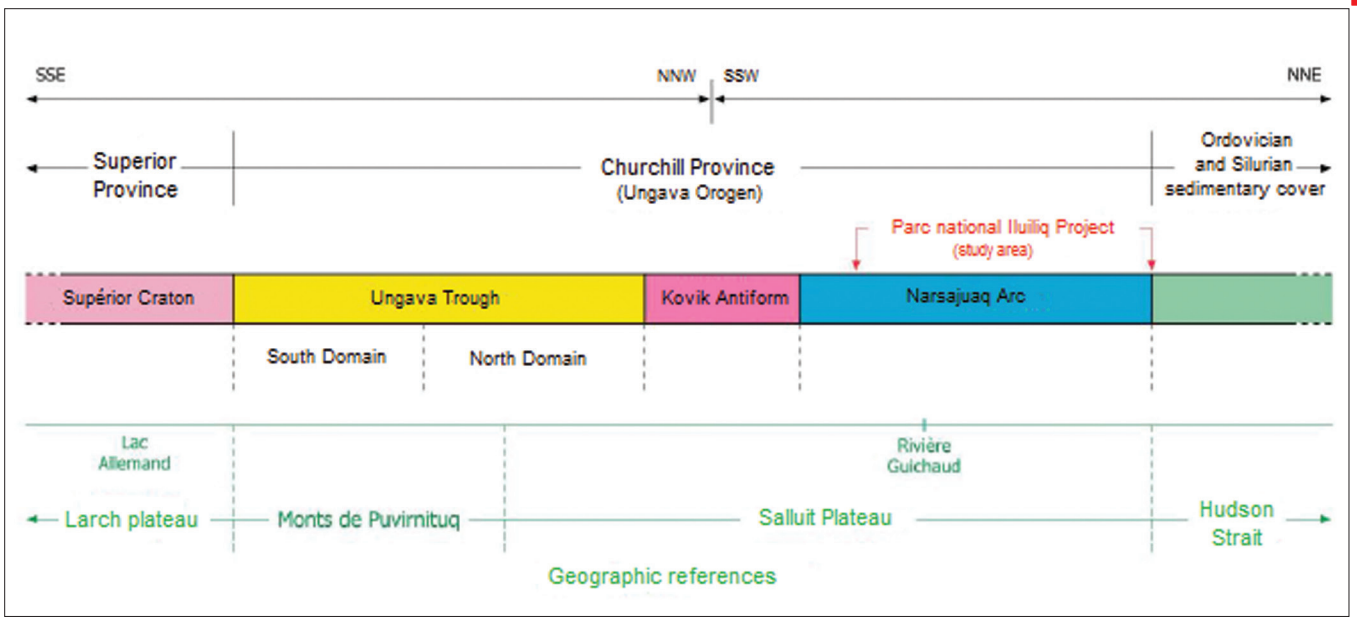


Figure 3.26 Schematic Section of the Main Ungava Orogen Geological Domains

Source : modified from Poly-Géo inc. (2017)

along a coastline. In fact, this morphology is mainly the result of repeated wave action against the base of the slopes, which cuts notches and causes overlying materials to fall. This phenomenon helps to keep the slopes steep. Notwithstanding the considerable difference in elevation between current sea level and the Salluit plateau, these high rocky slopes along the Hudson Strait coastline are not entirely the result of coastal erosion. The difference in elevation, rather, was produced through tectonics or differential erosion, i.e. between the more resistant rock of the plateau and the softer rock of the floor of Hudson Strait. In both cases, the drop of several hundred metres undoubtedly occurred prior to the Quaternary, i.e. several tens of millions of years earlier. Although not responsible for the difference in elevation, coastal erosion may explain the formation and continued existence of the steep slopes at the base of the cliffs. In addition, cliffs comprising generally resistant plutonic rock, such as that making up a majority of the study area, generally retreat very slowly, which is to say by a few millimetres per year. Such a retreat can be assisted or accentuated by weaknesses, such as joints or fractures. Because some of the metasedimentary rock of the Sugluk Group are softer than the plutonic rock, they are likely to erode more deeply, along the cliffs and elsewhere in the landscape.

ECONOMIC GEOLOGY

Mineral exploration of the Ungava Orogen begun at the end of the 19th century led to the discovery in the 1930s of the first Cu-Ni (copper and nickel) sulphide deposits, north of Baie Korak near Akulivik on the west coast of the Ungava Peninsula, well south of the study area (Lamothe, 2007).

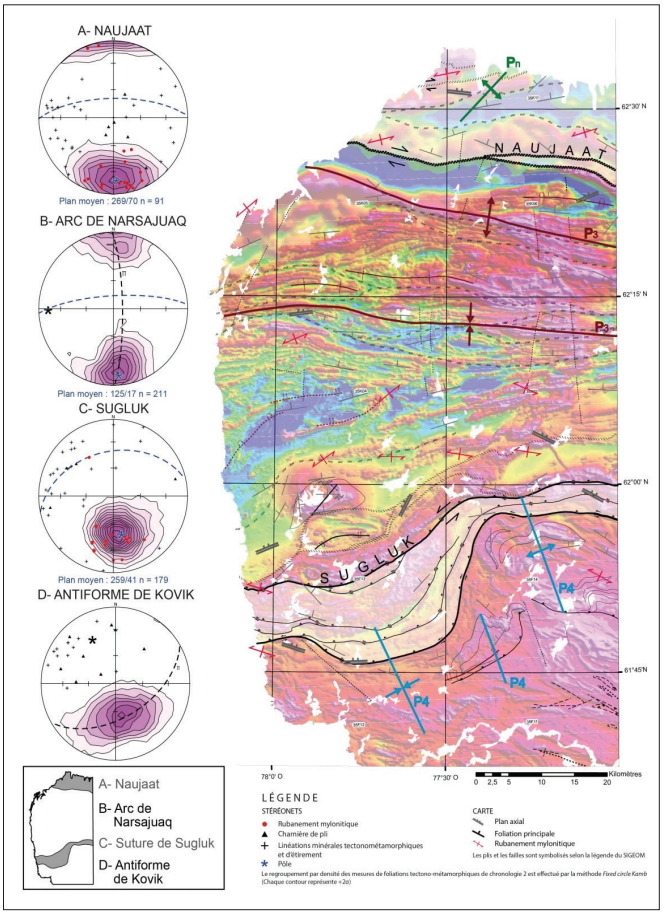


Figure 3.27 Structural Geology of the Study Area

Source: Charrette et Beaudette (2017)

Cliffs
Credit: Benoît Tremblay

Then, in parallel with geological mapping undertaken by the Québec government in the 1950s, several companies became interested in the Ungava Trough, also known as the Cape Smith Belt (Figure 3.23). At that time, this was the name given to the volcanic-sedimentary rock wedged between the Superior Province to the south and the Narsajuaq Arc and the Kovik Antiform to the north. The Ungava Trough is in fact the South and North domains of the Ungava Orogen (Figure 3.25). Several mineral occurrences and deposits were discovered at that time, especially in the eastern part of the Trough, including most of the deposits at the Raglan mine (Perreault, 2003).

The rock of the Watts Group, in the North domain, hosts ophiolitic fragments with chrysotile asbestos deposits; the largest was operated by Asbestos Corporation from 1973 to 1984 at Asbestos Hill, located about one hundred kilometres southeast of Salluit (maps 3.2 and 3.3) (Lamothe, 1994). The Ungava Trough was also targeted for the exploration of platinum group elements (PGE), particularly in the mid-1980s. More recently, mineral exploration has led to the opening of the Nunavik Nickel mine, near the Raglan mine (Map 3.3).

Map 3.3 shows the distribution of mineral deposits, active mining titles and mining activities in the northern part of the Ungava Orogen, as of July 2018. The vast majority of occurrences and mineral deposits, all mining titles and the two operating mines, i.e. Raglan and Nunavik Nickel, are concentrated in the South domain and, to a lesser extent, in the North domain, sectors located well south of the study area. Since 1992, mineral exploration has been prohibited by ministerial order in the territory designated as national park reserve, located in the western half of the study area and to the west of this (it may be noted that the 1992 boundaries of the national park reserve were modified with the signing of the *James Bay and Northern Québec Agreement* (JBNQA) by the community of Ivujivik).

Recent surveys over the Narsajuaq Arc (with the exception of zones exempt from mining activity, i.e. protected areas and Category I lands (see Map 2.1 – Land Regime)) have increased knowledge of the economic potential of the rock formations of the northern part of the Ungava Peninsula. Geochemical surveys of lake sediments (Maurice and Lamothe, 2012) targeted gold, nickel, PGE, yttrium, uranium and copper, as well as diamond, potassium,

uranium and thorium-bearing occurrences (Intissar *et al.*, 2014). In the sector of the study area and around it, the results of this work did not reveal any particular economic potential.

Preliminary Analyses in 2017

Although occurrences and mineral deposits are rare in the rock formations of the Narsajuaq Arc and none have been documented in the study area, sulphide and alteration zones were inventoried during work by the Ministère de l'Énergie et des Ressources naturelles (energy and renewable resources, MERN) in the summer of 2017 and suggest some mineral potential that remains to be evaluated (Charrette and Beaudette, 2017). In fact, during fieldwork carried out in the summer of 2017, the MERN extracted and analyzed 16 samples for their economic potential. It should however be noted that only some of the analysis results for the concerned sectors have been processed and published: to date, no index-based content has been identified (Charrette and Beaudette, 2017). A few kilometres southwest of the study area, in the rock of the Sugluk Group, a nickel occurrence was nonetheless detected, prior to the 2017 work (Map 3.3).

Finally, the 2017 MERN mapping also identified a zone conducive to mineral exploration, associated with banded iron formations, about 60 km southwest of Ivujivik (Figure 3.28). A **zone conducive to mineral exploration** refers to a sector where the geological context is considered favourable for metal or non-metal mineralizations, as demonstrated by the geoscientific work (geological, geophysical, geochemical, etc.) of the MERN or any other source (mineral exploration company reports, scientific articles, theses, etc.), and may eventually lead to a mineral discovery (SIGEOM, 2018). In this case, the conducive zone identifies two levels of banded iron formations not previously identified. They form discontinuous levels generally a few metres thick within a splinter of migmatitic paragneiss.

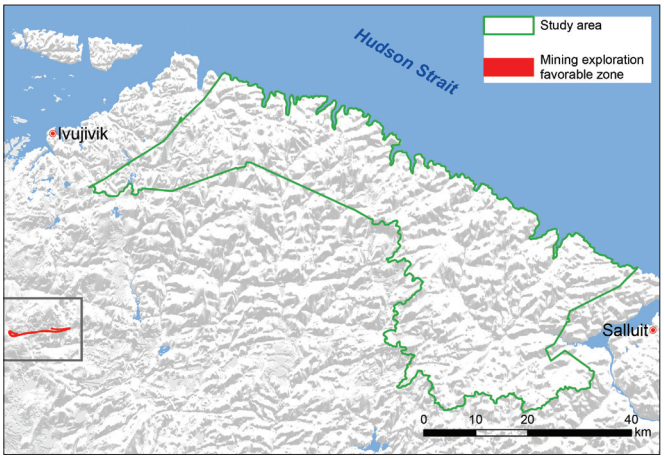


Figure 3.28 Mining Exploration Favorable Zone
Source: data from de SIGEOM (2018)

GEOLOGY OF QUATERNARY

The major landscape features in the study area, such as fjords, a few cirques and the Salluit plateau, are remnants of ancient geological eras. The events that have shaped the landscape during the current geological period are presented below.

Basic notions

The Quaternary is the current geological period, which began 2.6 million years BP, and has been marked by severe disturbances in the climate and by major continental glaciation cycles, interrupted by warmer intervals, called interglacial stages. Based on data extracted from the isotopic composition of oxygen in foraminifers found in seabed sediment cores or in Greenlandic and Antarctic ice, it is estimated that more than 20 glaciations have occurred during the Quaternary and that, for the last 800,000 years, glacial and interglacial cycles have been repeated every 100,000 years or so (Dredge *et al.*, 2014).

The continental glaciers of the Quaternary, known as ice sheets, were between two and three kilometres thick and almost covered Canada in its entirety (Dyke *et al.,* 2002). In Québec, continental glaciers covered northern Québec on at least four occasions (Bellavance, 2014). These gigantic masses of ice contained an enormous volume of water and weighing heavily on the continent, caused the lithosphere to sink significantly (glacio-isostasy), and lowered sea levels (glacio-eustasia), i.e. about one hundred metres.

During the warmer interglacial stages, the oceans and lithosphere gradually return to their original positions (isostatic lifting). Specifically, with the melting of an ice sheet, sea level increases progressively. For their part, the earth's crust and upper mantle which comprises the lithosphere, freed from the weight of the ice, return to their original positions. Because of the inertia of these landmasses, the phenomenon of isostatic lifting spans over thousands of years: this postglacial rebound is initially rapid, but very slow afterwards. During this process, lower regions on the margin of the continent, which are still depressed, remain submerged below sea level until the earth's crust returns to its original position.

In North America, the last glacial episode is known as the Wisconsinan glaciation. It began about 75,000 years BP and ended about 10,000 years BP, when the current interglacial stage, known as the Holocene, began (Figure 3.29) (Fensome *et al.*, 2014). During the Wisconsinan, the reach of the ice caps varied significantly.

Wisconsinan Glaciation in the Study Area

During the Wisconsinan glaciation (75,000 to 10,000 years BP) roughly half of North America was covered by the Laurentide Ice Sheet, comprising three distinct sections with one or more domes, also known as ice-dispersion centres (Occhietti, 1987). The middle Wisconsinan was marked by low ice accumulation, but around 27,000 to 24,000 years BP, glacial advances began and eventually culminated in the late Wisconsinan between 23,000 and 14,000 years BP (Dyke *et al.*, 2002). The maximum ice phase is estimated to have occurred 18,000 years BP, at which time almost all of Canada and the northern United States were covered with ice (Figure 3.30) (Dyke and Prest, 1987; Occhietti, 1987; Dyke *et al.*, 2002; Occhietti *et al.*, 2011). In certain regions of the Laurentide Ice Sheet, ice accumulation nonetheless peaked before 18,000 years BP while, in other regions, the glacial maximum continued after 18,000 years BP. On the Ungava Peninsula, the dispersion of erratic elements south of the Ungava Trough and the flow directions deduced from certain glacial erosion microforms etched into the bedrock provide evidence of an early phase of the Wisconsinan glaciation. In fact, snowfields initially accumulated on high ground north of the Monts de Puvirnituq (Figure 3.31a) until they had formed a glacial ice cap (Figure 3.31b) that flowed radially towards the edge of the peninsula and to the south.

During the last glaciation, Québec was covered by an ice dome called the New Québec dome (Figure 3.30). Except for certain peaks in the Torngat Mountains, Québec and Labrador were completely covered with ice (Dyke and Prest, 1987; Occhietti, 1987; Occhietti *et al.*, 2011). In addition, the thickness of the ice of this dome at the time of the last glacial maximum has been estimated at about 2,000 m (Dyke and Prest, 1987; Dyke *et al.*, 2002). The dome divided into subsections corresponding to regional ice flow (Dyke *et al.*, 2002). It seems that, on the west coast of Ungava Bay, the glacier mainly flowed to the northeast (Dyke and Prest, 1987).

More specifically, as it expanded, it appears the ice cap covering the Ungava Peninsula (Ungava Ice Cap) merged with a more southerly ice cap (Figure 3.31c), called the Payne dispersion centre (Bouchard and Marcotte, 1986). In the northern part of the Ungava Peninsula, ice flow was determined by an ice divide running northwest/southeast, between Ivujivik and the Nantais glacial lake (Figure 3.31d). On both sides of this axis, the ice flowed in opposite directions. In this sector including in the study area, most of the streamlined till and glacial erosion features (striation or embossed rock) are associated with this major phase of flow, which took place between 18,000

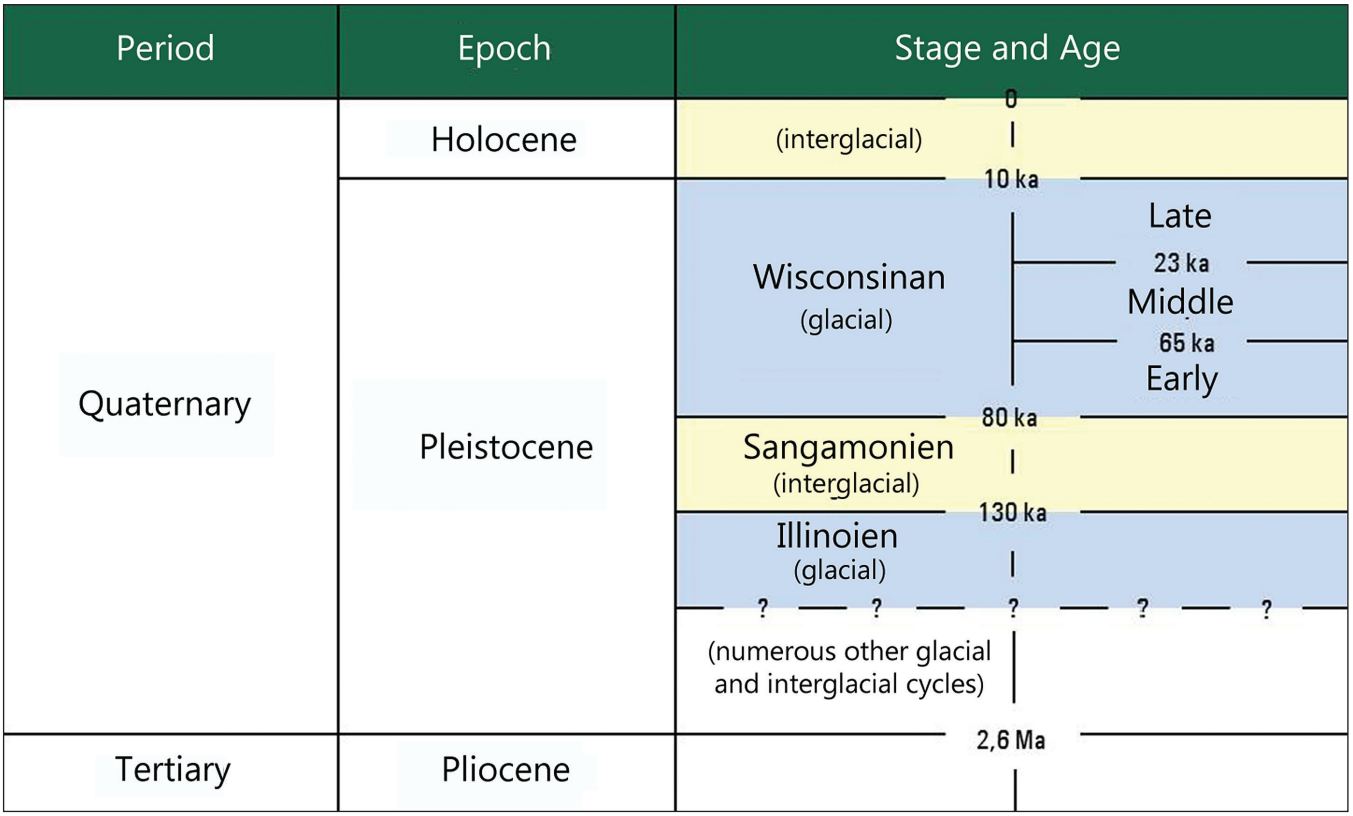


Figure 3.29 Chronology of Glacial and Interglacial Cycles in Canada

Source: adapted from Poly-Géo inc. (2013)

Figure 3.30 Hypothetical Limits of the Late Wisconsinan Ice Sheet

Source: Occhietti (1987)

and 8,400 years BP (Dyke and Prest, 1987). The absence of significant plant cover in the study area is conducive to the observation of the numerous glacial deposits (Tremblay, 2016). Immediately north of this ice divide, and therefore in the study area, the ice flowed towards the northeast (Figure 3.31d).

The separation of ice flow during the late Wisconsinan may be explained by the presence of an east-flowing glacial current in Hudson Strait that ensured the evacuation of continental ice (Figure 3.31d). Although some evidence of this flow may be observed on Charles Island and along the north coast of the Ungava Peninsula, mainly east of Cap de Nouvelle-France, there is none in the study area.

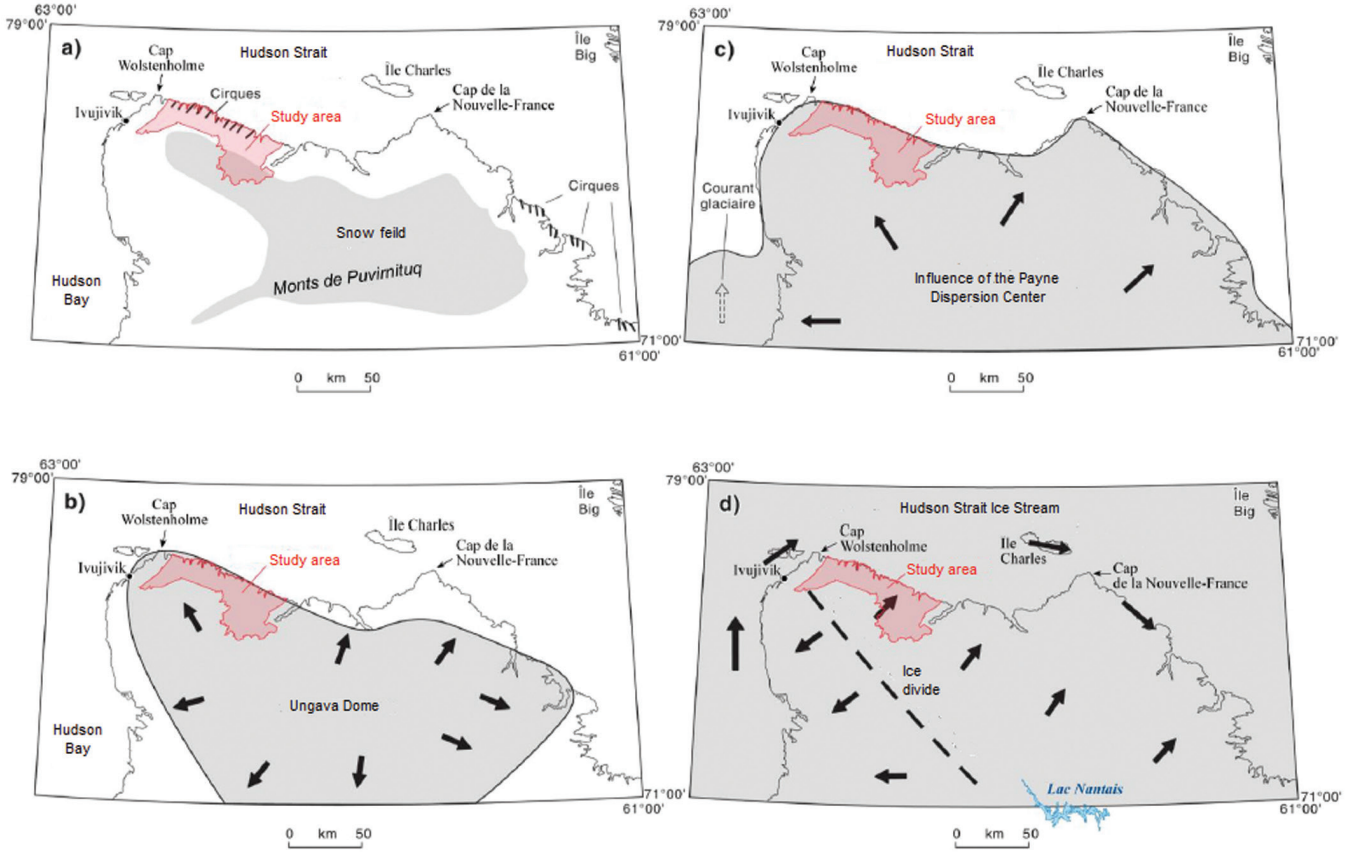


Figure 3.31 The Flow Phases of Upper Wisconsinan Glaciation in the Northern Ungava Peninsula.
Source: modified from Daigneault (2008) (Note: The arrows indicate the direction of glacial flow)

Deglaciation in the Study Area

The melting of the Laurentide Ice Sheet did not occur simultaneously along the different edges of the glacier. While melting began in the south shortly following the last glacial maximum (18,000 years BP), it only began in the north 4,000 years later, given the colder conditions of this region (Sugden, 1977; Dyke and Prest, 1987). It is also possible that the glacier underwent a major shift northward during glaciation, cooling even further its base. This northward migration would have taken place during the late Wisconsinan and led to the creation of new flow patterns (Clark *et al.*, 2000; Jansson, 2003). Some authors hypothesize that the main direction of flow was to the northeast, while others suggest a flow profile from a different period that was radial, in the shape of a horseshoe, and generally towards the south (Clark *et al.*, 2000; Jansson, 2003; Occhietti *et al.*, 2011).

On the Ungava Peninsula, the first regions to be ice-free were the north and northwest edges, around 8,000 years BP (Occhietti *et al.*, 2011). Notwithstanding, the successive positions of the glacier's edge during its retreat from the north of the Ungava Peninsula remain unclear due to the scarcity of deposits left by the glacier, such as frontal moraines.

For his part, Daigneault (2008) has proposed a regional deglaciation pattern based on the orientation of eskers, the localization of channels cut by meltwater along the edge of the glacier, the age and elevation of marine deposits (deposited following the retreat of the ice), and the distribution of remnants of proglacial lakes, i.e. ancient shorelines. According to the pattern, deglaciation of the study area began on the south shore of Tyrrell Strait, now Hudson Strait, from 10,700 to 9,000 years BP. This deglaciation continued southward at a fairly rapid rate, about 200 m per year, until the disappearance of the last remaining ice in the sector, previously the location of the ice divide, around 7,000 years BP (Figure 3.32). Along the northern edge of the peninsula, the glacier receded through contact with the waters of Tyrrell Strait. Between Cap Wolstenholme and Salluit, the land flooded by the sea was very limited given the high elevation of the plateau which makes up the largest part of the study area. Only the valleys were flooded, to elevations reaching from 149 to 176 m. In the valleys of the Rivière Guichaud and the Rivière Foucault, two major rivers in the study area, sea water nonetheless penetrated inland for several tens of kilometres.

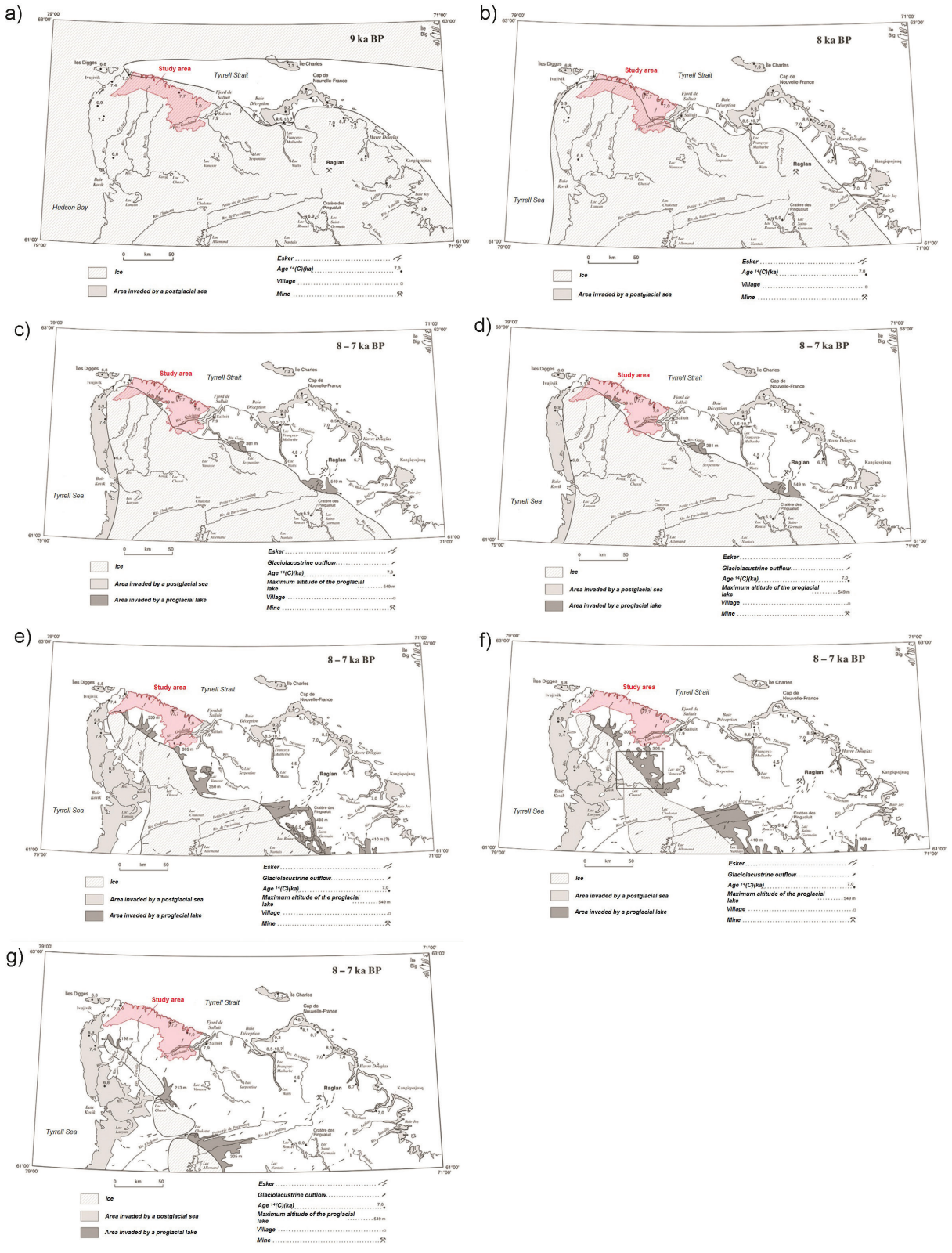


Figure 3.32 Regional Paleogeography of the Northern Ungava Peninsula Deglaciation, Approximately Between 9 ka AA and 7 ka BP

Source: modified from Daigneault (2008)

After withdrawing from most of the study area, the glacier retreated south of the watershed divide between the Hudson Strait drainage basin to the northeast and the Hudson Bay drainage basin to the southwest (Map 3.1). Then, over the next centuries, masses of ice prevented the natural drainage of meltwater southward according to the natural slope of the land, contributing to the formation of ice-dam lakes in the Rivière Frichet, the Rivière Durouvray and the Rivière Derville basins, three rivers located southwest of the study area (the latter two are also included in the Rivière Kovik drainage basin) (figures 3.32c to 3.32g and 3.33). Ancient shorelines and perched deltas in these basins provide evidence of several successive glaciolacustrine levels at elevations ranging from 439 to 132 m. At their highest levels, i.e. 439 to 381 m (figures 3.32c and 3.32d), these lakes covered a portion of the land along the southern edge of the study area. Mapping of the deposits formed during these episodes runs as far as about 15 km south of Cap Bazire, which is on the coast of Hudson Strait, approximately halfway between Salluit and Ivujivik (Figure 3.33). Initially, ice-dam lakes would have drained northward towards Hudson Strait through a pass over the current watershed divide (Figure 3.32c and Map 3.1). Subsequently, after the glacier opened outlets at higher and higher elevations (figures 3.32d to 3.32g), drainage would have shifted westward into the drainage basin of the Tyrrell Sea (today Hudson Bay).

Postglacial Marine Transgression

The retreat of the continental glacier was followed by the transgression of the postglacial D'Iberville Sea into areas depressed by glacio-isostasy (Occhietti *et al.*, 2011). In general, the transgression of the D'Iberville Sea into the southwest part of Ungava Bay occurred much more gradually than along the coast of Hudson Bay (Gray *et al.*, 1993). This is explained by the fact that deglaciation along the Hudson coast was very rapid compared to deglaciation along the Ungava coast.

As soon as the glacier retreated from the rugged shoreline of the study area, the waters of Tyrrell Strait flooded the still-depressed main valleys to form fjords. Deltas were created in these inlets by meltwater carrying rocky debris, initially during contact with the glacier and then gradually further and further from it (figures 3.32c and 3.32d), until the glacier had retreated further south and its meltwater

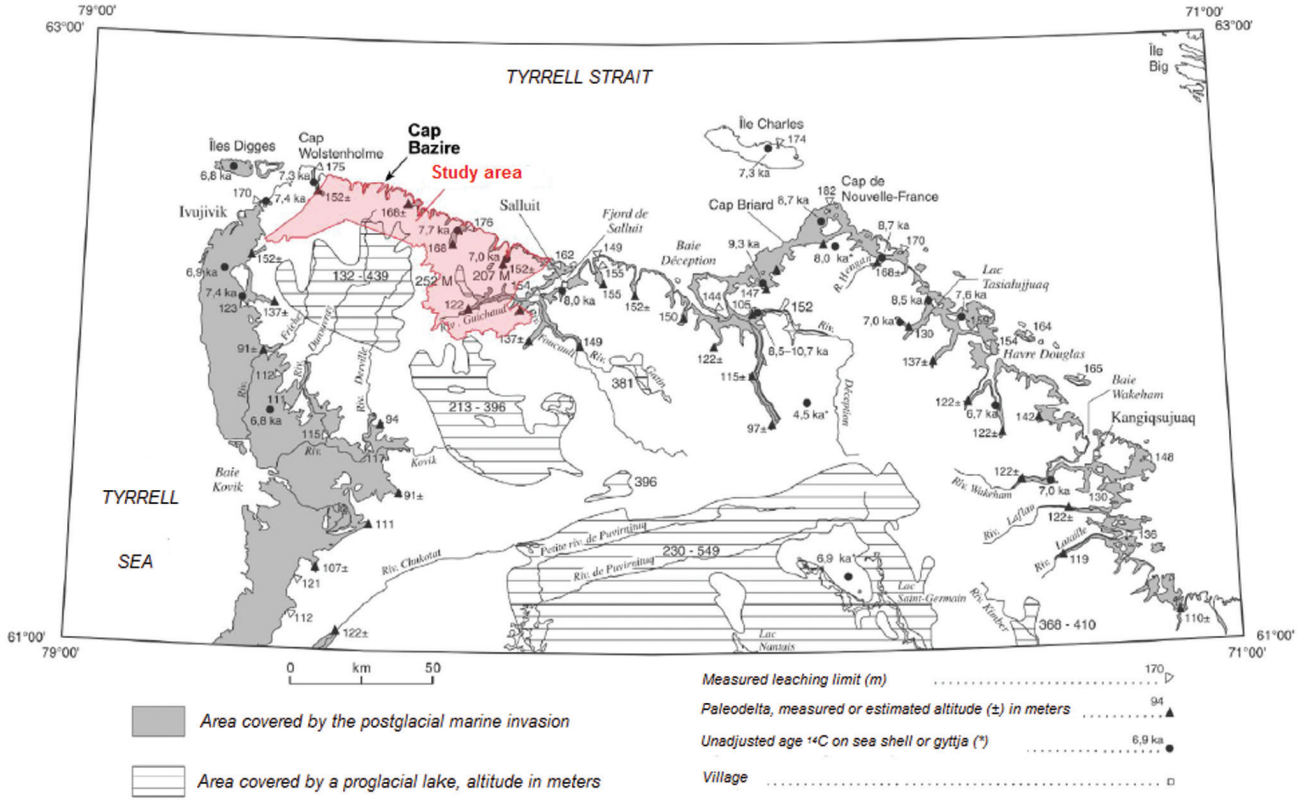


Figure 3.33 Maximum Altitude and Extent of Postglacial Seas and Glaciolacustrine Water Bodies in the Northern Ungava Peninsula Following Late Wisconsinan Deglaciation

Source: modified from Daigneault (2008)

began to flow into the Tyrrell Sea to the west. Between Cap Wolstenholme and Salluit, the highest elevations reached by this sea water range from 149 to 176 m (Figure 3.33). This limit marked the landscape by depositing a discontinuous strip of blocks produced by till washed from ancient shorelines. Below this limit, the highest paleodeltas are present at elevations from 122 to 168 m. The marine limit was higher along the coast than inland. A difference of roughly 45 m exists between delta surfaces formed along the coast, i.e. around 168 m, and those formed near the head of the valley of the Rivière Guichaud, i.e. around 122 m. In addition, in the valley of the Rivière Guichaud, these kinds of deltaic accumulations are distributed over more than 20 km between the postglacial marine limit and current sea level. Inland, the marine limit decreases because these sectors were flooded later, once postglacial isostatic lifting of the earth's crust was more advanced than at the time of deglaciation along the coast. In the main valleys along the northern coast of the Ungava Peninsula, stepped deltas formed at increasingly lower elevations as sea level dropped due to postglacial isostatic lifting.

A land emergence curve, based on the carbon-14 dating of 24 marine deposits, collected by different researchers, was proposed by Daigneault (2008) for the sector from Cap Wolstenholme to Salluit (Figure 3.34). This curve demonstrates that a first phase of emergence was slow, with a lifting rate of about 2.5 m/century during deglaciation up to about 6,000 years BP. Subsequently, the rate seems to have accelerated, i.e. lifting reached up to 5 m/century from 6,000 to 4,000 years BP, or 5 cm/year. The rate then decreased to 0.7 m/century after 4,000 years BP, or 0.7 cm/year. According to the emergence curve, it is possible to estimate that sea water was about 60 m above its current level 5,000 years ago, and 15 to 20 m above its current level 3,000 years ago.

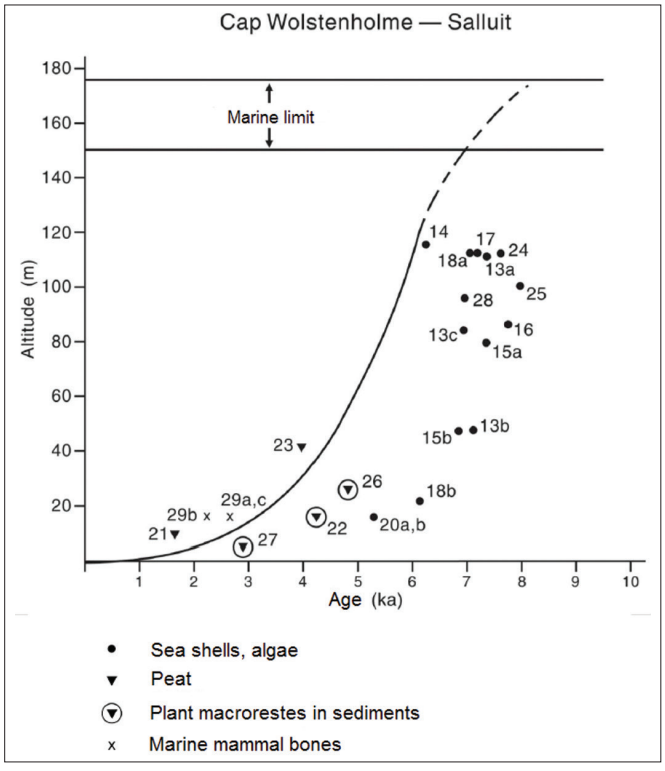


Figure 3.34 Land Emergence Curve from Cap Wolstenholme area to Salluit

Source: modified from Daigneault (2008)

GEOMORPHOLOGY

Located in the natural province of the Ungava Peninsula, the study area is characterized by a broad plateau forming an undulating peneplain that slopes gently westward. The southern boundary of the study area follows the watershed of the Rivière Guichaud drainage basin. Its northern boundary is Hudson Strait. Magnificent cirques accompanied by glacial valleys and deep fjords alternate along this coastline from Cap Boisseau (*Nipirvbik*) in the east to Pointe du Saint-François (*Itivata Nuvua*) in the west. Glaciers produced few changes in the pre-existing landscapes; notwithstanding, glaciers had a noteworthy effect on some remarkable landscapes of geomorphological interest, particularly in the fjords, cirques and glacial valleys, with the accumulation of sand materials produced by marine transgression, marine regression and the reworking of postglacial deposits.

Geomorphology is the study of the morphology of the earth's surface, and the forces that acted on it in the past, continue to act on it and will act on it in the future (Trenhaile, 2010). This science explains the landforms and surface materials observable in the study area. The Ministère du Développement Durable, de l'Environnement et de la Lutte contre les changements climatiques (*sustainable development, environment and fight against climate change*, MDDELCC) in cooperation with the KRG conducted fieldwork in the summer of 2015, in particular, to characterize the geomorphology of the study area for the Parc national Iluiliq Project. Denis Bellavance, a geomorphologist with the biodiversity expertise branch (DEB) of the MDDELCC, participated in this work and prepared a synthesis of knowledge for this status report (Bellavance, 2017). The following sections contain descriptions of the overall study area and the main components of the physical environment. Only elements with particular significance and of geomorphological interest are presented. Twenty-four **sites of geomorphological interest** are shown and described in greater detail on Map 3.4 and in Table 3.10.

ELEVATIONS

Drainage basins in the north are generally characterized by a relatively even topography and terrain that rises gently from the coasts to inland areas (Lapointe, 1979). The western sector of the study area follows this general principle. It is characterized by a broad plateau that gradually declines by approximately 25-m decrements towards the southwest boundary of the study area, to an elevation of about 168 m. The average elevation of the study area is 472 m, and the maximum elevation is 554 m to the south of Cap Révillon. The centre of the study area is marked by asymmetrical mounds, hummocks and subparallel depressions that follow the northeast–southwest geological structure. In the eastern sector of the study area, south of Anngiit, the topography is more rugged with larger vertical drops that are highly eroded by the drainage system (Map 3.5).

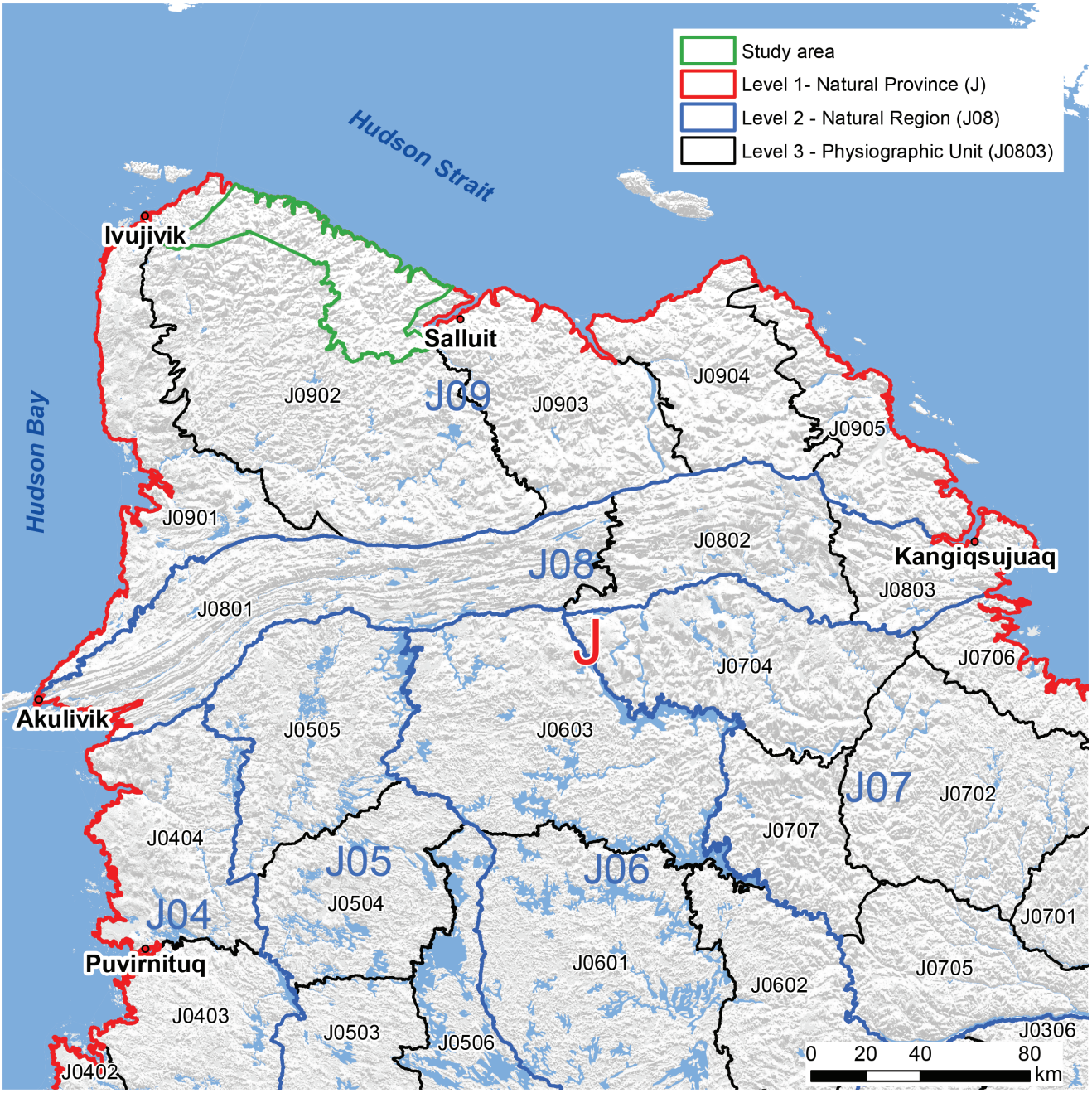


Figure 3.35 The Three Superior Levels of the Cadre écologique de référence du Québec; Natural Province, Natural Region, and Physiographic Unit of the Study Area Region

Cartographic Data from Cadre écologique de référence du Québec (CERQ)

ECOLOGICAL PROFILE

The Cadre écologique de référence du Québec (ecological reference framework, CERQ) is a cartographic tiering and ecological territory classification tool. It applies the physical elements of ecosystems (geology, topography, drainage system, etc.) to establish a tiered system of levels, fitting one inside another (MDDELCC, 2014). Figure 3.35 shows the CERQ's three upper levels. These levels are as follows: Level 1 Natural Province, Level 2 Natural Region and Level 3 Physiographic Unit. Specifically, the study area is situated in the natural province of the Ungava Peninsula (CERQ Level 1), in the natural region of the Salluit plateau (CERQ Level 2), and in the physiographic unit of the Lac Fargues high plateau (CERQ Level 3). It is then subdivided by the CERQ into eight ecological districts, made up of regional ecological units defined by specific configurations of topography, surface deposits and geology, corresponding to the CERQ Level 4. In this section, the ecological districts (Level 4) of the study area have been grouped into three sectors in the following text: the northwest sector, the northeast sector and the south sector. Figure 3.36 juxtaposes the ecological districts and the three sectors applied to describe the study area.

Northwest Sector

This sector stretches along Hudson Strait, covering both the coast and a portion of the inland plateau. It is marked by deep valleys and cirques cut into the edge of the rocky plateau. These landforms are carved mainly in metasedimentary rock of the Sugluk Group. (Map 3.2, Geology). Slopes in this sector are generally greater than 50% and have large talus slopes and debris cone at their bases. Both are formed from materials eroded from rocky escarpments; however, debris cone are fanned shaped since the materials are released through discharge channels. (Figure 3.37) (Genest, 2000; Trenhaile, 2010).

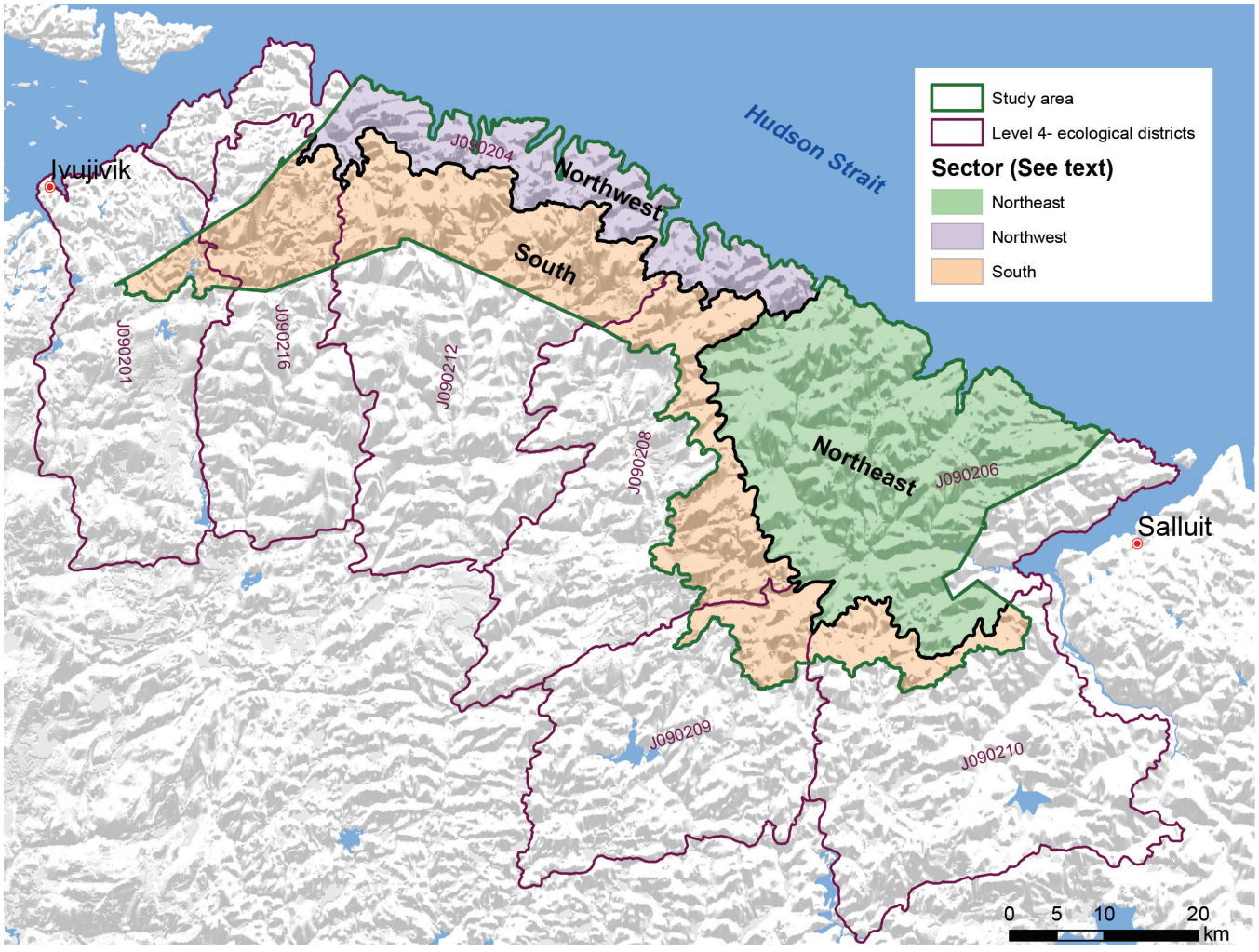


Figure 3.36 Ecological districts (level 4 of CERQ) and their Grouping in Three Sectors

Cartographic Data from Cadre écologique de référence du Québec (CERQ)

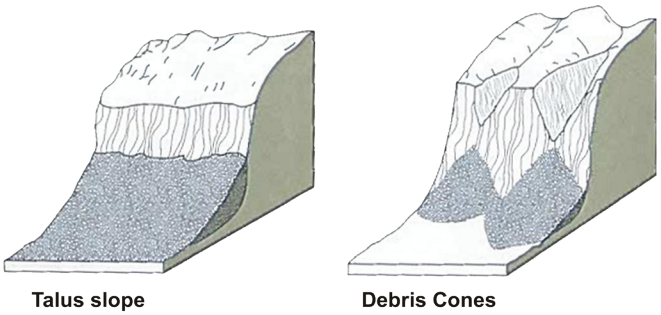


Figure 3.37 Talus slope and debris cone formations
Source: Trenhaile (2010)

The plateau portion of this sector possesses a slightly convex surface covered with stony till, and rocky mounds interlaced with small valleys. Generally speaking, the northwest sector of the study area has very little glacial deposits, except in the small valleys, depressions and the upstream sections of some cirques.

Northeast Sector

This sector also stretches along Hudson Strait, to the east and includes a good portion of inland area in the southeast. The sector can in fact be divided in two, i.e. a northern portion and a southern portion. Glacial valleys cut through the northern portion of this sector, carving deeply through the edge of the plateau. The cliffs along the northern edge of the plateau are formed from hard rock of the Narsajuaq Arc (Map 3.2, Geology) and a few isolated enclaves of metasedimentary rock. These sections of metasedimentary rock, eroded from the Sugluk Group, are positionned between the plutonic rock, giving the hills in this sector an especially northeast–southwest orientation with slopes of between 16 and 30%. At elevations under 150 m, depressions are filled with deep-sea sediment (silt, sand, fine loamy, etc.). For its part, the southern portion of the sector has an undulating surface covered with thick till. Asymmetrical mounds of thick till is in fact migrating, through the process of gelifluction, towards the bases of hillsides, valleys and depressions. Gelifluction is the downslope movement of an unfrozen surface over a permanently or temporarily frozen surface (Trenhaile, 2010). The slopes of the two major valleys in this sector, tributaries of the Rivière Guichaud, are covered with thick till**.** The following formations, which provide evidence of fluvioglacial accumulation, may also be observed: kame terraces, eroded sections of eskers, scattered hillocks, etc. They are all described in more detail below.

South Sector

Generally speaking, the south sector of the study area expresses a fairly monotone embossed topography. Asymmetrical mounds and hummocks are separated by small valleys and shallow depressions, covered with thicker glacial deposits. Several ancient channels filled with very stony material cover large areas of this sector. Towards the west, the plateau gradually declines by 25-m decrements to an elevation of 160 m, near Hudson Bay.

SURFACE MATERIALS

Map 3.6 and Table 3.9 present all the surface deposits in the study area, divided between Quaternary deposits and pre-Quaternary deposits. The most recent deposits, those of the Quaternary, are classified according to their origins, i.e. dating from the last glaciation or from the postglaciation period (Table 3.9). The map also indicates the main landforms in the study area for the Parc national Iluiliq Project.

Glacial deposits (more specifically till) are by far the most common type of deposit in the study area. In fact, the greatest part of the study area is covered by varying thicknesses of till, which is rarely more than 50 cm deep. The following section covers the different landforms found in the study area, i.e. all the formations and visible features attributable to morphogenic actions (erosion, transportation, accumulation, etc.) (Genest, 2000).

Table 3.9 Types of Deposit according to Period of Origin

PERIOD		TYPE OF DEPOSIT
Quaternary	Postglaciation	Organic
		Colluvial
		Alluvial
	Last glaciation	Glaciolacustrine
		Glaciomarine and marine
		Fluvioglacial
		Glacial
Pre-Quaternary		Rock substrate

Source: Poly-Géo inc. (2017)

GLACIAL ENVIRONMENT LANDFORMS

Several characteristic formations of the study area provide evidence of the passage of the ice sheet and the force of glacial erosion. Ranging from till to macroscale features of glacial erosion (cirques, glacial valleys, fjords, etc.), glacial environment landforms vary greatly according to the sector of the study area.

Moraines

A moraine is an accumulation of sediments, especially till, that is deposited by the ice sheet and may take any number of forms. It mainly contains an undifferentiated ground

moraine with a few sectors of ablation and disintegration moraine characterized by a knob-and-basin type topography, covered by dead ice sediment deposits.

Till refers to all the sediments deposited by a glacier. Thus, it is not strictly speaking a formation, but rather a layer of abandoned materials (Trenhaile, 2010). On the plateau, the till deposits are rarely more than 50 cm thick. For their part, glacial deposits greater than 1 m thick are rare and usually have no particular shape, as illustrated in the photo below. Valleys in the study area possess a greater number of deep glacial deposits expressing some particular formations.

Microscale Features of Glacial Erosion

Since glaciers contain enormous quantities of materials, their movements scar existing rock with the debris accumulated at their bases. The microscale features (groves, striations, etc.) produced by this phenomenon provide information on the direction of ice flow since they are generally oriented parallel to glacial movement. The study area comprises several microscale features, which can sometimes be difficult to observe where they are covered with unconsolidated deposits.

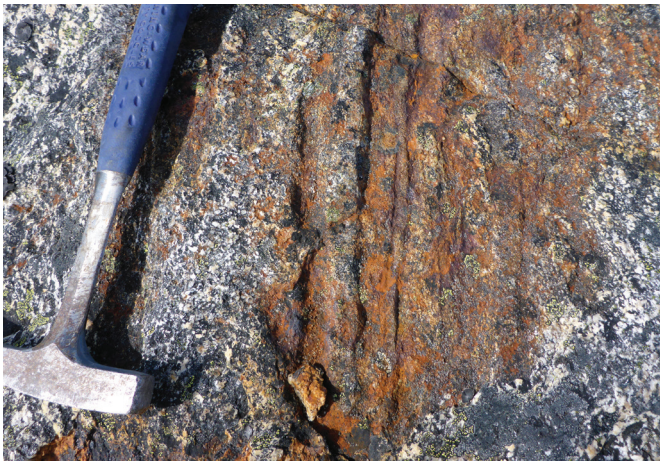
Thick till deposits occupy most of the small valley; block and pebble clustering is sorted by gelivation
Credit: Denis Bellavance

Shear through a morainic system. The materials consist of pebbles with many blocks in a sandy-gravel matrix
Credit: Denis Bellavance

Glacial Striation

The main microforms of glacial erosion observed in the study area are striations which are generally fairly deep and short, i.e. rarely more than 30 cm long. They are frequently located on peaks in rugged topography and on high slopes. They mainly run in the same direction as ice flow.

Example of glacial striation on rock
Credit: Denis Bellavance



Example of glacial striation on rock, close-up view
Credit: Denis Bellavance

Plastically Moulded Forms (P-Forms)

The term plastically moulded form (p-form) is used to describe several formations cut into existing rock, such as striations, curvilinear channels and potholes. There are several hypotheses explaining the development of these formations, in particular meltwater flow and abrasion

produced by the ice sheet and its debris (Daigneault, 2008; Trenhaile, 2010; Bennett and Glasser, 2011). These formations in particular suggest that pressurized meltwater flowed at high speeds under the ice (Daigneault, 2008). A superb example of this type of formation has been identified along Hudson Strait, in the stepped glacial cirque east of *Kangirsukutaak*. The stepped cirque is also a **site of geomorphological interest** (site no. 06; Map 3.4). The photos of this sector highlight these formations, and emphasize the distinct violet and purple colouring produced by the presence of minerals in the rock, probably manganese or iron oxide. It should be noted that these colours appear only on surfaces that have been highly polished by meltwaters (Denis Bellavance pers. comm., 2017).

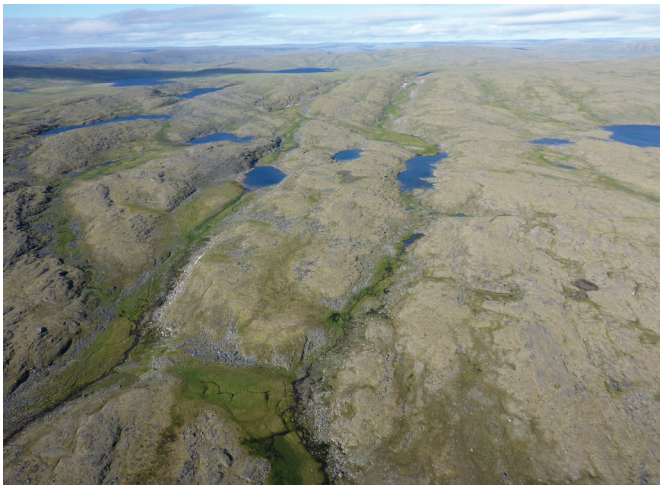
Example of distinctly coloured p-forms in the study area west of the Promontoire De Longueuil
Credit: Denis Bellavance

Site containing p-forms in the study area west of the Promontoire De Longueuil
Credit: Denis Bellavance

Macroscale Features of Glacial Erosion

Streamlined Outcrops

Streamlined outcrops are characteristic medium-sized features of the plateau in the study area (south sector). They are in fact bosses that have been rounded by the passage of glaciers, in particular the upstream side (Daigneault, 2008).



Example of streamlined outcrops in the study area. The arrow shows the direction of glacial flow. The small valleys are oriented perpendicular to glacial flow which is uncommon on the Ungava Peninsula

Credit: Denis Bellavance

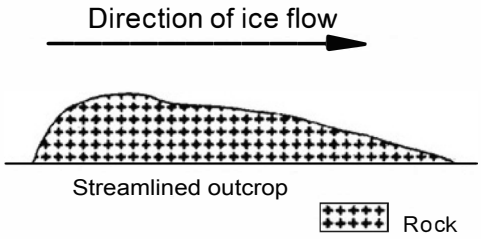


Figure 3.38 Streamlined Outcrop Formation

Souce: Dionne (1984)

Glacial Valleys and Fjords

Glacial valleys are fairly linear landforms carved into the bedrock by the force of glacial erosion, in places where the topography restricted ice flow (Bennett and Glasser, 2011). Most of the actual glacial valleys existed as preglacial rivers, while certain valleys were entirely created by glacial erosion (Trenhaile, 2010). It has been suggested that the form of a valley formations represent a steady-state landform, i.e. they are modified by erosion to facilitate ice flow and, subsequently, their morphologies remain relatively constant (Bennett and Glasser, 2011). Different valley profiles, including u-shaped and v-shaped valleys, are the result of factors such as lithology, rock structure, postglacial river action, etc. Research conducted by Harbor *et al.* (1988), and reported in Bennett and Glasser (2011), covered modelling of the formation of

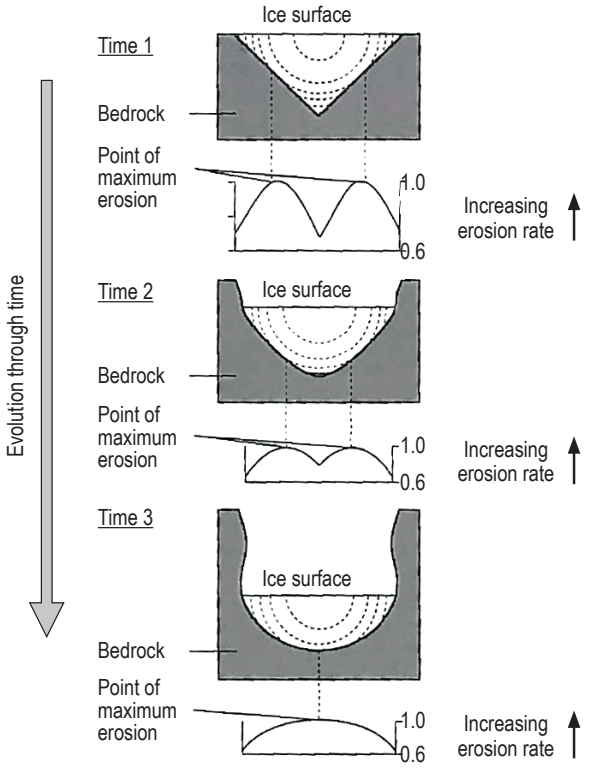


Figure 3.39: Modelling of the formation of a u-shaped valley according to time and glacial erosion

Source: Harbor *et al.* 1988

fluvioglacial deposits upstream. These give way to deltaic deposits in the downstream section of the valley.

Hanging Glacial Valleys

The weight of a glacier in a wide valley generates greater erosion than along the bed of smaller tributaries. The rate of erosion in these two types of valleys is not the same. Consequently, the valley with the slower rate is eventually left "hanging" from the wall of the deeper valley (Figure 3.40) (Trenhaile, 2010; Bennett and Glasser, 2011). The study area possesses several hanging valleys slong Hudson Strait, ranging from small to large along Hudson Strait.

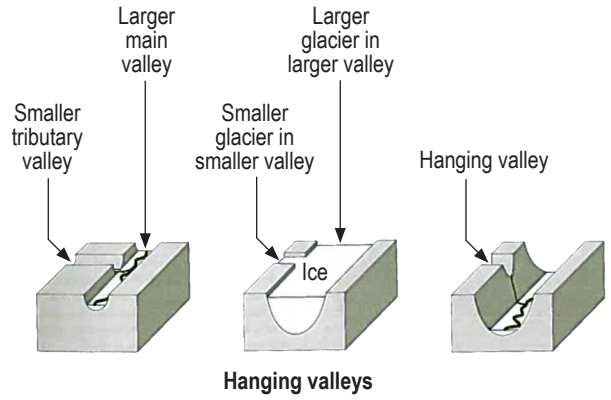


Figure 3.40 Formation of a hanging valley

Source: Trenhaile 2010

u-shaped valleys from preglacial v-shaped river valleys. It has been estimated that, at an erosion rate of 1 mm per year, 100,000 years would be required for the formation of a 100-m deep valley (Figure 3.39).

For their part, fjords are simply glacial valleys with downstream sections flooded by the sea: their walls are steep and their floors, irregular (Bennett and Glasser, 2011). In the study area, glacial valleys and fjords are located along Hudson Strait. In general, the length of these macroscale features correlates to the length of the related drainage basin. Thus, along Hudson Strait, glacial valleys and fjords are more spectacular in the east sector than in the west sector. The immense glacial valley of Baie Déception is a good example and it also holds true for the study area. The largest glacial valley in the study area is the valley of the Rivière Guichaud. It covers a distance of 40 km to its fjord and is located on the eastern edge of the study area. It is a **site of geomorphological interest** (site no. 24; Map 3.4). Upstream, the valley is u-shaped; narrow and rectilinear. The valley of the Rivière Guichaud and its many tributaries cut a deep dendritic pattern through the plateau. The Tyrell Strait marine transgression submerged this valley to an elevation of 122 m, and created several

The hanging valley site no. 23 located southeast of Cap Qarliik Nuvua is distinctively set against a glacial cirque (site no. 18). The valley and the glacial cirque, which are **sites of geomorphological interest** (Map 3.4), are perched at an elevation of 120 m. They press more than 300 m into the plateau. The valley floor is covered in particular with deep-sea sediment (silt, sandy clay, etc.). South of the small shallow lake, close to Hudson Strait, a small kame and ridges produced by ice-proximal downwasting have been identified.

Cirques

Cirques are amphitheatre- or bowl-shaped basins with steep walls on the face of a hill, mountain or cliff. Carved by glacial erosion, cirques are generally located at the heads of glacial valleys, the starting point of valley glaciers. With climatic cooling, snow that collects in these depressions never completely melts. Year after year, the snow continues to accumulate and become more tightly packed, expelling the air it contains and transforming into a neve. Over years and centuries, successive layers of snow accumulate and the neve becomes a glacier. Then, under its own weight, the ice begins to deform and flow. Glacial erosion and alteration, through abrasion, crushing and the freeze-and-thaw process,

Glacial valley of the Rivière Guichaud
Credit: Benoit Tremblay

The hanging glacial valley (site no. 19) east of Qarliik is an example of a large hanging valley in the study area. South of the small shallow lake, close to Hudson Strait, a small kame and ridges produced by ice-proximal downwasting have been identified.
Credit: Benoit Tremblay

contribute to the expansion of the initial depression. The force of gravity initiates a circular ice flow and fosters the formation of crevasses in the upper part of the glacier. Through this process, the rock debris carved from the floor of the cirque and produced by gelifraction along the overhanging rocky walls is incorporated into the glacier and ejected towards the bottom of the slope, boosting erosion and overdeepening the cirque. After the ice melts, a small body of water remains in the bowl of the cirque.

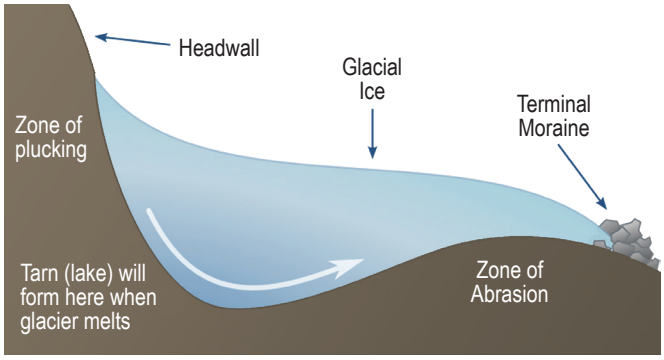


Figure 3.41 Formation of a glacial cirque with glacial lake

Source: Wikipedia, 2018 [https://commons.wikimedia.org/w/index.php?curid=4070165].

The roughly 16 cirques found in the study area express a continuum of forms according to their degree of development. They vary from a small amphitheatre-like formation with almost regular profile to a very elongated cirque with a flooded downstream section. Most of the cirques face north-northeast (Hudson Strait) and several are carved into the softer metasedimentary rock of the Sugluk Group. The many cirques notched into the steep-sided coastline of Hudson Strait in the study area were formed at the very beginning of the Wisconsinan, i.e. during the last ice age in North America. Notwithstanding, given their size, it is probable that the largest, which are up to 460 m deep, existed before the last glaciation, even before the Quaternary, and simply became active again during the Wisconsinan (Polygéo inc, 2017). In Québec, the Laurentide Ice Sheet, during the Wisconsinan Glaciation, nonetheless erased a majority of the remnants of previous glaciations, making them more complex to identify. In the following section, cirques are divided into four categories according to their degree of development, size and location. All the cirques in the study area are **sites of geomorphological interest**.

Mature Cirques

Mature cirques are the most spectacular; the most entrenched in the plateau. They have reached a advanced stage of morphogenesis. They are moreover the most common. The study area includes six mature cirques (site nos.: 05, 11, 13, 16, 18 and 22; Map 3.4). All are **sites of geomorphological interest**. At least one has a depth below actual sea level, providing a hint as to when it began to develop: sea level would necessarily have been lower than the actual level to permit snow accumulation. According to the estimated erosion rate and the depth of the cirques, it has been calculated that their development began about 5 million years ago. The depths of these cirques reach 460 m between Cap Wolstenholme and Qarliik Nuvua. It has even been suggested that these large cirques were only slightly modified during the last ice age (Daigneault, 2008). Including zones flooded by the sea, mature cirques measure on average 4 km in length and 1.5 km across while the heights of the cliffs and rocky walls are about 400 m. These cirques are also generally characterized by small upstream glacial lakes. Cirque walls are described as active, since considerable gelifraction feeds the talus and lower slopes. As well, the notches carved in the cirque walls act as flow channels that permit the continual formation of debris cones.

Mature cirque in the study area next to the fjord at *Kangirsukutaak*, to the east (site no. 11)
Credit: Benoit Tremblay

Intermediate Cirques

Intermediate cirques are not as well defined as mature cirques, especially in their upstream sections. They are also not as long nor as wide. Their morphologies are somewhat undulating with the constant injection of talus slope**.** Their floors are also more irregular: littoral terraces and morainic accumulations are sometimes observed. The study area for the Parc national Iluiliq Project comprises two intermediate cirques (site nos. 03 and 12; Map 3.4).

Juvenile Cirques

Stretching an average distance of 1.5 km and with widths rarely greater than 900 m, nascent cirques are the smallest glacial cirques in the study area. There are six nascent cirques in the study area (site nos.: 02, 04, 07, 14, 15 and 20; Map 3.4). They comprise small bowl-shaped formations

Intermediate cirque in the study area. *Puijisiurvik* near the western boundary of the study area
Credit: Benoit Tremblay

Nascent glacial cirque (no 15) at *Qarliik Kuunga*
Credit: Benoit Tremblay

Stepped cirques (no 17) in the middle of Qarliik, view to the south
Credit: Jean Gagnon

and depressions recessed in cliffs and rocky escarpments, mainly in the northern part of the study area. Their floors are covered with highly eroded ancient and actual littoral materials that have been reworked by ice in addition to fluctuations in sea levels.

Cirques stairway

The cirques stairway observed at Baie Qarliik are a distinctive formation. They consist of successive glacial verrous that resemble a staircase. These large cirques have developed in the more resistant plutonic rock of the Narsajuaq Arc. The cirque no. 17 is a **site of geomorphological interest**. It possesses three successive catchment basins at the respective elevations of 273 m, 106 m and 29 m. The highest basin is 1,500 m long, 850 m wide and 167 m deep. It was not flooded by postglacial marine transgression. The second basin is more spectacular with a length of 2,000 m, width of 1,000 m and 450-m escarpments. There are significant quantities of talus slope and a grouping of debris cones. This basin marks the limit of postglacial marine transgression. The third basin is a bench with a cirque lake and marine terraces. Situated at an elevation of approximately 20 m, this basin has deep-sea sediment deposits (silt and sandy clay), which are rare in the study area. Rather than being covered with rocky debris, its slopes show signs of polishing and the flow of a glacial-tongue.

Fluvioglacial Formations

An enormous volume of water was produced when the glaciers melted. This water action tore away and transported many particles which, when later deposited, produced fluvioglacial landforms. They are evidenced in only a small portion of the study area.

Kame Terraces

Kame terrraces are created by ice-contact deposits. The sediments are carried by meltwaters and accumulate on the edges of glaciers next to slopes (Trenhaile, 2010; Bennett and Glasser, 2011). In the study area, kame terraces have been identified, among other sites, north of the Rivière Guichaud. One good example of a kame terrace is a **site of geomorphological interest**. It is located at Ikkarujaalik (site no. 09; Map 3.4), southwest of Cap Révillon, in a glacial valley with a fjord, also designated as a **site of geomorphological interest** (site no. 08; Map 3.4). It is a longilineal valley with a steep-sided, v-shaped profile and approximately 70% slopes. The escarpments are approximately 450 m high and the rusty colour is produced by the metasedimentary rock of the Sugluk Group. Covering a total distance of 6 km, the valley opens up and change its aspect about 1.5 km from its mouth. Ice-contact deposits formed kame terraces that have been sheared by intense flow. The site is moreover at the limit of marine transgression. The kame terrace at Ikkarujaalik is 50 m high and covers roughly 450 m^2. The intense flow made several natural cuts in the formation, exposing the terrace's strata and very stony deposits.

Kame terrace at Ikkarujaalik
Credit: Denis Bellavance

Glacial valley with a fjord at Ikkarujaalik
Credit: Benoit Tremblay

Meltwater Channels

As the name suggests, meltwater channels are formed by torrents of meltwater carving a channel or a series of channels in glacial deposits or in bedrock. Meltwater channels suggest the direction of retreating glaciers. In the study area, several subglacial meltwater channels cut into the plateau and covering a large area have been identified. These are mainly found on the plateau, in depressions, between asymmetrical mounds and hummocks. An unnamed valley in the southwest sector of the study area was highly eroded by meltwaters. It is a **site of geomorphological interest** (site

Meltwater channels in the study area.
Credit: Denis Bellavance

Front edge of a glaciomarine delta in the glacial valley at Baie Qikirtaaruliup Kangirsunga
Credit: Denis Bellavance

no. 21; Map 3.4). The site comprises an overdeepened strip of friable metasedimentary rock of the Sugluk Group, which gives it a characteristic rusty colour. The valley is 1 km wide upstream and gradually narrows to 0.5 km downstream. The site is formed by a series of ancient dendritic channels winding between hillocks and irregular surfaces. The small valleys are carpeted with highly reworked till, while the wider channels lay directly on bedrock.

LITTORAL AND MARINE ENVIRONMENT LANDFORMS

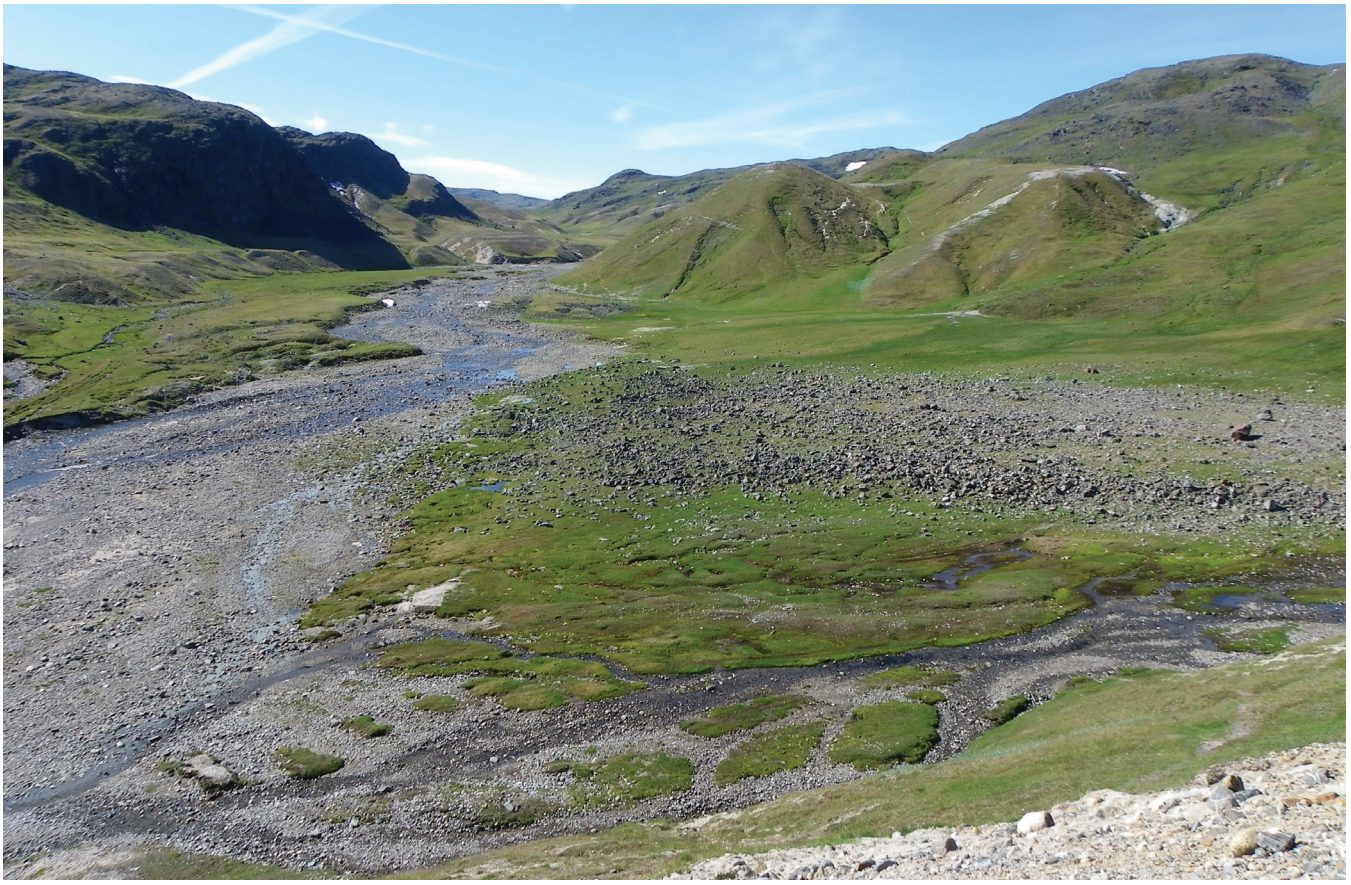
Postglacial marine transgression in the study area by the waters of Tyrell Strait (today's Hudson Strait) following the retreat of the ice sheet made significant marks on the landscape. The marine transgression flooded large sections of the main valleys, which were stilled depressed. Most of the formations and sediment associated with these types of landform are therefore located in coastal depressions in the study area.

Glaciomarine Deltas

During marine transgression into several valleys located in the study area, the ice sheet released a large quantity of materials, creating substantial glaciomarine deltas. Large quantities of water and detritic sediments, mainly bedded silty sand and stratified gravel aggregate, produced deltas sometimes more than 50 m thick. The highest deltas have elevations between 122 and 168 m, and are generally located near the coast. Where the marine limit penetrated far inland, an approximate 45-m difference has been noted between the elevation of deltas formed along the littoral (168 m) and the elevation, for example, of a delta located at the head of the Rivière Guichaud (122 m). The glacial valley with a fjord at *Sinaaliariaq*, a **site of geomorphological interest** (site no. 23; Map 3.4), stands out for its large upstream deltas. This glacial valley also possesses significant deltaic terraces, more than 40 m thick, eroded by the ancient and actual river system. Shells found at this site have been identified by Matthews (1967a) as belonging to the *Hiatella arctica*-type, aged 7,050 years BP (±150 years).

The fjord at the mouth of this valley is also remarkable. It is 5.3 km long by 2.5 km wide. The height of the cliffs transitions from 300 m high upstream to 50 m high at the mouth. The fjord comprises rock of both the Narsajuaq Arc and the Sugluk Group. Discharge channels, rectilinear notches and a change in rock colour mark the contact zone. The fjord possesses littoral formations mid-distance along the two shorelines, specifically sand spits formed where two opposite-flowing littoral drifts meet. These littoral formations have been produced by the combined action of drifting unconsolidated materials (sand, pebbles) at the foot of the cliffs, currents and tides, as well as windblown particles. These formations also have an anchor point (rocky outcrop) at one end and a free point at the other end.

The glacial valley with a fjord at *Sinaaliariaq* is a site of geomorphological interest
Credit: Benoit Tremblay



The glaciomarine deltas in the glacial valley with a fjord at *Sinaaliariaq* are a site of geomorphological interest
Credit: Camille Le Gall-Payne

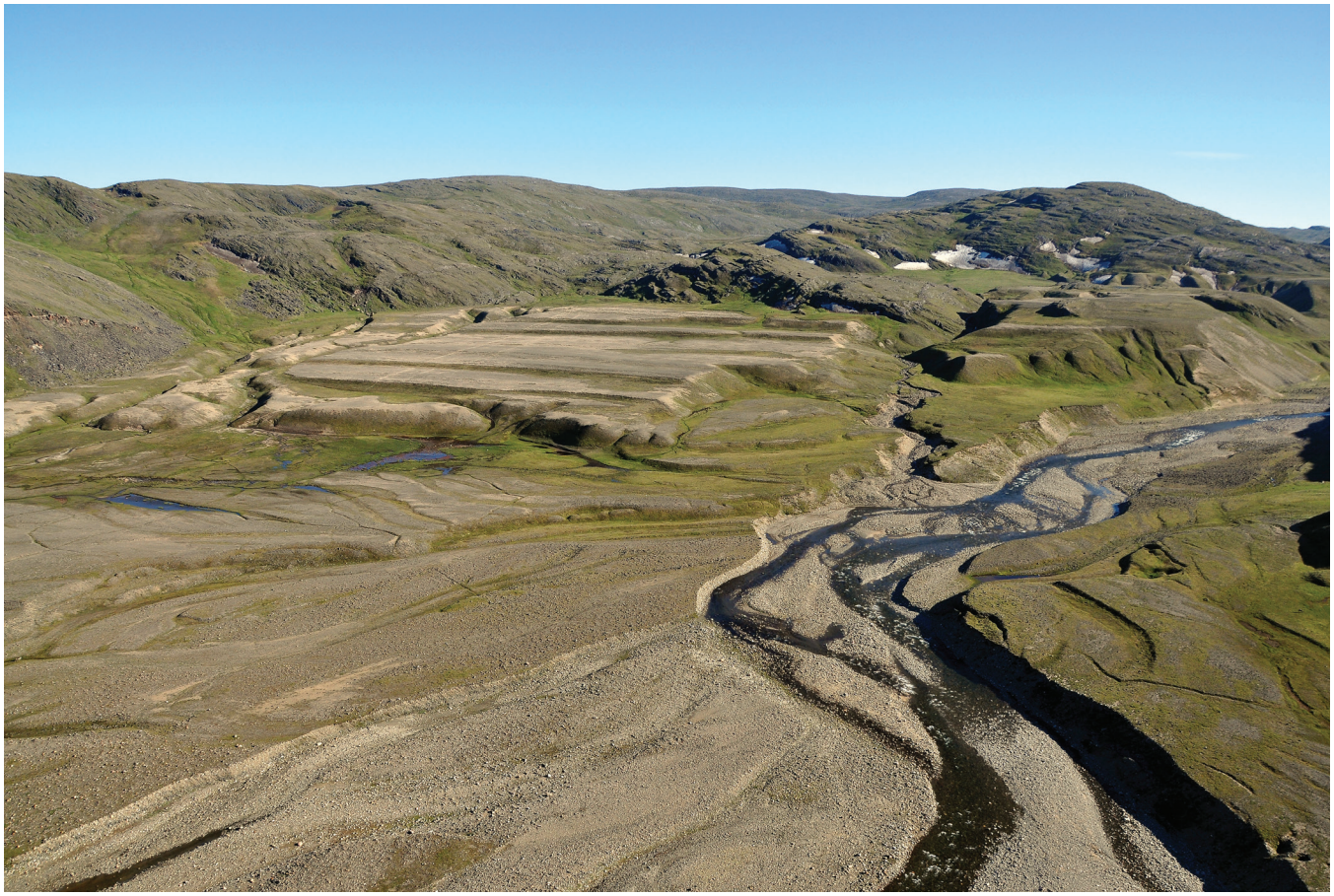
Marine Beaches

The study area possesses several raised beaches resulting from the phenomenon of isostatic uplift that occurred with the retreat of the waters of Tyrell Strait. They are mainly composed of fossilferous littoral sediments. In fact, certain shells were discovered in living positions. These were bivalve molluscs, specifically softshell clams (*Mya arenaria*) and (*Cerastoderma edule*). These bivalve molluscs feed using a protruding and retractable siphon that filters the water while they lay buried in mud. When they are found upright in sandy deposits, they are described as being in a living position, i.e. the position taken by bivalve molluscs feeding.

Mussels (centre) in a living position
Credit: Denis Bellavance

Deep-Sea Deposits

Deep-sea deposits consist mainly of clayey silt as well as sandy silt and may be more or less carbonated, in particular due to the hard parts of marine micro-organism remains. During marine transgression, calm and deep water conditions permitted the sedimentation of fine materials forming these deposits. In general, they are found along a fringe northeast of the Ungava Peninsula. In the study area, they are located west of Baie Déception, along the strait to the bay at Qarliik Nuvua. They fill several depressions above the limit of marine submergence at large sites, varying on average from 45 to 76 m and 90 to 122 m. Dating performed on organisms found in the region suggest that sedimentation in these deep-sea environments began more than 7,000 years



Raised beaches in the valley at Baie Qikirtaaruliup Kangirsunga
Credit: Alain Thibault

ago. (Daigneault, 2008). Since the deep-sea deposits consist of fine sediments with high water content, they are highly subject to periglacial phenomena, such as gelifluction and cryoturbation.

Deep-sea deposit and striped patterned ground near Qarliik
Credit: Benoit Tremblay

PERIGLACIAL LANDFORMS

Periglacial landforms are associated with cold climates, termed periglacial, i.e. cold and non-glacial conditions as well as permafrost. Cryoturbartion, which is to say all the processes associated with the heaving and churning of ground due to freezing action, plays a determining role in the development of the main landforms in periglacial environments. As described under the Climate heading in Section 3: Physical Environment, the study area is situated entirely in a continuous permafrost zone (Figure 3.11). In a continuous permafrost zone, depth is generally greater than 150 m. However, unfrozen layers (called taliks, i.e. a portion of free water) may be a part of the permafrost (Figure 3.12). The active layer, the uppermost layer of permafrost, is especially important in cold regions, since most hydrological, ground formation, ecological and biochemical processes occur in this layer (Trenhaile, 2010). The thawing of this layer in the spring generally occurs rapidly, starting at the surface and progressing downwards. Inversely, the refreezing of this layer in the fall can take from six to eight weeks. The phenomenon occurs simultaneously from the surface downwards and from the

permafrost upwards (Trenhaile, 2010). The main landforms associated with the periglacial climate and permafrost in the study area include gelifluction sheets and lobes, patterned and striped ground, as well as ostiole fields. These are all described below.

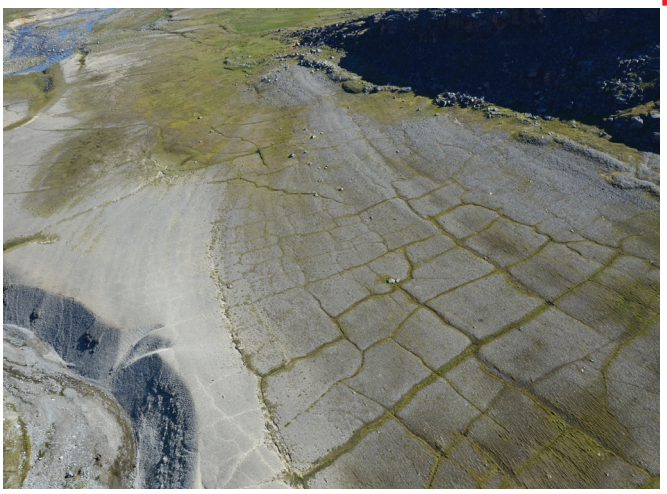
Gelifluction Sheets and Lobes

The phenomenon of gelifluction involves the slow downward movement toward the foot of a slope of a formation made plastic or liquid by thawing action. The permafrost, the permanently frozen layer, traps rain and meltwater in the active layer. At the time of spring thawing, the oversaturated sediments lose cohesion and the materials begin to flow. The degree of movement varies according to the specific conditions at each site, but rarely exceeds 15 cm annually. The phenomenon of gelifluction is responsible for several formations in the study area. These are characterized in particular by the stretching and alignment of sediments and low vegetal structures parallel to the slope. On mounds and hills, the dispersal occurs radially. The most common formations are gelifluction sheets and lobes found frequently on slopes. These formations possess fairly consistent surfaces, generally comprising significant sedimentary cover, variable inclination and an abrupt front edge of between 50 and 150 cm high. They are also associated with the accumulation of very angular blocks, which in certain small valleys may be more than 2 m high.

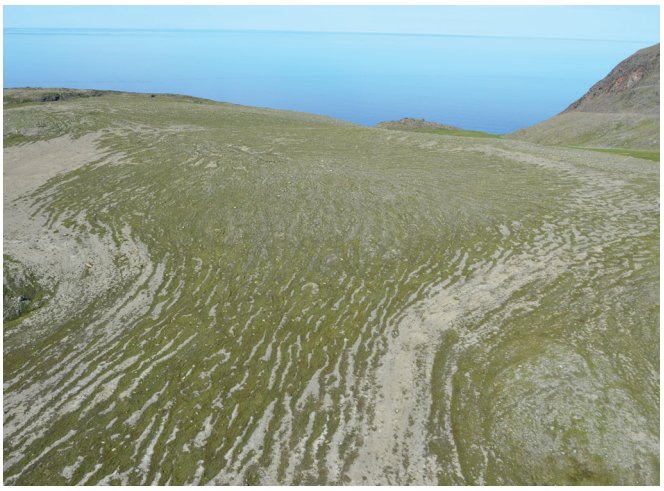
Gelifluction phenomenon in the southeast sector of the study area
Credit: Denis Bellavance

Patterned Ground (Polygonal Soil)

Patterned ground presents geometric shapes in unconsolidated formations. They are found in different types of climate, but are more visible in cold climates. The



Patterned ground (polygonal soil) at the bay at Anngiit
Credit: Benoit Tremblay



Patterned ground near *Napirvik*
Credit: Benoit Tremblay

Close-up of striped patterned ground near *Napirvik*
Credit: Denis Bellavance

main geometric shapes are circles, polygons and stripes. These types of ground may consist of sorted or non-sorted materials.

Generally, there is a transition between circular- or polygonal-shaped ground on flat surfaces and stepped or striped ground on inclined surfaces. In fact, on slopes, polygons transform into stripes, i.e. long strips of fine materials alternating with long strips of pebbles.

Ostiole Fields

Tundra ostioles are more or less circular formations, 1 to 3 m in diameter, and found on bare soil. They are formed by convection movements in the active layer resulting from freeze-and-thaw processes. Pressure is exerted on the water-saturated fine materials, which freeze last in the ground. These materials are pushed to the surface. Their shapes are most affected by inclination: the steeper the slope, the greater the elongated shape. Tundra ostioles are one of the most common formations associated with permafrost in the study area, and sometimes form in large fields.

Ostiole field in the study area
Credit: Benoit Tremblay

Ostiole in the southeast sector of the study area
Credit: Denis Bellavance

SITES OF GEOMORPHOLOGICAL INTEREST

Based on photo interpretation, terrain analysis and fieldwork, 24 **sites of geomorphological interest** have been identified (Table 3.10 and Map 3.4). These sites are mainly the result of events in the Quaternary, the retreat of the last ice sheet, the Tyrell Strait marine transgression or periglacial phenomena. They correspond to spectacular landforms or distinctive landscapes of geomorphological and geological interest. These sites of geomorphological interest are identified and detailed in Table 3.10 and shown on Map 3.4. As most of these sites are described above in the text, only the sites of geomorphological interest not already mentioned are covered below.

Kangirsukallak (no. 01)

The **site of geomorphological interest** known as *Kangirsukallak* is a glacial valley with a fjord, at the northwest boundary of the study area. Starting on the plateau, the valley is in fact formed by three distinct winding branches (three v-shaped valleys). They have steep west-facing walls (20 to 25%) and moderate east-facing walls (10 to 20%). Their confluence is associated with a nick point roughly 6.7 km downstream. This sector expands into a 480-m wide, u-shaped valley that runs to Hudson Strait. There are substantial glaciomarine deltas in each of the three valleys associated with the high-level terraces on both sides. Downstream from the confluence zone, stepped-accumulation deposits become more important. The valley floors are carpeted with ancient fluvial terraces and actual alluvial terraces. The valley empties into a fjord called *Kangirsukallak*, which is 6.6 km long and, at its widest, 2.6 km across. It should be noted that the fjord is located outside the study area for the Parc national Iluiliq Project.

Table 3.10 Sites of Geomorphological Interest

Map reference no.	Site toponym or nearby	Dominant geology	General formation	Characteristics	Dimensions Elevation (m) (min./max.) Slopes (average)	Area (km^2)	Orientation
Glacial valley with a fjord							
01	*Kangirsukallak*	Tonalite, Mudrock	U-shaped valley with wide floor; begins with three tributaries.	High erosion of fluvial terraces; significant deltas upstream of the confluence zone.	Elev.: 0/397 Slopes: 23%	40.40	NNW
08	Ikkarujaalik	Mudrock and sandstone; tonalite	V-shaped profile upstream and becomes u-shaped downstream; presence of kame terraces; 4-km long fjord with 450 m high escarpments.	The cliffs of the fjord express different geologies, colours and several signs of preferential erosion.	Elev.: 0/165 Slopes: 52%	11.52	NNE
10	*Kangirsukutaak*	Tonalite, mudrock	Small valley but large fjord.	Rocks of the Sugluk Group form the central part of the fjord; notches and channels on the southward-facing wall; talus from the opposite slopes meet along the thalweg.	Elev.: 0/249 Slopes: 55%	10.63	NNE
23	*Sinaaliariaq-Tasiujaq*	Mudrock and sandstone; tonalite	Has distinctive upstream deltas and fjord; deltaic terraces are cut by ancient and actual steams.	The deltas are located at the foot of a nick point (where the valley widens); inclination of the geological layers; presence of shells (*Hiatella arctica*, 7050+-150 years old).	Elev.: 0/125 Slopes: 25%	16.21	NE
24	Rivière Guichaud	Tonalite, quartziferous diorite	U-shaped valley with longitudinal profile stepped towards the mouth; has several tributaries; convex and stepped slopes below the marine limit.	The largest valley in the study area; has its head in a canyon; significant gelifluction on the slopes.	Elev.: 0/126 Slopes: 13%	170.88	ENE
Hanging glacial valley							
19	South of *Qarliik Qitinga*	Mudrock and wacke	Hanging u-shaped valley set against a glacial cirque; irregular convex slopes upstream; downstream section more regular.	The flat of the valley floor is filled with deep-sea sediments (silt and sandy clay); the valley is cut more than 300 m into the plateau.	Elev. 120 m	2.14	N
Mature cirque							
05	*Nuvuuqiulak*	Mudrock and wacke	Well-defined bowl with regular slopes; floor flooded by the sea; many notches most noticeable on the westward-facing side.	Significant notches and channels on the rocky walls.	Depth: 400 m Width: 1.5 km Length: 4.6 km	6.27	N
11	East of *Kangirsukutaak*	Tonalite; mudrock and wacke	Typical cirque with lake at the foot of the upstream wall and the downstream section flooded; downstream nick point; notches and channels on the eastward-facing walls and on the upstream walls.	Notches and channels on the headwall; glacial polishing on certain walls.	Depth: 450 m Width: 1.3 km Length: 4.1 km	5.12	N

Table 3.10 Sites of Geomorphological Interest

Map reference no.	Site toponym or nearby	Dominant geology	General formation	Characteristics	Dimensions Elevation (m) (min./max.) Slopes (average)	Area (km^2)	Orientation
13	East of Cap Pachot	Tonalite; mudrock and wacke	The inclined headwall makes this cirque distinctive, and it is incised by a stream; wide at the mouth.	Presence of a central stream that cuts through the terrace floor; the back slopes are less abrupt and precipitous.	Depth: 473 m Width: 1.3 km Length: 4.7 km	6.21	NE
16	*Qarliik Qaninnisaq*	Mudrock and wacke; tonalite	Eighteen times longer than deep, this cirque forms an "S" with a sizeable flooded area.	Rare deltaic deposit in a cirque.	Depth: 400 m Width: 1.2 km Length: 7.2 km	8.33	NE
18	*Qarliik Ungasinnisaq*	Mudrock and wacke	Narrow cirque with domed and slim floor; downstream section flooded (presence of a lake).	Presence of two small creaks on the eastward-facing wall; the upstream walls are highly eroded and incised; the back slopes are less abrupt and precipitous.	Depth: 380 m Width: 1.4 km Length: 5.7 km	8.32	N
22	Anngiit Kuunga	Mudrock and wacke; tonalite	Small cirque with typical bowl shape, the width of the mouth is considerable; downstream section flooded.	The eastern edge of the cirque (west-facing slope) follows a line of lithological contact.	Depth: 300 m Width: 1.2 km Length: 6.8 km	13.33	NE
Intermediate cirque							
03	Puijisiurvik	Mudrock and wacke; tonalite	Well-defined bowl shape with regular slopes; floor flooded by the sea; accompanied on the west side by another cirque, smaller with a domed floor.	Notches and channels on the walls fostering the formation of debris cones; numerous subhorizontal dykes in the rock of the Narsajuaq Arc; cirque at a mature stage.	Depth: 380 m Width: 2.0 km Length: 3.7 km	6.02	NNE
12	West of Cap Pachot	Tonalite; mudrock and wacke	Characterized by its bowl shape; the slope is gentler on the southeast side with small notches on the opposite slope.	Presence of a central stream that cuts through the terrace floor; the back slopes are less abrupt and precipitous.	Depth: 455 m Width: 0.9 km Length: 3.4 km	2.96	NE
Juvenile cirque							
02	*Namunngavissa-qangituq*	Tonalite, quartziferous diorite	The smallest cirque in the study area; notches and channels on the westward-facing walls.	At the point of geological contact between the Narsajuaq Arc and the Sugluk Group; bowl-shaped basin better-defined and larger on the west side; floor incised in slope materials.	Depth: 300 m Width: 0.7 km Length: 1.3 km	0.85	N
04	Puijisiurviapik	Tonalite; mudrock and wacke	Mature cirque with typical bowl shape; sloped floor.	Notches and channels on the eastward-facing walls and upstream walls.	Depth: 400 m Width: 1.2 km Length: 2.0 km	22.2	NNW

Table 3.10 Sites of Geomorphological Interest

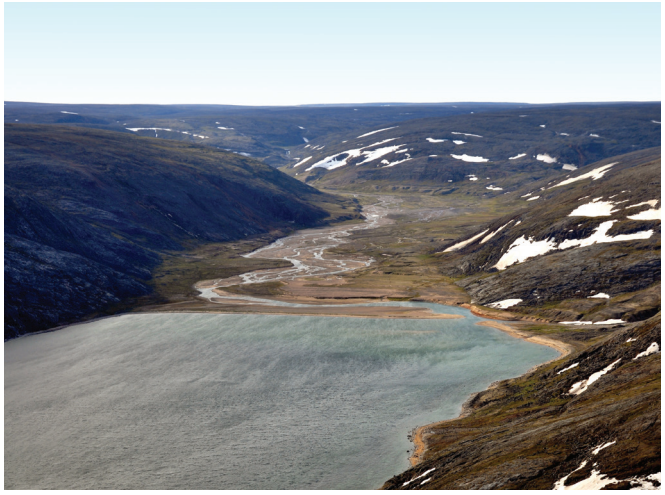
Map reference no.	Site toponym or nearby	Dominant geology	General formation	Characteristics	Dimensions Elevation (m) (min./max.) Slopes (average)	Area (km^2)	Orientation
07	West of Promontoire De Longueuil	Mudrock and wacke	Small cirque (intermediate) with typical bowl shape; domed floor.	Downstream section restricted by a bench or glacial ridge.	Depth: 430 m Width: 1.0 km Length: 1.3 km	1.21	N
14	East of Cap Pachot	Mudrock and wacke	Small cirque (intermediate) with bowl shape; domed floor.	Notches and channels on the westward-facing wall; situated along a glacial valley.	Depth: 400 m Width: 0.9 km Length: 1.0 km	0.88	N
15	West of Qarliik Kuunga	Mudrock and wacke	Small cirque with typical bowl shape.	Many notches and channels on the westward-facing wall; irregular floor with nick point downstream.	Depth: 400 m Width: 1.0 km Length: 1.9 km	2.09	ENE
20	West of *Qikirtaarulip Siukkaalunga*	Tonalite; mudrock and wacke	Small cirque with typical bowl shape.	Presence of dykes on the cliffs, presence of very stony stepped terraces and lake.	Depth: 345 m Width: 0.8 km Length: 1.8 km	1.33	N
Cirque stairway							
06	West of Nuvvuqiulaap Tikirakutaanga	Mudrock and wacke	Characterized by the coalescence of two glacial tongues; flooded floor.	At the NW edge, presence of p-forms and marble with calcio-silicate rocks; eroded littoral terraces.	Depth: 445 m Width: 1.2 km Length: 4.3 km	4.85	N
17	Between the two bays at Qarliik	Tonalite, quartziferous diorite	Stepped cirque with three levels (three lakes); around the first lake, thick till; nick point (falls; connecting talus); slopes are characterized by talus slopes.	Lithological contact between the three levels.	Depth: 420 m Width: 0.9 km Length: 5.9 km	6.48	NE
Meltwater channel							
21	South of *Qkirtaaruliup Kuungata Sangummanga*	Mudrock and wacke	Reddish or rusty colour, series of non-symmetrical rocky mounds with meanders through several benches.	Low mounds undergo significant weathering; rocks disintegrating and accumulating in the form of residual ferruginous gruss.	Length: 1.0 km Width: 1.5 km	1.5	N
Kame terrace							
9	Ikkarujaalik	Tonalite, quartziferous diorite	Gravelly, very stony deposits.	Several upstream sections eroded and several clear natural cuts.	Height: 50 m Surface: 450 m^2	0.032	NE

The three branches of the glacial valley at *Kangirsukallak* and numerous glaciomarine deposits
Credit: Benoit Tremblay

***Kangirsukutaak* (no. 10)**

The **site of geomorphological interest** known as *Kangirsukutaak* is also a valley with a fjord. It is located in the northeast sector of the study area. The site has a steep-sided, v-shaped profile with average slopes measuring 60% and cliffs 350 to 450 m high. The fjord is sizeable, i.e. 5 km long by 1.7 km wide.

The section of cliff comprising resistant rock (tonalite, diorite, granite, etc.) is characterized by convex slopes,



Fjord and valley at *Kangirsukallak*
Credit: Alain Thibault

Upstream portion of the valley at *Kangirsukallak*
Credit: Marianne Ricard

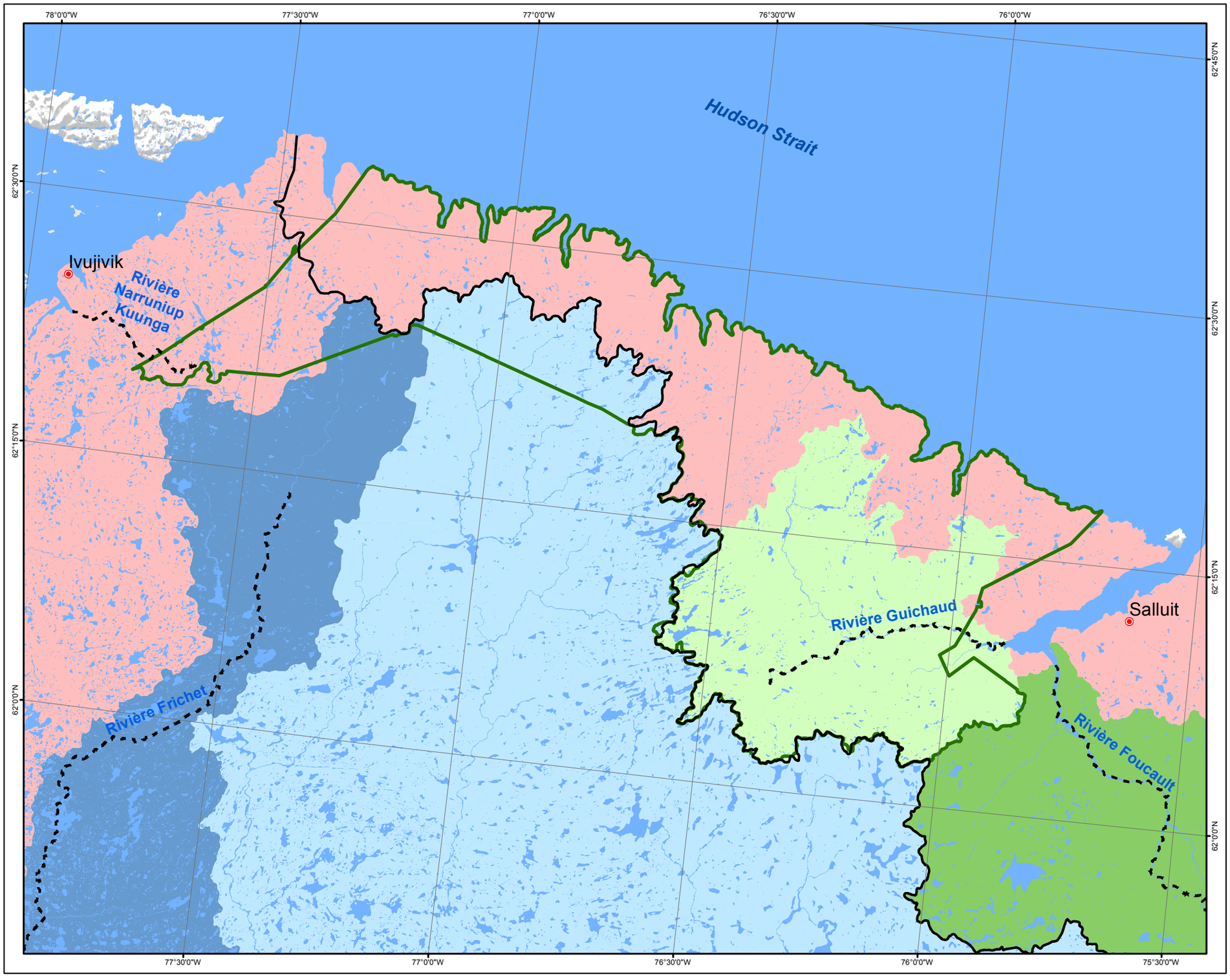
The fjord at *Kangirsukutaak* is a site of geomorphological interest
Credit: Alain Thibault

while the rock in the centre, associated with the Sugluk Group, has a slightly concave profile with talus slope at its base.

The valley possesses numerous notches and discharge channels that feed the debris cones and talus slope on the valley floor. These formations almost block the valley floor. In several places, the talus slope is coalescent.

Section of cliff comprising rock of the Sugluk Group at the fjord at *Kangirsukutaak*
Credit: Camille Le Gall-Payne

View towards the valley at *Kangirsukutaak*
Credit: Marianne Ricard



PARC NATIONAL
ILUILIQ PROJECT

Drainage basins

Watershed divide

Study area

Drainage basins

- Minor drainage basins
- Rivière Foucault
- Rivière Frichet Rivière
- Guichaud Rivière
- Kovik

Source : MDDELCC (2017)

Map Scale : 1:400 000

0 5 10 20 km

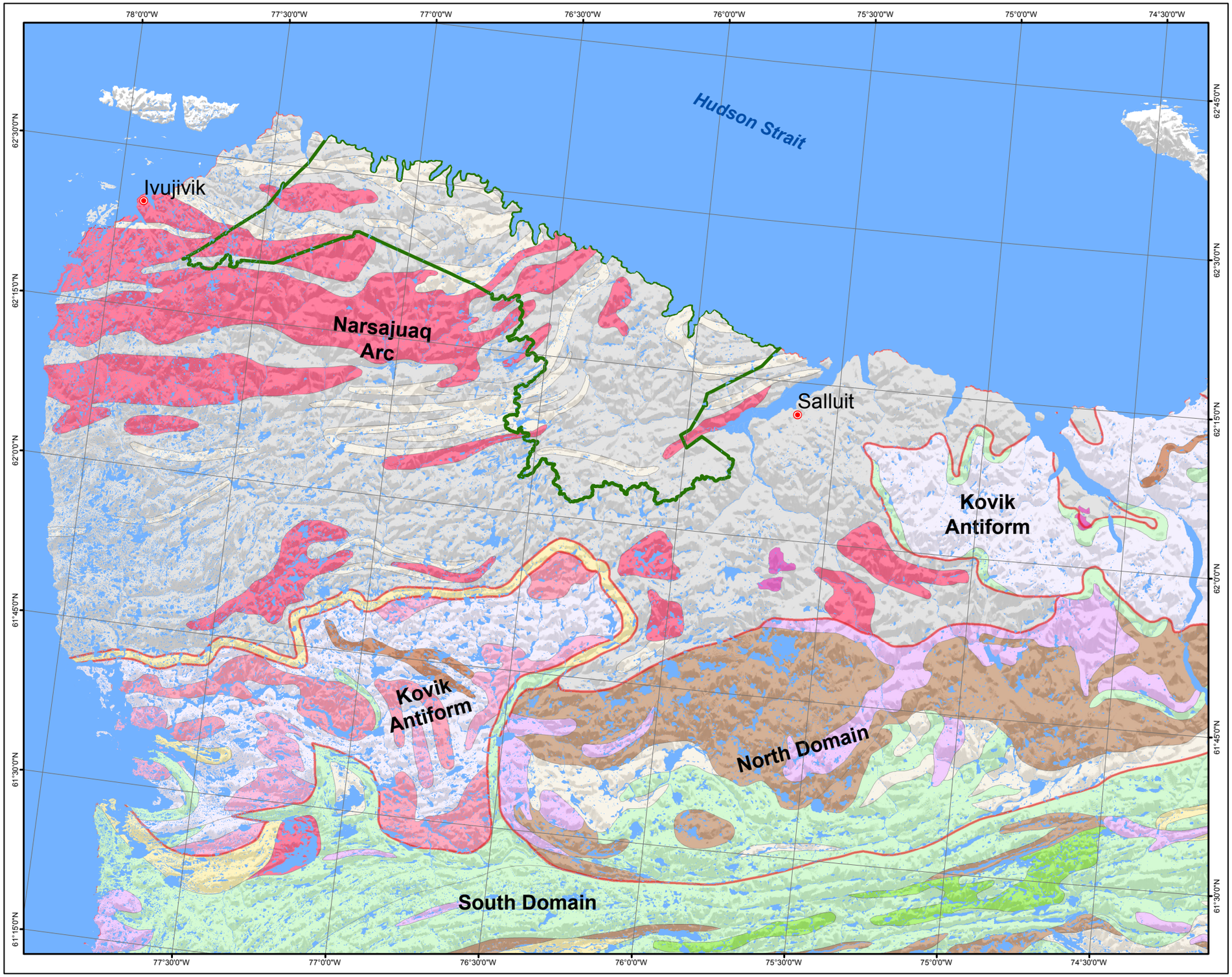
Geodetic datum : NAD 83
Coordinate system: Québec Lambert

August 2018

Map 3.1

Drainage Basins

Map 3.1



PARC NATIONAL
ILUILIQ PROJECT

Geology

Study Area

Churchill Province

Narsajuaq Arc
- Late plutonic suite
- Recent plutonic suite
- Ancient plutonic suite
- Sugluk Group

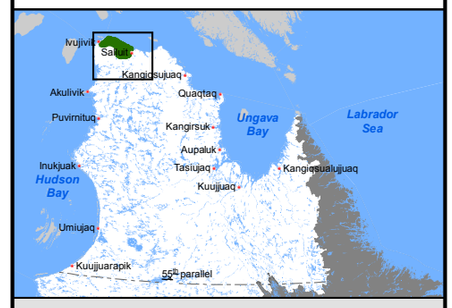
Kovik Antiform
- Tonalite, quartzitic diorite, granodiorite
- Granodiorite and tonalite
- Monzogranite
- Sedimentary rock
- Nituk Formation
- Beauparlant Formation

North Domain
- Spartan Group
- Parent Group
- Watts Group
- Cape Smith Belt

South Domain
- Chukotat Group and Beauparlant Formation
- Cécilia Formation
- Nituk Formation
- Esker Lake Suite
- Bélanger Lake Suite

Source: MDDELCC (2017)

Map Scale: 1:650 000
0 10 20 40 km



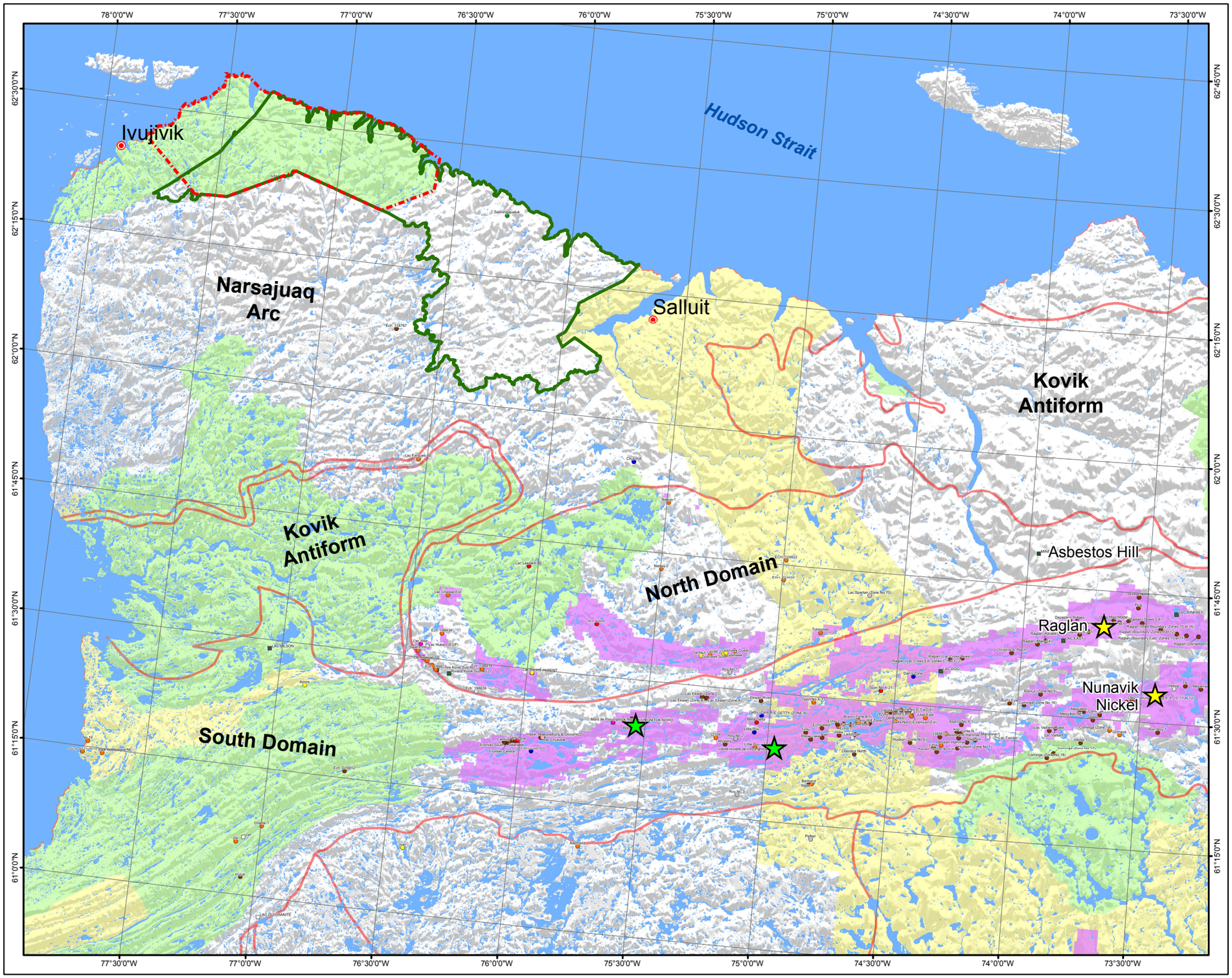
Geodetic datum : NAD 83
Coordinate system: Québec Lambert

August
2018

Map 3.2

Geology

Map 3.2



PARC NATIONAL
ILUILIQ PROJECT

Economic Geology

- Study Area
- National Park Reserve 1992
- Mine in operation
- Mining exploration project
- Tectonostatigraphic Domains
- Active mining title
- Exploration prohibited
- Exploration allowed under conditions

Mineral Deposits

Metal Deposits

- Copper, uranium, iron, nickel
- Gold, thorium, zinc, silver
- Lead, palladium, rare earth, chrome
- Molybdenum, platinum, tungsten

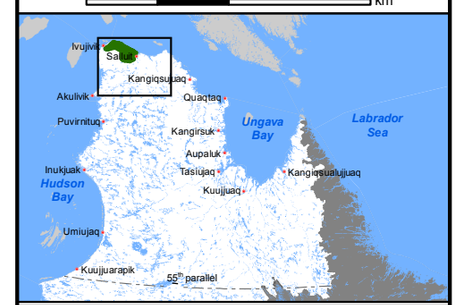
Non-metallic deposit

- Other, chrisotite (asbestos)
- Diamond, Graphite

Source: MERN (2018)

Map Scale: 1:800,000

0 10 20 40 km



Geodetic datum : NAD 83
Coordinate system: Québec Lambert

KATIVIK

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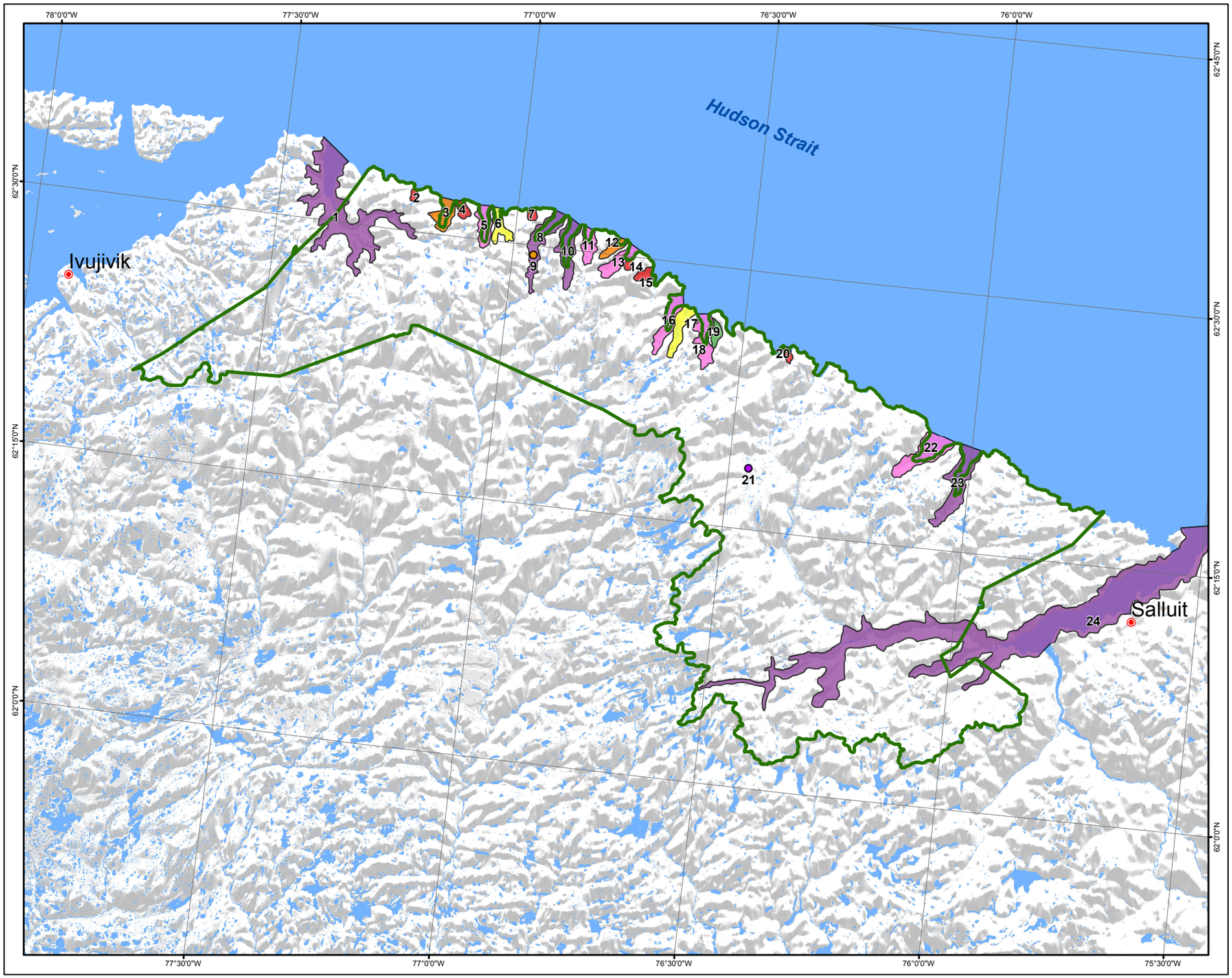
Map 3.3

Economic Geology

Map 3.3



PARC NATIONAL
ILUILIQ PROJECT

Sites of geomorphological interest

Study area

Meltwater channels

Ikkarujaalik Kame Terrace

Geomorphological site type

Glacial valley with a fjord

Hanging glacial valley

Mature cirque

Intermediate cirque

Juvenile cirque

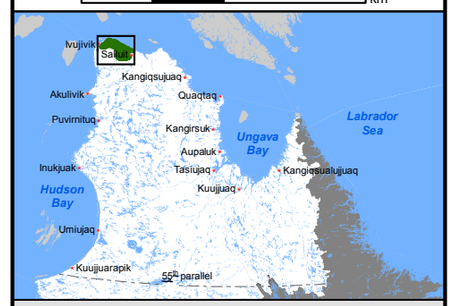
Cirque stairway

Note : This map must be consulted with table 3.10

Source : MDDELCC (2015)

Map Scale : 1:400 000

0 5 10 20 km



Geodetic datum : NAD 83
Coordinate system : Québec Lambert

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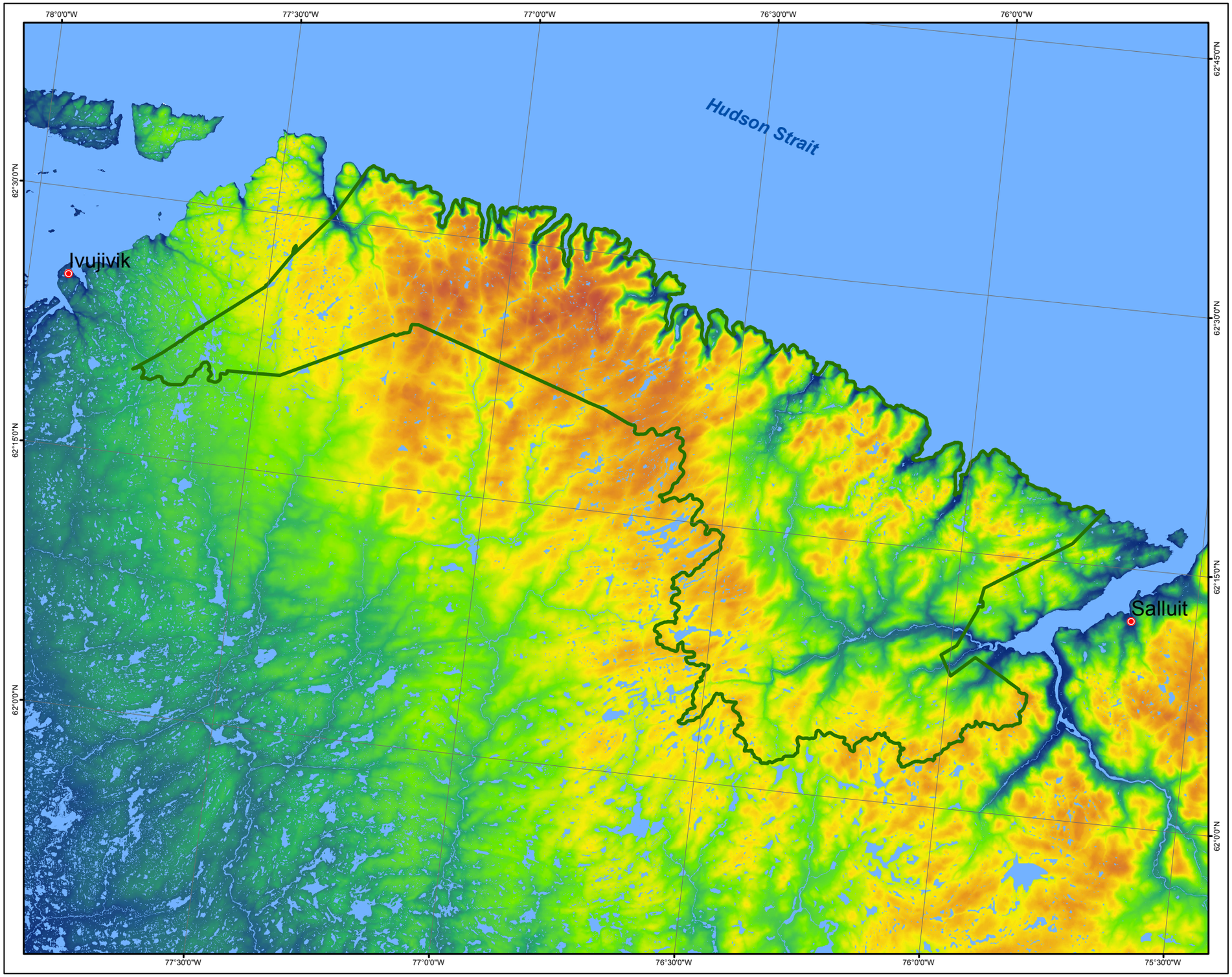
Map 3.4

Sites of geomorphological interest

Map 3.4



PARC NATIONAL
ILUILIQ PROJECT

Elevation

Study Area

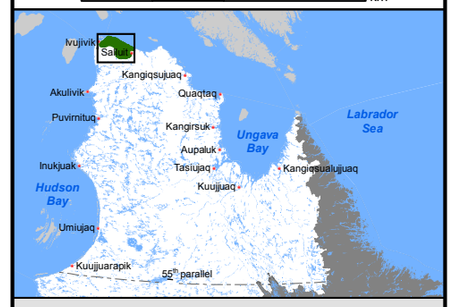
Elevation

675 m
600 m
500 m
400 m
300 m
200 m
100 m
0 m

Source: NRCAN (2002)

Map scale: 1:400 000

0 5 10 20 km



Geodetic datum : NAD 83
Coordinate system : Québec Lambert

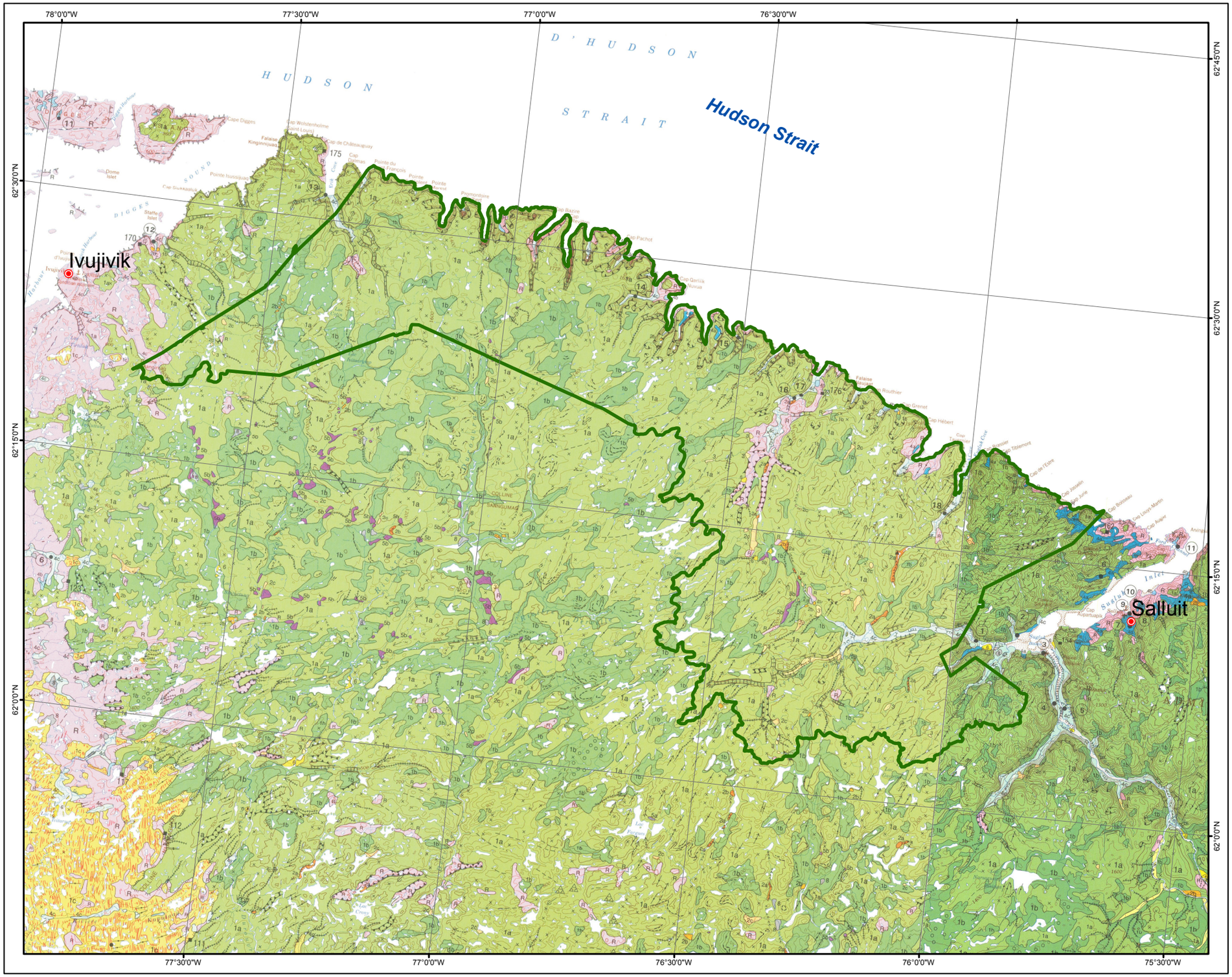
KATIVIK

August
2018

Map 3.5

Elevation

Map 3.5



PARC NATIONAL ILUILIQ PROJET

Surficial Materials and Landforms

Study Area

QUATERNARY

Postglaciation

- 8 Organic deposits
- 6 Alluvial deposits

LAST GLACIATION

Glaciolacustrine deposits

- 5b Delta sediments

Glaciomarine and marine deposits

- 4c Delta sediments
- 4a Deep water sediments

Fluvioglacial deposits

- 3 Proglacial sediments
- 2c Undifferentiated ice-contact sediments
- 2b Interlobated ice-contact sediments
- 2a Esker ice-contact sediments

Glacial deposits

- 1c Proglacial sediments
- 1b Undifferentiated ice-contact sediments
- 1a Interlobated ice-contact sediments

PRE-QUATERNARY

Rock substrate

- R Archean or Proterozoïc

Limit of Marine Invasion (alt. in m) 154

Meltwater Channel

De Greer Moraine

Glacial Striation

Cirque

Rock Canyon

Rocky Cliff

Linear depression

Rock Outcrop

Radiocarbon Dating Point 18

Source : DAIGNEAULT 1996

Map Scale 1:400 000

0 5 10 20 km

Geodetic datum : NAD 83
Coordinate system : Québec Lambert

August 2018

Map 3.6

Surficial Material and Landforms

Map3.6

4 BIOLOGICAL ENVIRONMENT

Thick-billed murre colonie on cliffs near *Anaulirvik*
Credit: Alain Thibault

Located where land and sea meet, the study area for the Parc national Iluiliq Project has been shaped by distinctive geological events, specifically by glaciers and the marine transgression of the Tyrrell Strait. Today, it is influenced by various physical elements and climate change. These phenomena and its geographical position combine to make the study area a diverse biological environment that supports a range of plant and wildlife species.

VEGETATION

The study area for the Parc national Iluiliq Project is situated in the most northerly sector of Québec in a very rugged climate and can be difficult to reach depending on weather conditions and the means of transportation used. It is therefore not surprising that, except in the immediate surroundings of the two adjacent villages, Salluit and Ivujivik, and of the former Cap Wolstenholme trading post, data concerning the flora and vegetation of this region was practically inexistent prior to the knowledge acquisition work undertaken for the park project in the summer of 2015.

The areas around the villages of Salluit and Ivujivik were studied by various botanists through the 20th century. First, in 1984 Marcel Blondeau explored the area around Ivujivik. His collections are today conserved at the Louis-Marie herbarium at Université Laval in Quebec City. Blondeau's research led him to prepare a detailed record of vascular flora around the village, including Digges Islands, Cap Wolstenholme and the site of the Cap Wolstenholme trading post (Blondeau, 1989a). According to this research, the earliest sampling conducted by any naturalist in this sector of Nunavik was done by the geologist Robert Bell who collected specimens from Digges Islands in 1884 and from Cap Wolstenholme the following year. As well, the Cap Wolstenholme trading post operated by the Hudson's Bay Company (HBC) (refer to Section 5: Human Occupation) was witness to the passage of many botanists through the sector during the first half of the 20th century, such as Malte Oscar Malte in 1928, Nicholas Vladimir Polunin in 1934 and 1936, Father Arthème Dutilly in the company of Thomas Hugh O'Neill and Maximillian George Duman in 1936 and Margaret E. Oldenburg in 1939. In fact, during his research work in 1934, Polunin collected for the first time in Québec the very rare *Micranthes stellaris*, for which the only other known community in the province is found near the Rivière Koroc, in Parc national Kuururjuaq (Dignard, 2004; Payette, 2015). Given the inadequacy and imprecision of sampling location data during that period (generally identified as "Wolstenholme" or "Wolstenholme, Hudson Strait"), and given the proximity of this site with the study area, it is not unlikely that some of the sampling may have been conducted in the study area (Tremblay, 2016). Secondly, although no document on the history of floristics exists for Salluit and its surroundings, the *Flore nordique du Québec et du Labrador* (northern plants) nonetheless compiles more than 420 specimens from the area around this village. The first botanist to have conducted research in that sector was Malte Oscar Malte in 1933. Marcel Blondeau is however the botanist who has most explored the area. He visited the region from August 7 to 16, 1989, and collected 263 specimens during this trip, which are also mainly conserved at the Louis-Marie herbarium at Université Laval (Tremblay, 2016).

Extensive aerial surveys carried out from 2010 to 2013 by the Ministère des Forêts, de la Faune et des Parcs (forests, wildlife and parks, MFFP) under the Plan Nord led, in 2018, to the production of vegetation mapping for northern Québec that meets some of the knowledge acquisition needs for the vegetation in this region, i.e. related to the various assemblages characteristic of plant species in given habitats with specific combinations of ecological factors (pH, deposits, drainage, slope, etc.) (MFFP, 2018a). In addition, in order to accurately document the vegetation of the study area for the Parc national Iluiliq Project, i.e. all the taxa that make up the plant cover, a survey of vascular and nonvascular plants was carried out in 2015 by two expert botanists, Jean Gagnon and Benoît Tremblay (Tremblay, 2016; Gagnon, 2018). The combined results of this most recent work are presented in the following sections.

ECOLOGICAL CLASSIFICATION OF THE STUDY AREA

The purpose of the MFFP hierarchical ecological classification system is to describe the ecological diversity of the plant territories of Québec and present their distribution. Comprising various levels, the system identifies ecosystems at different scales. The upper levels are termed vegetation zones. These vast territories, on a continental scale, are characterized by the physiognomy of their plant formations. Québec is divided into three major vegetation zones: the northern temperate zone, the boreal zone and the arctic zone (MFFP, 2016c). The study area for the Parc national Iluiliq Project is situated in the latter. The arctic zone possesses shrub and herbaceous vegetation.

Bioclimatic Domain of the Study Area

Bioclimatic domains are lower levels of the the MFFP hierarchical ecological classification system (MFFP, 2016c). A bioclimatic domain is an area characterized by the nature of the vegetation that occupies, in terms of ecological succession, the sites where pedologic, drainage and exposure conditions are average: the balance between vegetation and climate is the main criterion for distinguishing between domains (MFFP, 2016d). Due to its vast size and many climate variations, Québec has a number of different plant formations, each of which is more or less homogeneous

in terms of structure and composition. Moving from the south of the province to the north, ten successive bioclimatic domains occur and are classified according to their affiliation with the deciduous or mixed-wood forest zones, the boreal coniferous forest zone and the arctic tundra zone. These zones are divided into smaller units, referred to as subzones, according to specific geographic and ecological characteristics (Figure 4.1). The study area is situated in the Low Arctic subzone, specifically in the arctic herbaceous tundra domain (Payette, 1983; Dignard and Michaud, 2013).

The term "arctic herbaceous tundra domain", i.e. the area covering the most northerly regions of Québec, may nonetheless be confusing: the tundra in the environments with average ecological conditions in this part of Québec is not only herbaceous, but rather dominated by creeping or hemi-prostrate shrubs, with bryophytes and terricolous lichens in varying proportions. On occasion, the lichens and bryophytes may even be dominant; herbaceous plants therefore make up only a secondary part of the coverage. Strictly speaking, herbaceous tundra is restricted to wetland depressions (Tremblay, 2016).

Land Cover Classes in the Study Area

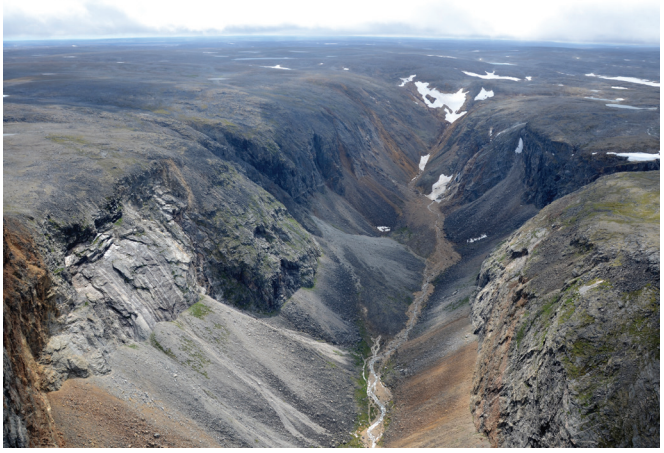
On a more local scale, vegetation mapping conducted in northern Québec by the MFFP in 2018 provides some information on terrestrial ecosystems, describing the classes of land cover within each ecosystem (Map 4.1). A little more than half of the study area comprises prostrate shrub tundra and about one quarter prostrate shrub tundra dominated by rock substrate. The remaining quarter of the study area is composed of other classes of land cover that are smaller in size (Table 4.1).

PLANT HABITATS IN THE STUDY AREA

The harsh climate conditions in the study area are reflected in the poor plant cover and diversity of vascular flora on the plateau between Salluit and Ivujivik. In the glacial valleys of the western sector of the study area, air temperature remains low year-round and growing conditions are difficult due to the depth, narrowness and steep walls of the valleys, which combined greatly reduce sunshine. These valleys also gather and trap the cold air from the surrounding plateau and their predominantly north–south axis gives the heads of these valleys a northerly exposure. Wind-blown snow from across the plateau is deposited and accumulates in these zones. Massive snow banks become compacted and transform into ice, forming neves that may last for years or even decades. Due to active melting throughout the growing season, the snow banks produce a continuous flow of ice-cold waters along the valley floors, contributing to cooler temperatures. Notably, during the knowledge acquisition work conducted in mid-August 2015, wide-spread and very thick neves were still present in most glacial valleys (Tremblay, 2016).

The valleys of the eastern sector of the study area, and more specifically the valley of the Rivière Guichaud, are wider and not as deep, resulting in milder climate conditions, expressed by the rich plant cover present on their slopes. The slopes of the downstream section of the Rivière Guichaud moreover have a southerly exposure, which produces the gentlest climate in the study area where are confined communities of upright shrubs (Tremblay, 2016).

Based on these observations, the botanist Benoît Tremblay identified various types of habitat that influence vegetation composition in the study area, situated in the herbaceous tundra domain, and subdivided them into four major groups: coastal and tidal habitats, freshwater wetland habitats, mesic to xeric terrestrial habitats, and snow or periglacial habitats. Table 4.2 provides descriptions of each of the habitats associated with these major groups.



Deep and narrow valleys with steep walls characterize the upstream sections of the glacial valleys in the study area
Credit: Benoît Tremblay

Massive neves (snow banks that last more than a year) along the upstream section of a glacial valley in the study area
Credit: Benoît Tremblay

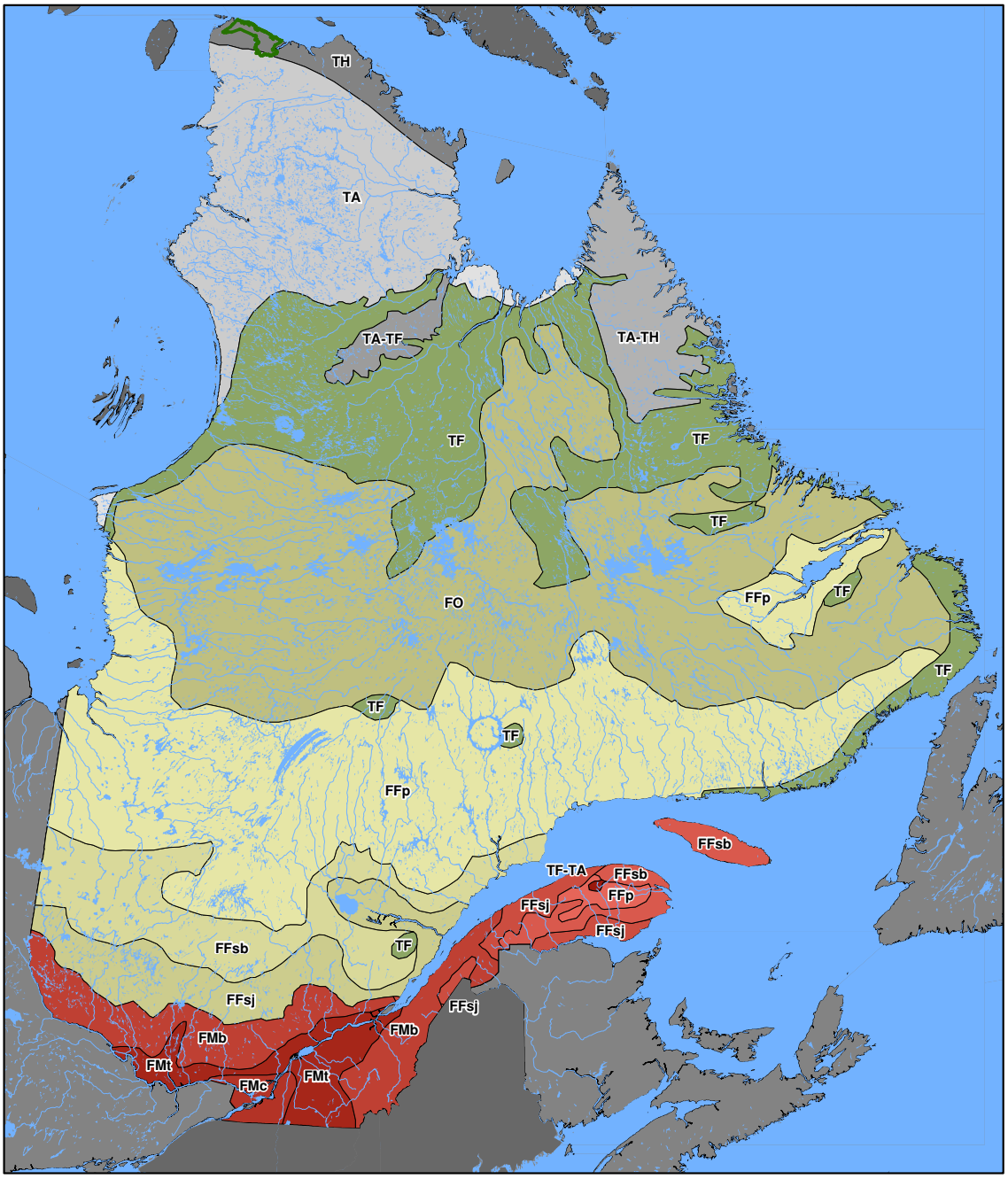


Figure 4.1 Main Vegetation Zones Boundaries

Source: adapted from Payette and Rochefort (2001)

Table 4.1 Land Cover Classes in the Study Area for the Parc national Iluiliq Project

LAND COVER CLASSES	AREA (KM²)	PROPORTION OF STUDY AREA (%)
Prostrate shrub tundra	1,150.60	53.17
Prostrate shrub tundra dominated by rock substrate	534.29	24.69
Prostrate shrub tundra with ostioles	187.40	8.66
Rock outcroppings/fragments	133.74	6.18
Water	60.37	2.79
Herbaceous tundra with prostrate shrubs	44.58	2.06
Arctic peatland or tundra wetland	30.51	1.41
Bare surface	11.25	0.52
Upright shrub tundra	6.92	0.32
Snow	4.54	0.21
Island	0.04	0.002

Source: MFFP (2018)

NONVASCULAR PLANTS

Very little is known about the nonvascular flora of northern Québec, in particular in Nunavik and specifically in the study area for the Parc national Iluiliq Project. In the study area, nonvascular plants are largely comprised of saxicolous lichens on rocks in uplands and mainly of mosses in wetlands. From August 5 to 13, 2015, Jean Gagnon, an expert botanist specializing in nonvascular flora, carried out a survey of lichens and bryophytes in the study area and in a few nearby sectors.

Portrait

Further to the nine-day survey, close to 1,500 specimens were submitted to the Louis-Marie herbarium at Université Laval. Consultation of online herbarium collections (bryophyteportal.org) also made it possible to add a moss and a liverwort identified in the study area to the list of specimens harvested during the 2015 survey.

At the 39 sites visited during the 2015 survey, 228 taxa of lichens (142 crustaceous lichens and 86 macrolichens) as well as 197 taxa of bryophytes (57 liverworts and 140 mosses) were observed. The full list of taxa harvested during the survey is given in Appendix 1. For its part, Appendix 2 lists the taxa harvested outside of the study area by Jean Gagnon and other botanists around the villages of Salluit and Ivujivik as well as at *Kangirsukallak*. These observations add 22 species of lichens and 28 species of bryophytes (two species of liverworts and 26 species of mosses) to those documented for the Parc national Iluiliq Project.

Lichens

Lichens are complex plant organisms formed through a symbiotic association of fungus and algae or cyanobacteria. The two elements comprising lichen perform different functions. The fungus element, known as the mycobiont, determines the form and structure of the lichen, and is responsible for reproduction. For its part, the algae or cyanobacteria element, known as the photobiont, ensures the supply of organic materials through photosynthesis (OQLF, 2012). Lichens are very resistant to drought, heat and cold, partly explaining their distribution in northern regions.

In the study area for the Parc national Iluiliq Project, lichens possess the greatest diversity of all the nonvascular plants identified during the 2015 survey. Overall, 228 species were observed, spread across 41 families and 104 genera. Table 4.3 shows the families and genera of lichens with the greatest number of species. There is no doubt that future surveys will increase the number of species on this list.

Lecanora epibrion (lichen)
Credit: Jean Gagnon

Table 4.2 Types of Habitat in the Study Area for the Parc national Iluiliq Project

GENERAL HABITAT	TYPES	DESCRIPTION	PHOTO
Coastal and tidal habitats	Coastal sand plains and beaches	- Sand beaches of littoral marine deposits, at the head of fjords protected from the sea and at the outlet of major glacial valleys; - East of Cap Gobin: coastal sand beaches of reworked littoral and deltaic glaciomarine deposits; - Sporadic carpeting of a few vascular plants along the upper sections of beaches, essentially *Honckenya peploides* subsp. *diffusa*, *Mertensia maritima* subsp. *maritima* and sometimes *Puccinellia tennella* subsp. *langeana* or *P. phryganodes*; - Upper beach crests stabilized by communities of *Leymus mollis* subsp. *villosissimus* and *Honckenya peploides* subsp. *diffusa*; - Carpeting of *Silene acaulis* and *Saxifraga tricuspidata* behind some upper beach crests.	
	Rocky and stony littorals	- Lacking deposits and vegetation; exposed to strong winds and erosion by waves and drift ice; - Talus slope formations at the base of littoral escarpments in fjords, continuously eroded by waves: no vegetation grows; - Sometimes formed of beaches with rounded blocks of varying sizes, bare except for rare isolated plants: *Pucinellia tenella* subsp. *langeana* or *Honckenya peploides* subsp. *diffusa*.	
Freshwater wetland habitats	Riparian and flood plain habitats	- Assortment of habitats: lake, river and creek banks, terrains flooded during periods of high discharge; - Substrate composed of mud, pure sand, blocks or interstitial sand (humid, permanently saturated or only during periods of high discharge); - Banks sometimes with vegetation: cover dominated by herbaceous plants with creeping shrubs (sometimes dominated by bryophytes); - Along the bottom of the slopes of the Rivière Guichaud, on talus debris cones at tributary discharge points: high (>1.5 m) and dense shrubland of *Salix planifolia*; - Variable species diversity according to conditions: *Chamerion latifolium* colonizes major sand-stone river beds, with graminoides (*Deschampsia cespitosa*, *Luzula confusa, Poa glauca* subsp. *glauca, Trisetum spicatum*); little plant diversity on upper sandy lacustrine banks on the plateau (*Carex bigelowii* subsp. *bigelowii, Salix herbacea* and *Poa artica subsp. arctica* with a moss layer of *Polytrichum piliferum* and *Racomitrium canescens*); fine substrate banks (mud, loam, fine sand) with diversified vegetation with high cover (*Arctagrostis latifolia* subsp. *latifolia, Carex aquatilis s. lat.*, *C. bigelowii* subsp. *bigelowii, C. membranacea, Deschampsia cespitosa, Eriophorum angustifolium* subsp. *angustifolium, E. scheuchzeri* subsp. *scheuchzeri, Salix arctophila*).	

Table 4.2 Types of Habitat in the Study Area for the Parc national Iluiliq Project

GENERAL HABITAT	TYPES	DESCRIPTION	PHOTO

	Arctic fens	- Small-sized minerotrophic peatland scattered on valley floors or slope benches, with surface runoff (seepage) supplying nutrients, on permafrost and where the peat layer is thin (sometimes <30 cm);
		- Peat and acidophilous vegetation in cover dominated by herbaceous plants (sedge) with creeping shrubs on continuous carpeting of brown mosses and sphagnum;
		- 2 types in the study area:
		  - ***Slope fens***: most common type; on slope terraces downstream from snow accumulation zones (snow beds or snow niches), where runoff and gelifluction structure slopes into a series of drops and benches; fed by surface runoff; sphagnum mounds or tufted cotton grass tussocks;
		  - ***Fens with ice wedges***: on valley floors with more or less thick alluvial deposits (50 to 60 cm of peat); in extreme conditions thermal contracting can produce surface cracks (polygonal networks of frost cracks) where ice wedges form and, as they grow, develop into mature arctic fens with wedges and beading around the polygonal soils and sometimes containing, in their centres, endorheic-drainage pools;
		- Main species: *Arctagrostis latifolia* subsp. *latifolia, Bistorta vivipara, Carex aquatilis s. lat., C. atrofusca, C. holostoma, C. membranacea, C. rariflora, C. simpliciuscula, Eriophorum angustifolium* subsp. *angustifolium, E. callitrix, E. vaginatum subsp. spissum, Salix arctophila, Vaccinium uliginosum.*

	Slope seepage or snow-melt runoff	- In most of the valleys in the study area: bright green bands alternating with yellow-, brown- or gray-ish sections (mesic or dry interfluves); - Scattered snow niches or snow banks along the upper sections of slopes slowly melt during the growing season, feeding a diffused surface runoff on the slopes; - Relatively fine mineral substrate, absence of or little organic material but vegetation is fairly rich, especially when the slope does not have a northerly exposure; - More or less dense herbaceous plant cover: sometimes creeping shrubs on a dense and continuous carpeting of bryophytes where *Sarmenthypnum* spp. and *Paludella squarrosa* are common; vascular plant cover dominated by *Carex membranacea, Arctagrostis latifolia* subsp. *latifolia, Carex bigelowii* subsp. *bigelowii, Eriophorum scheuchzeri* subsp. *scheuchzeri* and *E. angustifolium* subsp. *angustifolium.*	

Table 4.2 Types of Habitat in the Study Area for the Parc national Iluiliq Project

GENERAL HABITAT	TYPES	DESCRIPTION	PHOTO
Mesic to xeric terrestrial habitats	Rocky escarpments and talus slopes	- Mainly in coastal zones, on the walls of fjords and slopes of glacial valleys from the coast up to 5 to 10 km inland: along the upper sections of **rocky escarpments** and along the lower sections of **talus slopes**; - Vegetation on ledges, benches, nick points and crevices along the lower sections of escarpments where snow cover is greater; exposure to the elements is less severe and erosion less intense; - Vascular plant cover along the upper sections of talus slopes where the thick mineral substrate is relatively fine; vegetation on talus slopes and along the lower sections of rocky escarpments is extremely varied, without any dominant species (especially mesophiles or xerophiles, and hygrophiles in zones with water seepage and runoff); - Vegetation composition influenced by the nature of the mother rock, the type of colluvia and exposure (example, more abundant and diversified vegetation on escarpments and talus slopes having basic compositions rather than acidic ones, vegetation more abundant at sites facing south rather than north).	
	Block fields	- On the plateau in the western sector of the study area and in ancient discharge channels dating from the time of glacial retreat that washed away till but left more or less rounded blocks; - Very rugged and xeric habitats, essentially lacking an unconsolidated substrate and vascular plants; - Block surface covered with crustaceous lichens; crevices between the blocks conducive for bryophytes and fruticose or saxicolous foliose lichens.	
	Raised beaches, kame terraces and glaciomarine deltas	- Downstream sections of glacial valleys: raised beaches, littoral deposits in parallel strips formed during the marine regression; - Glacial valley floors: glaciomarine deposits forming bedded silty-sand and gravel terraces >10 m thick (example, Rivière Guichaud sector), kame terraces formed by fluvioglacial deposits left by rivers between glacial-tongues and valley walls; - Polygonal networks of frost cracks typically observed; - Insignificant plant cover and plants distributed in sporadic tufts or pockets, especially xerophilous prostrate shrubland (creeping shrubs) with graminoide herbaceous plants; - Some glaciomarine delta and kame terrace peaks conducive to xerophilous species plant cover on more or less continuous carpeting of *Racomitrium lanuginosum;*	

Table 4.2 Types of Habitat in the Study Area for the Parc national Iluiliq Project

GENERAL HABITAT	TYPES	DESCRIPTION	PHOTO
		- Main species forming the cover: *Anthoxanthum monticola* subsp. *alpinum; Arctous alpina, Carex bigelowii* subsp. *bigelowii; Carex myosuroides, Luzula confusa, Racomitrium lanuginosum, Salix herbacea, Salix uva-ursi, Vaccinium uliginosum, Vaccinium vitis-idaea.*	
	Deep-sea glaciomarine deposits	- Along the northeast and north edges of the Ungava Peninsula, below the limit of marine submergence; - Calcareous habitats (formed from marine micro-organism remains), i.e. basic nutrient-rich enclaves in vast acidic areas, resembling ecological islands: distinctive florule comprising elements of great interest for phytogeography and conservation; - Subject to periglacial phenomena, gelifluction and cryoturbation that rework deposits: the surfaces of the active parts of these deposits are beige or whitish due to bare and hardened clay loam (similar to tundra ostioles), where gravel and pebbles are ejected on the surface. These active zones lack bryophytes and lichens, with very poor plant cover (<5%) of herbaceous and shrub species; - Although they may represent difficult growing environments, exposed, wind-swept, poor snow cover, with a disturbed substrate; less active zones with little or no slope on valley floors conducive to a rich continuous or almost continuous cover of herbaceous plants and creeping shrubs with the greatest flora diversity of any habitat in the study area despite the small 1.5 km^2 area (i.e. 0.07% of the study area); - The most common and abundant vascular plants in this type of habitat: *Arnica angustifolia* subsp. *angustifolia*, *Astragalus eucosmus*, *Bistorta vivipara*, *Braya glabella* subsp. *glabella*, *Carex fuliginosa, C. myosuroides, C. nardina, C. scirpoidea* subsp. *scirpoidea, Cerastium arcticum, Deschampsia cespitosa, Dryas integrifolia* subsp. *integrifolia, Festuca hyperborea, Poa glauca* subsp. *glauca, Poa hartzii* subsp. *hartzii, Potentilla vahliana, Sabulina rubella, Salix arctica, S. reticula, Saxifraga aizoides, S. oppositifolia* subsp. *oppositifolia, Trisetum spicatum.*	
	Sparse xeric tundra on exposed plateau	- The most desolate and rugged habitats at elevated zones in the study area, especially the surface of the plateau in the west: flat terrain swept by strong winds, thin snow cover except where snow niches form, cold temperatures; - Acidic granitic, gneissic or quartzitic mother rock outcroppings, scattered with erratic blocks; and occasionally iron-bearing sedimentary rock with oxide facies, which is even more acidic; - Surface of rock outcroppings covered with thin discontinuous alteration deposits (gelifracted) and finer substrate transported and reworked by the wind; surfaces crisscrossed by till veneer where cryoturbation reworks the deposits to create patterned ground; - Abundance of crustaceous lichens covering stones and rock outcroppings; plant cover especially comprised of *Racomitrium lanuginosum* (xerophilous moss) and *Luzula confusa* (xerophilous and acidophilous plant), <1% of vascular plants, especially: *Anthoxanthum monticola* subsp. *alpinum, Cardamine bellidifolia, Carex bigelowii* subsp. *bigelowii, Cassiope tetragona* subsp. *tetragona, Luzula confusa, L. nivalis, Salix herbacea, Silene acaulis.*	

Table 4.2 Types of Habitat in the Study Area for the Parc national Iluiliq Project

GENERAL HABITAT	TYPES	DESCRIPTION	PHOTO
	Continuous mesic tundra on thick deposits	- On terrain with gentle grades at low elevations and slope with till reworked by gelifluction and nivation, phenomenon that evacuates and concentrates the unconsolidated substrate towards the bases of hillsides; - Factors conducive to a rich and dense plant cover: unconsolidated substrate, thick active layer, available nutrients, protection and adequate snow cover; - Example, valley of the Rivière Guichaud: ideal thermal regime, thick active layer, upright shrubland comprising *Betula glandulosa* with an abundant herbaceous layer dominated by *Calamagrostis lapponica* (some shrubland comprising *Salix glauca* var. *cordifolia* with a herbaceous sublevel of *Calamagrostis canadensis* subsp. *Langsdorffii*, mangled by caribou grazing); - Prostrate and hemi-prostrate shrubland comprising especially heaths (*Vaccinium uliginosum, V. vitis-idea, Arctous alpina, Cassiope tetragona* subsp. *tetragona, Empetrum nigrum* subsp. *hermaphroditum, Rhododendron lapponicum*), creeping willows (*Salix herbacea, S. arctica, S. reticulata*) and *Dryas integrifolia* subsp. *integrifolia* in basic environments; on a base of bryophytes and terricolous lichens; the abundance varies in accordance with microtopography and variations in the local humidity of the substrate.	
Snow or periglacial habitats	Snow beds and snow niches	- **Snow beds** at low elevations on sun-exposed slopes: - Rich plant cover, especially herbaceous, in downstream sections with gentle grades (shelter against the rugged climate); - Terrain at the bottom of the snow bed: dense and low vegetation comprising creeping shrubs and herbaceous plants on a base of bryophytes and lichens; especially boreal and chionophilous species: *Anemone richardsonii, Carex lachenalii, Epilobium anagallidifolium, Erigeron humilis, Oxyria digyna, Parnassia kotzebuei, Phyllodoce caerulea, Poa alpina* subsp. *alpina, P. pratensis* subsp. *alpigena, Sibbaldia procumbens, Taraxacum lapponicum, Veronica wormskjoldii*; - On more protected slopes: snow beds surrounded by upright shrubland of *Betula glandulosa*; - **Snow niches** along the coldest and most elevated sections of valley slopes, in plateau depressions, on north-facing slopes and at low elevations where there is significant snow accumulation: - Humid habitats and continuous surface runoff of meltwater from snow banks that last late in the season, even for more than a year; - Soil lacking plant cover (short growing season, cold temperatures, ice-cold waters, some years the surface is not exposed);	

Table 4.2 Types of Habitat in the Study Area for the Parc national Iluiliq Project

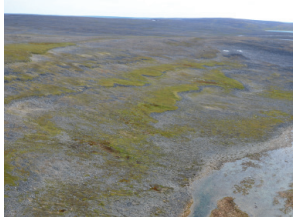
GENERAL HABITAT	TYPES	DESCRIPTION	PHOTO
		- Less humid terrain: cryptogamic crust, terricolous lichens (*Stereocaulon paschale*, *Ochrolechia frigida*, etc.) and liverworts (*Gymnomitrion* spp., *Pleurocladula albescens*). Further away from the deepest parts of the niche, are miniscule, resistant, chionophilous vascular species adapted to the short growing seasons: *Alopecurus borealis, Carex lachenalii, Cerastium cerastoides, Oxyria digyna, Phippsia algida, Poa alpina* subsp. *alpina, Ranunculus nivalis, R. pygmaeus, Salix herbacea, Saxifraga hyperborea*; - Downstream from the niche, terrain fed continuously by snow-melt runoff, where herbaceous mosses are dominated by *Dupontia fisheri* and *Eriophorum scheuchzeri* subsp. *scheuchzeri*.	
	Patterned ground	- Cryoturbation, gelifluction and gelifraction structure the ground into complex and regular forms, often in polygonal cells bounded by stone circles with raised centres containing a tundra ostiole encompassed by a moss bead of *Racomitrium lanuginosum*; - Relatively inactive ostioles covered with cryptogamic crusts and sporadic herbaceous plants; crustaceous lichens existing in deposits with a poor composition of fine elements; - When grade increases, gelifluction creates striped ground with alternating strips of bare fine substrate, vegetation and rubble; - The microtopography of patterned ground affects humidity on a microscale: stone circles are typically xeric, ostioles somewhat humid, while intermediate zones are somewhat mesic and contain a high diversity of vascular plants on a base of bryophytes and lichens: *Anthoxanthum monticola* subsp. *alpinum, Arctagrostis latifolia* subsp. *latifolia, Cardamine bellidifolia, Carex bigelowii* subsp. *bigelowii, Cassiope tetragona* subsp. *tetragona, Deschampsia cespitosa, Luzula confusa, L. nivalis, Poa arctica* subsp. *arctica, Salix arctica, S. herbacea, Silene acaulis*; - Vascular plants commonly found in tundra ostioles: *Festuca hyperborea*, *Juncus biglumis*, *Luzula nivalis, Micranthes foliolosa, Phippsia algida, Sagina caespitosa, S. nivalis, Silene acaulis.*	
	Gelifluction slopes	- Water-saturated active layer produced by snow melt or liquid precipitation; due to gravity, the active layer separates and glides on the permafrost towards slope bases: slopes more or less stepped with a series of scalloped-shaped gelifluction lobes, characterized by a drop marking the front of a flowing layer, followed by a relatively regular grade to the next lobe front; coarse elements are abandoned in small block fields, finer elements are transported downwards and snow beds or snow niches form along the lobe fronts; - Slopes colonized by vegetation which varies according to local topography, the type of substrate, elevation and exposure: along lobe fronts, snow bed or snow niche vegetation; downstream, sparse somewhat-xerophilous vegetation; further down, more or less wide strips above the following gelifluction lobe fronts covered with relatively rich and dense vegetation where the unconsolidated substrate is thick and well saturated in water; - Slopes that combine vegetation associated with block fields, sparse xeric tundra on thin deposits, continuous mesic tundra on thick deposits, and that typical of snow beds and snow niches.	

Table 4.3 Families and Genera of Lichens with the Greatest Number of Species in the Study Area for Parc national Iluiliq Project

FAMILIES OF LICHENS	NUMBER OF TAXA	NUMBER OF GENERA
Parmeliaceae	23	14
Lecideaceae	21	7
Lecanoraceae	20	7
Rhizocarpaceae	17	1 (Rhizocarpon)
Cladoniaceae	14	1 (Cladonia)
Peltigeraceae	12	2
Teloschistaceae	10	7
Verrucariaceae	10	7
GENERA OF LICHENS	**NUMBER OF TAXA**	
Rhizocarpon	17	–
Cladonia	14	–
Lecidea	12	–
Peltigera	11	–
Umbilicaria	7	–

Source: Gagnon, 2018

In addition, 30 species of lichens (i.e. 12.7% of the lichens identified) are considered cyanolichens. They are thus termed because a cyanobacterium acts as the photobiont, or in other words as the partner in the symbiotic association that captures atmospheric nitrogen. These species play an important role by feeding nitrogen into environments with nitrogen-deficient soils. This element is essential for plant growth. Except for *Euopsis granatina*, which is a crustaceous cyanolichen, all these species are macrolichens (Table 4.4). As well, some of these species comprise cyanobacteria that form organs called cephalodia, i.e. small external cyanobacterium tubercles. Cephalodia help lichens to colonize and grow in nitrogen-deficient soils or substrates by contributing to the capture of atmospheric nitrogen. Except for the lichen *Lichenomphalia hudsoniana*, which has a basidiomycete mycobiont, all the taxa of lichens identified are formed from ascomycete.

With regard to traditional use and current interest, lichens are very important in northern regions. In addition to

Peltigera aphthosa with cephalodia
Credit: Jean Gagnon

Close-up view of *Peltigera aphthosa* with cephalodia
Credit: Jean Gagnon

Table 4.4 Lichen Morphology

	Fruticose lichen (macrolichen)	Foliose lichen (macrolichen)	Crustaceous lichen (macrolichen)
Characteristics	Fruticose lichens possess a central stem enveloped in cortex. They are easily harvested. In the study area for the Parc national Iluiliq Project, they often grow on the ground, also among moss, or hanging on the stalks of shrubs.	Foliose lichens possess an applanate lamina (resembling a tree leaf). Cortex covers the upper and lower faces of the lamina. Foliose lichens are easily harvested by scraping them from the substrate with a knife. In the study area for the Parc national Iluiliq Project, they often grow on rock, on bark or the peeled stalks of shrubs, or on the stalks of shrubs.	Crustaceous lichens possess cortex on the upper face, but not on the lower face. They are fixed to the substrate so that, when harvesting, a layer of the substrate must be removed as well. In the study area for the Parc national Iluiliq Project, crustaceous lichens grow on a diversity of substrates, including rock, mosses, bark or the peeled stalks of shrubs, mineral-rich soil, or organic material.
Examples	Green witch's hair (*Alectoria ochroleuca*)	Smoky crottle (*Parmelia omphalodes*)	L'ophioparme (*Ophioparma sp.*)

Source: produced by Jean Gagnon

representing the main diet of caribou, which is a major food source of Inuit, lichens from the genera *Cladonia, Umbilicaria* and *Cetraria* were mixed with berries, meat or fat if meals needed to be made more nutritious. These lichens are easier to digest when boiled, while retaining their medicinal properties. Sometimes pre-digested lichens were removed from caribou stomachs and eaten. Dry lichens, particularly those from the genera *Alectoria* and *Bryoria*, are used to light fires.

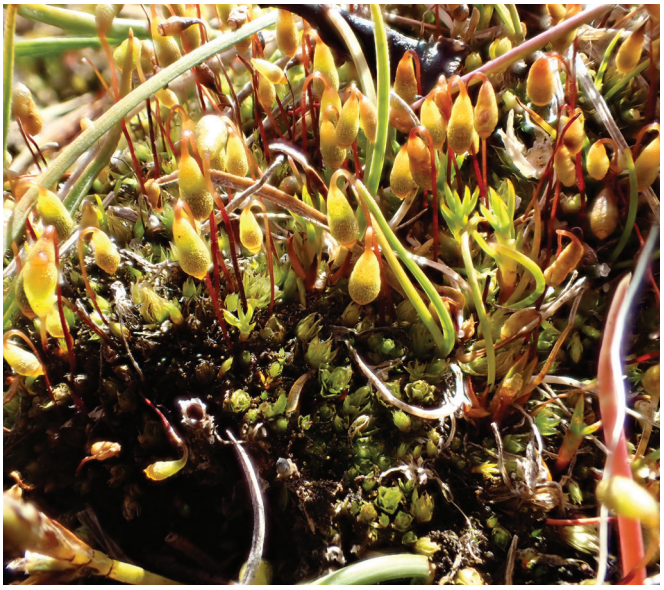
Bryophytes

Broadly speaking, bryophytes form the branch of the plant kingdom characterized by the absence of a vascular system but having leaves with chlorophyll. They include mosses, liverworts and hornworts, and they reproduce in two phases: from spores or gametes (OQLF, 2012).

In the study area, 197 species of bryophytes were recorded during harvesting carried out in 2015, specifically 140 species of mosses and 57 species of liverworts. Future surveys will substantially increase the total count of bryophytes.

Mosses

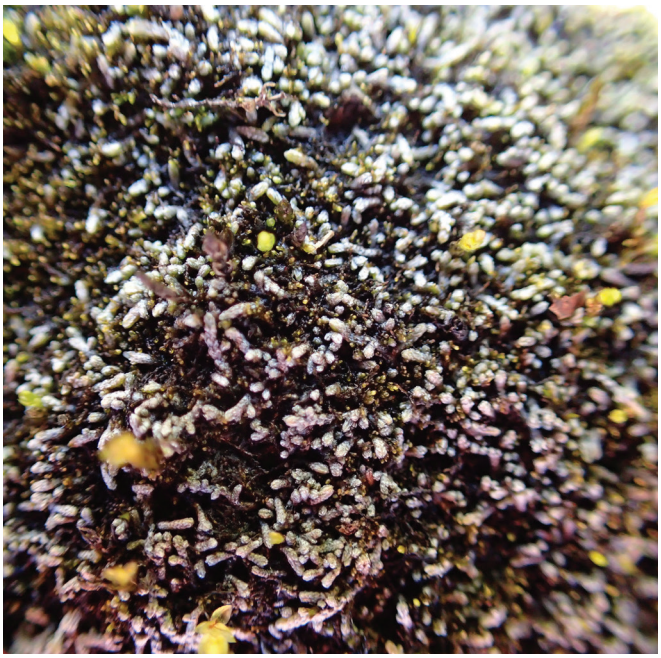
Bryophytes are nonvascular plants with rhizoids. Their reproduction is sexual and sometimes vegetative with spores. They also lack lignin. The 140 species of mosses identified divide into 25 different families and 50 genera. Table 4.5 shows the families and genera of mosses with the greatest number of species.



Bryum sp. (moss)
Credit: Jean Gagnon

Liverworts

Liverworts are land plants possessing either applanate thallus or leafy stems. They colonize wetlands and their reproduction is sexual. These plants are also termed liverworts because of the liver-like shape of some species (in Latin "*hepaticus*" means "relating to the liver") (OQLF, 2012).



Foliose liverworts
Credit: Jean Gagnon

The 58 liverworts identified divide into 17 families and 34 genera. Table 4.6 shows the families and genera of liverworts with the greatest number of species. Among the species of liverworts identified, only five species are thalloid liverworts; the remainder are foliose liverworts.

Species of Special Interest

The occurrences of nonvascular species of special interest surveyed in the study area for the Parc national Iluiliq Project are listed below. Map 4.2 shows the occurrences of rare lichens and bryophytes in Québec, as well as new species for Québec, Canada and science.

Rare, Threatened or Vulnerable Nonvascular Plants in Québec

Three species of rare lichens in Québec were identified in the study area: *Agonimia gelatinosa*, *Myriolecis torrida* and *Pertusaria subdactylina*.

The study area also hosts six rare mosses, observed especially near the coast: snow rock moss (*Andreaea nivalis*), wide-leaved cinclidium moss (*Cinclidium latifolium*), sickle-leaved hair moss (*Oligotrichum falcatum*), curved leafy moss (*Plagiomnium curvatulum*), bluish bloom moss (*Schistidium venetum*) and inclined twisted moss (*Tortella inclinata*).

In the study area, four rare liverworts were surveyed, mainly in valleys far from the coast: hyaline liverwort (*Clevea hyalina*), arctic flapwort (*Jungermannia polaris*), thin starwort (*Mannia gracilis*) and Kaurin's earwort (*Scapania kaurinii*).

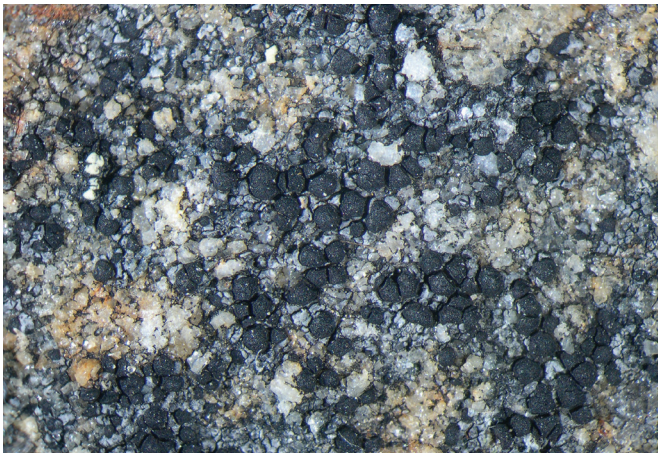
Table 4.5 Families and Genera of Mosses with the Greatest Number of Species in the Study Area for the Parc national Iluiliq Project

FAMILIES OF MOSSES	NUMBER OF TAXA	NUMBER OF GENERA
Grimmiaceae	16	3
Polytrichaceae	14	4
Sphagnaceae	12	1
Mielichhoferiaceae	10	2
Dicranaceae	10	5
Pottiaceae	10	5
GENERA OF MOSSES	**NUMBER OF TAXA**	
Sphagnum	12	–
Pohlia	9	–
Schistidium	9	–
Bryum	8	–

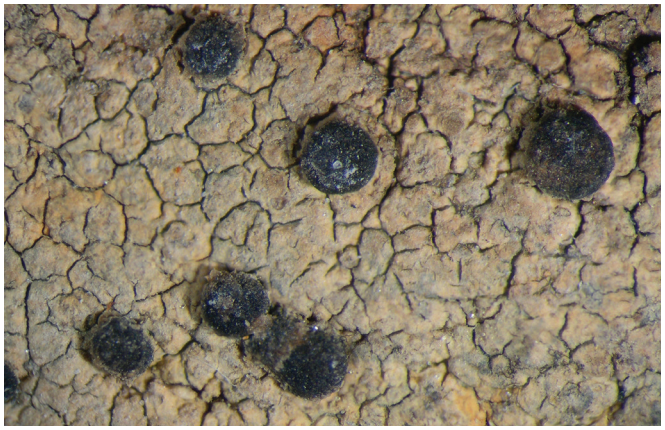
Source: Gagnon, 2018

Addition to Known Plant Species

Among the 228 species of lichens identified in the study area, 31 are new occurrences in Québec, nine are new in Canada and two are new for science, i.e. species from the genera *Rhicocarpon* and *Porpidia*. Appendix 3 lists all these new occurrences.



Rhicocarpon (lichen)
Credit: Alan Fryday



Porpidia (lichen)
Credit: Alan Fryday

Interestingly, the first occurrence in Québec of the curved leafy moss was also recorded during the 2015 survey. A site supporting this species had already been documented at Killiniq (Nunavut), on the east coast of Ungava Bay, or 650 km from the study area as the crow flies. Moreover, although not appearing on the list of rare species in Québec, *Schistidium platyphyllum* has been added to the list of bryophytes in Québec (Faubert and Gagnon, 2016).

Curved leafy moss (*Plagiomnium curvatulum*)
Credit: Jean Faubert
(extracted from the website of the Société québécoise de bryologie: http://www.societequebecoisedebryologie.org.)

Table 4.6 Families of Liverworts with the Greatest Number of Species in the Study Area for the Parc national Iluiliq Project

FAMILIES OF LIVERWORTS	NUMBER OF TAXA	NUMBER OF GENERA
Scapaniaceae	12 (9 of which are from the *Scapania* genera)	3
Anastrophyllaceae	11	9
Gymnomitriaceae	7	3
Lophoziaceae	6	3
Cephaloziaceae	5	3

Source: Gagnon, 2018

Around the study area, survey work has also led to some interesting discoveries for the region and identified some rare species in Québec. First, showy blown moss (*Schistidium pulchrum*, from the *Grimmiaceae* family) was harvested in Salluit by the botanist Jean Gagnon. In addition, splendid peat moss (*Sphagnum mirum*), oriental peat moss (*Sphagnum orientale*) and *Sphagnum incundum* Flatberg & Hassel, all three from the *Sphagnaceae* family, were observed in Ivujivik in 2007 by K. I. Flatberg, a global sphagnum (a branch of bryophytes) specialist. And finally, *Sphagnum incundum* is a new species for science (Kyrkjeeide *et al*. 2018). Given the location of this discovery, this new species will very likely be found in the study area for the Parc national Iluiliq Project.

VASCULAR PLANTS

During the knowledge acquisition work conducted in the study area for the Parc national Iluiliq Project from August 5 to 13, 2015, Benoît Tremblay, an expert botanist specializing in the northern Québec region, surveyed vascular flora and vegetation. The work performed by the latter provides a basic portrait of the vascular flora, vegetation and ecosystems in the study area. Of course, given the brief work period and that no previous botanical studies had ever been conducted in the study area, this portrait of plant diversity is necessarily incomplete, but remains the most exhaustive work to date.

Portrait

Overall, 39 vascular plant survey sites were visited in the study area for the Parc national Iluiliq Project, permitting 137 vascular plants to be harvested. The 2015 survey increased to 187 the total number of known taxa (species, subspecies and varieties) comprising the vascular flora in the study area for the Parc national Iluiliq Project. These divide into 82 genera and 30 families. Appendix 4 lists all the vascular plants recorded in the study area for the Parc national Iluiliq Project. It is important to note that this survey work did not permit coverage of the entire territory or in-depth exploration of each site. Taking into account taxa that were not surveyed but that are likely to be found in the study area (determined according to past surveys in the region or where conditions are conducive for certain species), the diversity of vascular plants could reach 215 taxa.

The vascular plants comprise 6 pteridophytes (3.2% of the vascular flora), while 181 other taxa are angiosperms (96.8% of the vascular flora). Gymnosperms are absent at the latitudes of the study area. Angiosperms consist of 55 monocotyledons (29.5% of the vascular flora) and 126 dicotyledons (67.4% of the vascular flora). In total, 10 out of 30 families alone combine to form more than three quarters of species diversity, i.e. 145 taxa making up 77.5% of the vascular flora (Table 4.7). *Cyperaceae* (sedge) and *Poaceae* (grasses) greatly outnumber the other families and comprise close to one third of total species diversity, i.e. 54 taxa making up 28.8% of the vascular flora.

As regards growth form, 167 taxa of the vascular plants, i.e. 89.3%, are herbaceous plants (Table 4.8). Although the total number of shrubs, 20 plants (representing 19.7% of the vascular flora), is low compared to the number of herbaceous plants, they dominate the plant cover in several ecosystems. Only four shrub species, however, stand upright: *Betula glandulosa, Salix calcicola, S. glauca* var. *cordifolia* and *S. planifolia*. A major portion of the plant cover in a wide

Table 4.7 Ten Most Diversified Families of Vascular Plants in the Study Area for the Parc national Iluiliq Project

FAMILY	NUMBER OF TAXA	PROPORTION OF TOTAL NUMBER OF TAXA (%)
Cyperaceae	30	16.0
Poaceae	24	12.8
Brassicaceae	16	8.6
Caryophyllaceae	15	8.0
Saxifragaceae	12	6.4
Juncaceae	11	5.9
Asteraceae	10	5.3
Ericaceae	10	5.3
Rosaceae	9	4.8
Salicaceae	8	4.3
Total	**145**	**77.5**

Source: Tremblay (2016)

Table 4.8 Distribution of Vascular Plant Taxa in the Study Area for the Parc national Iluiliq Project according to Growth Form

GROWTH FORM	NUMBER OF TAXA	PROPORTION OF TOTAL NUMBER OF TAXA (%)
Upright shrubs	4	2.1
Prostrate/hemi-prostrate shrubs	16	8.6
Herbaceous plants	167	89.3

Source: Tremblay (2016)

range of habitats is mainly prostrate heath: *Arctous alpina, Cassiope tetragona* subsp. *tetragona, Dryas integrifolia* subsp. *integrifolia, Empetrum nigrum* ssp. *hermaphroditum*, *Rhododendron tomentosum*, *Salix arctica*, *S. arctophila*, *S. herbacea*, *Vaccinium uliginosum* and *V. vitis-idaea*.

Phytogeographic Portrait

The 2015 survey showed that 160 taxa identified (85.6% of the vascular flora) are clearly arctic-type (in the broad sense of the term) (Table 4.9). Among these, 36 (19.3% of the vascular flora) are arctic-type in the strict sense, while 124 (66.3% of the vascular flora), i.e. the majority, are arctic-alpine-type. Boreal elements are represented by 25 taxa (13.4% of the vascular flora): with a few exceptions, these taxa are rare and in low abundance in the study area. Overall, geographically speaking, the flora comprises a mainly circum-hemispheric distribution, with 123 taxa (65.8% of the vascular flora) from this type of distribution.

Draba cayouettei Mulligan & Al-Shehbaz in the study area; a species endemic to the Ungava Trough
Credit: Benoît Tremblay

The phytogeographic spectrum of the vascular flora in the study area is akin to that for Parc national des Pingualuit, also situated in the northern sector of the Ungava Peninsula (Table 4.10). This similarity can in particular be explained by the fact that both territories comprise the most elevated zones of the Ungava Peninsula, that their ecosystems possess a strong arctic character, and that there are few habitats with thermal regimes conducive to the persistence of isolated communities of species with more southerly distributions, such as sun-exposed slopes in deep and protected valleys.

Elements of Special Interest

During the 2015 survey, certain vascular flora species of special interest in the study area for the Parc national Iluiliq Project were identified, such as threatened, vulnerable, rare and endemic vascular plants not to mention some new occurrences in Québec. These are described below.

Threatened or Vulnerable Vascular Plants in Québec

Map 4.3 shows the occurrences of at-risk vascular plants in Québec recorded in the study area. In fact, survey work confirmed the presence of eight species likely to be designated threatened or vulnerable in Québec, pursuant to the *Act respecting Threatened or Vulnerable Species* (CQLR, c. E12.01): *Cerastium articum, Draba cayouettei*, *D. corymbosa*, *D. subcapitata*, *Epilobium articum*, *Hulteniella integrifolia*, *Poa hartzii* subsp. *hartzii* and *Potentilla vahliana*. Moreover, a hydrid between *P. vahliana* and another species likely to be designated threatened or vulnerable in Québec, *P. arenosa* subsp. *chamissonis*, was found in the study area (B. Tremblay, pers. comm., 2018). Moreover, among these at-risk species, *Draba subcapitata* is in the process of being legally designated as a vulnerable species in Québec.

Rare Vascular Plants

A plant considered to be rare in the Canadian arctic, *Braya glabella* subsp. *glabella,* is found in the study area. It is also considered rare in Québec. Two species considered rare in both Canada and Québec, and another considered rare only in Canada, were also recorded. They are respectively *Cerastium cerastoides, Woodsia alpina* and *Comastoma tenellum.* In addition to these three rare species for the province, 13 other species considered rare in Québec are found in the study area: *Carex marina, Draba corymbosa, Draba crassifolia, Erigeron uniflorus* var. *eriocephalus, Luzula nivalis, Sabulina stricta, Oxytropis deflexa* ssp. *Dezhnevii, Phippsia algida, Pleuropogon sabinei, Potentilla pulchella, Potentilla vahliana, Sagina caespitosa* and *Sagina nivalis*.

Table 4.9 Phytogeographic Spectrum of Vascular Plants in the Study Area for the Parc national Iluiliq Project

PHYTOGEOGRAPHIC GROUPS		FREQUENCY	
CLIMATIC DOMAIN	GEOGRAPHIC DOMAIN	NUMBER OF TAXA	PROPORTION OF TOTAL NUMBER OF TAXA (%)
Arctic *sensu lato*		160	85.6
Arctic	Circumpolar	17	9.1
	Amphi-Atlantic	7	3.7
	North America	5	2.7
	Northeast America	3	1.6
	North America and Asia	1	0.5
	North America and East Asia	3	1.6
	Subtotal	**36**	**19.3**
Arctic-alpine	Circumpolar	88	47.1
	Amphi-Atlantic	16	8.6
	North America	8	4.3
	Northeast America	2	1.1
	North America and Asia	3	1.6
	North America and East Asia	7	3.7
	Subtotal	**124**	**66.3**
Boreal	Circum-hemisphere	18	9.6
	Amphi-Atlantic	2	1.1
	North America	4	2.1
	North America and Asia	1	0.5
	Subtotal	**25**	**13.4**
Endemic to the Ungava Trough		**1**	**0.5**
Cosmopolitan		**1**	**0.5**
	Total	**187**	**100.0**

Source: Tremblay (2016)

It is nonetheless important to point out that the studies which identified these species as rare, date from more than 20 or 30 years ago. New data generated by numerous surveys conducted in arctic Québec since then have considerably increased the knowledge of flora in this region of Québec. Except for *Draba corymbosa*, which is likely to be designated threatened or vulnerable, none of the above-mentioned species considered to be rare truly are in arctic Québec, the Canadian arctic or Canada. Certain are definitely localized (examples: *Braya glabella* subsp. *glabella, Draba crassifolia, Potentilla vahliana, Woodsia alpina*), but most are frequent and relatively abundant in their habitats (examples: *Carex marina, Luzula nivalis, Phippsia algida, Sagina nivalis*, etc.).

Endemic Vascular Plants

The survey demonstrated a point of major interest in the study area, i.e. the presence of a plant endemic to the Ungava Trough, Cayouette's **Draba** (*Draba cayouettei*).

Table 4.10 Phytogeographic Spectrum of Vascular Plants in the Study Area for the Parc national Iluiliq Project compared to Six Other Sectors on the Northern Ungava Peninsula in the Same Bioclimatic Domain

SITES	STUDY AREA FOR THE PARC NATIONAL ILUILIQ PROJECT	AKULIVIK	IVUJIVIK	PARC NATIONAL DES PINGUALUIT	MONTS D'YOUVILLE AND MONTS DE PUVIRNITUQ	KANGIQSUJUAQ–DOUGLAS HARBOUR	QUAQTAQ
PHYTOGEOGRAPHIC DOMAIN	PROPORTION OF THE TOTAL NUMBER OF TAXA (%)						
Arctic *sensu lato*	85.6	75.0	81.8	87.7	78.1	77.0	81.8
Arctic *sensu stricto*	19.3	29.6	30.2	21.0	30.8	27.0	29.7
Arctic-alpine	66.3	45.4	51.6	66.7	47.3	50.0	52.1
Boreal	13.4	23.6	16.6	11.7	20.7	23.0	17.0
Circum-hemisphere	65.8	68.4	69.3	72.1	70.4	68.0	70.3
Amphi-Atlantic	13.4	12.4	13.5	10.1	10.6	12.0	10.9
North America	9.1	11.5	9.4	10.9	10.1	13.0	11.5
Northeast America	2.7	–	–	–	1.8	–	-
North America and Asia	2.6	3.7	5.7	6.3	–	–	5.4
North America and East Asia	5.3	1.8	–	–	5.4	7.0	–

Source: Tremblay (2016) (around Akulivik (Blondeau, 1989b), around Ivujivik (Blondeau, 1989a), Parc national des Pingualuit (Gauthier and Dignard, 2000), Monts d'Youville and Monts de Puvirnituq (Dion *et al.*, 1999), Kangiqsujuaq–Douglas Harbour (Blondeau and Cayouette, 2002), and around Quaqtaq (Blondeau, 1990))

Addition to Plant Species in Québec

The 2015 survey also permitted discovery of a new vascular plant for the Québec–Labrador Peninsula, i.e. *Draba artica* subsp. *ostenfeldii*. This addition to known vascular flora enriches our knowledge of the biodiversity.

Draba artica subsp. *ostenfeldii* in the study area; an addition to the vascular flora known in Québec
Credit: Benoît Tremblay

ECOSYSTEMS OF INTEREST

The study area contains a scattering of ecosystems of interest due to the specific elements they contain. Fieldwork made it possible to identify sectors supporting these ecosystems of interest (Map 4.4). Among them, certain are considered outstanding, i.e. characterized by one or more unusual ecological factors producing unique habitats, conducive to the existence of rare plant or animal species, or even, communities, such as endemic species, disjunct species, species at the edge of their distribution range, etc. They are consequently of major interest for biodiversity, conservation and biogeography. In other words, since these outstanding ecosystems cover a limited area and are rare and sporadic in Québec, they must be protected to ensure effective conservation efforts.

Deep-Sea Glaciomarine Deposits

In the study area for the Parc national Iluiliq Project, deep-sea glaciomarine deposits constitute unquestionably an outstanding type of ecosystem. The deposits, rich in calcium carbonate, are remnants of the marine transgression and are very sensitive to periglacial phenomena, such as gelifluction and cryoturbation. They form ecological enclaves that

permit the growth of a characteristic florule comprising a large number of basophilous species in a mostly acidic environment. More specifically, areas that are almost completely barren or have at least some bare patches of substrate are of particular floristic interest. In areas where periglacial phenomena are less present, the vegetation is nonetheless rich, with cover often approaching 100% and comprising a wide diversity of vascular and nonvascular plants. Moreover, several species of crustaceous lichens new in Québec, and even Canada, were found in this habitat on many small blocks low to the ground.

Striped patterned ground in silty clay deep-sea glaciomarine deposits
Credit: Benoît Tremblay

Table 4.11 Eighteen Vascular Plants Recorded Exclusively in Deep-Sea Glaciomarine Deposits in the Study Area for the Parc national Iluiliq Project

SPECIES
Alopecurus borealis
Braya glabella subsp. *glabella*
Carex krausei
Carex microglochin subsp. *microglochin*
Comastoma tenellum
Draba arctica subsp. *ostenfeldii*
Draba cayouettei
Draba corymbosa
Draba subcapitata
Equisetum variegatum subsp. *variegatum*
Festuca baffinensis
Hulteniella integrifolia
Poa hartzii subsp. *hartzii*
Sabulina stricta
Salix calcicola
Saxifraga aizoides
Saxifraga hirculus
Silene uralensis subsp. *uralensis*

Source: Tremblay (2016)

Map 4.4 identifies completely or partially barren areas of deep-sea glaciomarine deposits in the study area for the Parc national Iluiliq Project. These deposits are located exclusively in the eastern half of the study area, near the coast and in particular around Baie Qarliik, Cap Jurie and Lac Napirviik Tasingak. Although they occupy only a small proportion of the territory, i.e. 1.5 km^2 (0.07%), their contribution to biodiversity is nonetheless significant. A total of 18 vascular plants were recorded exclusively on these glaciomarine deposits (Table 4.11), and one of these is not found anywhere else in Québec, i.e. *Draba arctica* subsp. *ostenfeldii*. As well, a majority of the rare lichens in the study area were found on these deposits, on the many small rocky blocks low to the ground: among them, three are new in Canada, nine are new in Québec and one is rare in Québec (Table 4.12). Accordingly, it has been recognized that the sector extending from the eastern boundary of the initial national park reserve all the way to the Category I lands of Salluit is of very major interest and comprises the richest and most diverse habitats of the study area in terms of flora and vegetation. This sector east of the national park reserve moreover includes most of the occurrences of threatened or vulnerable plants (Tremblay, 2016).

Rivière Guichaud Sector

The Rivière Guichaud sector is an important contributor to plant diversity in the study area. The valleys of this sector, in particular due to their relative continentality, the abundance of stable unconsolidated deposits and their predominantly east–west axis, giving certain slopes a southerly exposure,

Deltaic glaciomarine deposits in the valley of the Rivière Guichaud
Credit: Benoît Tremblay

Table 4.12 Thirteen Lichens Recorded Exclusively in Deep-Sea Glaciomarine Deposits in the Study Area for the Parc national Iluiliq Project

SPECIES	STATUS
Acarospora rugulosa	*New in Québec*
Arthonia lapidicola	*New in Québec*
Aspicilia cingulata	*New in Québec*
Caloplaca approximata	*New in Québec*
Diplotomma hedinii	*New in Canada*
Hymenelia epulotica	*New in Québec*
Hymenelia heteromorpha	*New in Québec*
Myriolecis torrida	*Rare in Québec*
Polyblastia gothica	*New in Canada*
Polysporina urceolata	*New in Québec*
Rhizocarpon intermediellum	*New in Québec*
Rinodina notabilis	*New in Canada*
Staurothele arctica	*New in Québec*

Source: Gagnon (2018)

produce much milder climate conditions, demonstrated by rich plant cover. The uneven topography of the valleys is an asset, providing protection against winds and good snow accumulation, insofar as the valley is sufficiently wide to permit adequate sunshine and prevent too much snow accumulation. The downstream section of the Rivière Guichaud with its southerly exposed slopes has the gentlest climate in the study area and the only communities of upright shrubs (Tremblay, 2016).

Cap Wolstenholme Sector – Outside the Study Area

The cliffs adjacent to Cap Wosltenholme were identified by Polunin as a special habitat during his exploration of the sector in 1934 and 1936. Although outside of the study area, the cliffs are nonetheless of interest for the region, and the ecological processes occurring in these ecosystems may influence neighbouring sectors, including the study area for the Parc national Iluiliq Project. This special habitat is above all closely associated with the colony of thick-billed murres (refer to Section 4: Biological Environment under the Wildlife heading). The abundance of guano deposited around the thousands of nests contributes to a considerable quantity of nitrogenated and phosphated elements to the environment, representing a natural fertilizer that fosters the

Vegetation cover at Cap Wolstenholme
Credit: Marianne Ricard

growth of nitrophilous species (Polunin, 1948). The extent of peat formation varies according to topography and moisture, but the phenomenon has been observed up to 275 m inland from the cliffs and is marked by growth of *Poa arctica*. For its part, *Alopecurus borealis* is abundant on cliff ledges (Gaston and Donaldson, 1995; Polunin, 1948). Vascular plants are in some places completely replaced by mosses and lichens (Polunin, 1948). Since these birds are essential for the formation of these peat patches, it is possible to approximately date the minimum age of colonies using peat extracted from the base of deposits. Accordingly, Gaston and Donaldson (1995) have estimated that two colonies of thick-billed murres in the Canadian arctic (Digges Islands and Coats Island) were established 1500 years ago.

Vegetation on cliff ledges adajacent to Cap Wosltenholme
Credit: Marianne Ricard

There can be no question that specific conservation efforts to ensure the ecological integrity of outstanding ecosystems will serve to maintain the rare or at-risk plant communities they nurture. Given that the surveying conducted in the study area was both brief and piecemeal, more systematic and larger-scale surveys will further enrich documentation of the plant communities and threatened or vulnerable species present, in addition to permitting the discovery of other floristic elements of interest. Other more interesting discoveries should be expected in this part of Québec!

WILDLIFE

The study area for the Parc national Iluiliq Project covers a considerable coastal region as well as various terrestrial habitats conducive to a large diversity of wildlife species, despite being situated in Québec's far north. A review of literature (D'Astous, 2017a and 2017b) and fieldwork carried out in 2015 and 2017 have identified wildlife species that are present in the region or are likely to be present in the region. Specifically, at least 103 vertebrate species (25 mammals, 51 birds and 27 fish) may be found in the study area. Among these species likely to be observed in the study area, certain are at-risk species on lists maintained by the provincial and federal governments, i.e. 14 species (9 mammals, 3 birds and 2 fish). No count of species considered "invertebrates" is presented since only limited data is available on this group, thus the number of species presented must be interpreted as the minimum number established based on available data. A subsection below nonetheless provides a description of this group (D'Astous, 2017b).

The following subsections present scientific and Inuit traditional knowledge acquired regarding all these species. Although not guided by the conventional scientific paradigm, this knowledge is an essential part of the knowledge acquisition process on species. It should however be noted that few studies have been published reporting on this environmental knowledge (Usher, 2000; Lewis *et al.*, 2009).

MARINE MAMMALS

Beluga

The beluga (*Delphinapterus leucas*) is a toothed whale that has a circumpolar distribution. Its completely white colouring and the absence of a dorsal fin are two adaptations to an environment where ice abounds. Belugas are unique among whales, since they shed worn surface skin once a year. While adults are camouflaged by their white colouring, calves are pale pink or dark brown at birth, turning grey as they mature (around 3 or 4 years old). Belugas can reach a length of 350 cm by adulthood and their jaws have 32 to 42 pointed teeth (Richard and Prescott, 2005; CMEPS, 2006). A study on Inuit traditional knowledge of the feeding ecology of beluga identified more than 21 prey species, the main ones being sculpin, cod, salmon, trout, whitefish and some crustaceans (Breton-Honeyman *et al.*, 2016). When swimming, belugas surface two or three times per minute to breathe, but can remain under water for 15 to 25 minutes and travel between 2 and 3 km. Gregarious in nature, belugas often congregate in pods of five or six individuals, although herds of hundreds may be observed together during migrations, in particular near Ivujivik (Adamie Kalingo pers. comm., 2015). In groups, belugas are very talkative and emit a variety of songs and other sounds, earning them the nickname "sea canary". Belugas can cover impressive distances when migrating from their wintering range to spring and summer calving and feeding areas. Mating takes place in April and May, gestation lasts about 14 to 15 months, and calves spend two to three years with their mothers (Richards and Prescott, 2005; DFO, 2016a). In summer, they are often found around the mouths of river and in estuaries; in winter, they congregate in ice-free areas such as Hudson Strait, the Labrador Sea and some parts of Ungava Bay (Turgeon *et al.*, 2012). Hudson Strait hunters report that whales arrive

in spring from Hudson Bay. Belugas feed very little during their migration; surprisingly, they are leanest in early spring and fattest late in the winter season (Breton-Honeyman *et al.*, 2016). They enter the bays near the study area during their spring and fall migrations, but may also be observed in the Ivujivik area in winter (Lewis *et al.*, 2009; Breton-Honeyman *et al.*, 2016) (figure 4.2). Hunters report many beluga sightings in Hudson Strait during their migrations (Hammill and Lesage, 2009). Moreover, several local hunters reported they carry out beluga hunting in various bays in the study area. Traditionally, seven populations of beluga are recognized in Québec according to distinct summer ranges and genetic differences. They are called management units by Fisheries and Oceans Canada (DFO). Of these, three may be found in Nunavik: that of the eastern Hudson Bay (EHB), western Hudson Bay (WHB) and Ungava Bay (UB) (Brown *et al.*, 1999; Turgeon *et al.*, 2009; DFO, 2014). Populations that are likely to be observed along the coast in the Cap Wolstenholme area belong to the WHB and EHB management units. These populations are abundant and have been estimated to total about 54,400 and 3,800 individuals respectively. This species is of great importance to Inuit, both culturally and for subsistence purposes (Hammill *et al.*, 2009; Matthews *et al.*, 2017).

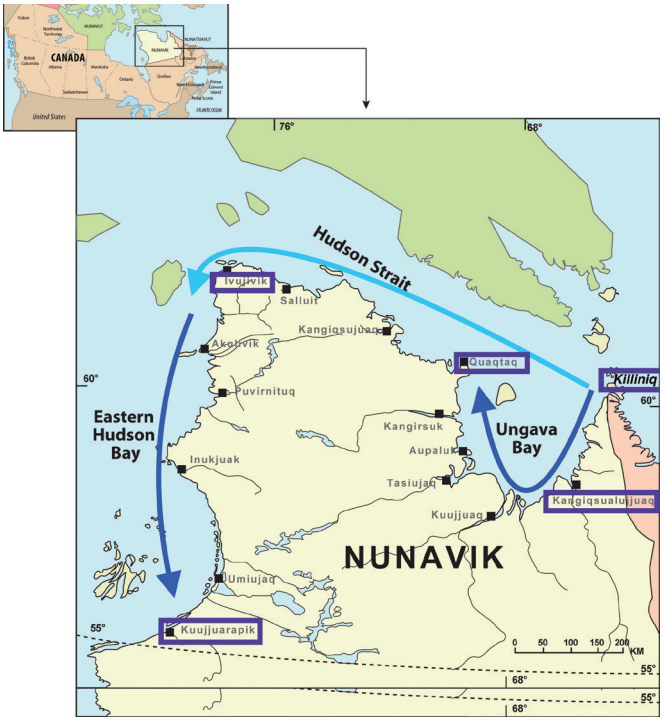


Figure 4.2 Beluga spring migration route around Nunavik; fall migration occurs in the reverse direction. Boxes around community names indicate where interviews were conducted under the study by Breton-Honeyman *et al.* (2016)

Source: Breton-Honeyman *et al.* (2016)

Beluga calf and mother in the region of the study area
Credit: Robert Fréchette

Historically, belugas were hunted using *qajaqs*. Whales were pursued closely by these vessels to prevent them from breathing at the water's surface and ultimately to exhaust them. Then, the hunter would harpoon the whale: a rope tied to the harpoon head connected the whale to a float known as an *avataq*. The entire whale was used by Inuit, with the skin and oil being the most valued parts. The skin, *muktuk*, is still considered a delicacy by Inuit. A whole beluga would provide a large quantity of oil which, in former times, served different purposes: a whale can yield up to about 300 L of oil (Heyes and Helgen, 2014). Today, belugas are hunted by the Aboriginal communities of Nunavik for subsistence purposes. Among Inuit from across the Canadian Arctic, adult Inuit from Nunavik practise traditional subsistence hunting the most (81%) and beluga is the most consumed marine mammal (ITK, 2008). Beluga hunting is however

Man standing next to a *qajaq* with hunting equipment, including a harpoon, *circa* 1919
Credit: Captain George E. Mack. McCord Museum. MP-0000.597.166

regulated by the DFO which introduced quotas in 1985. In 2002, the beluga hunt was completely closed from eastern Hudson Bay to Ungava Bay to foster recovery of the populations; the hunt was only re-opened in these areas in 2007 (DFO, 2013). Over the past five years, the beluga catch in Nunavik has remained stable: in 2013, 158 belugas were reported killed in Hudson Strait and Ungava Bay in the spring and 87 in the fall (DFO, 2014).

In 1988, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the UB **beluga** management unit as *endangered;* this status has remained unchanged (COSEWIC, 2018). In Québec, this management unit is considered ***likely to be designated threatened or vulnerable***. The EHB management unit was also designated as ***endangered*** by the COSEWIC in 2004 and is considered ***likely to be designated threatened or vulnerable*** at the provincial level (COSEWIC, 2018). For its part, the WHB management unit was designated *of* ***special concern*** by the COSEWIC in 2004 (COSEWIC, 2018). Commercial hunting in the 19th and early 20th centuries by the Hudson's Bay Company (HBC) significantly reduced beluga numbers on the east coast of Hudson Bay and in Ungava Bay (Reeves and Mitchell, 1987). Although this hunting ended in 1950, the beluga management units have shown no signs of recovery (DFO, 2014). Analysis results also indicate that any harvesting in Ungava Bay would threaten the recovery potential of these management units (Doniol-Valcroze *et al.*, 2012).

Since the *Nunavik Inuit Land Claims Agreement* (NILCA) was signed in 2006, the Nunavik Marine Region Wildlife Board (NMRWB) has been responsible for managing Nunavik's beluga whales, although the federal government must approve all decisions. For the period from 2014 to 2017, the NMRWB developed a new management plan based on a flexible three-year total allowable take (TAT) system for Nunavik's belugas (Rogers, 2014a; 2014b). This new management plan is designed to offer the different communities greater flexibility regarding the beluga hunting period and sites. The quotas set by this system are based on EHB management unit characteristics but, according to the NMRWB, they also make it possible to protect the other management units. For the 2014–2017 period, this system allowed 162 EHB belugas to be harvested (Rogers, 2014a; 2014b; Mark O'Connor, pers. comm., 2014).

Beluga pod in the region of the study area for the Parc national Iluiliq Project
Credit: Robert Fréchette

Under this new management plan, all belugas hunted are considered to belong to the EHB management unit. Since belugas are migratory, however, individuals from other management units are also found in the different hunting areas, in proportions that vary over the year. As a result, a beluga's value in relation to the 162 EHB beluga quota depends on the time and place where it is harvested (Mark O'Connor, pers. comm., 2014). For example, during the fall migration in the Hudson Strait area, genetic analyses have determined that approximately 24% of the belugas are from the EHB management unit; this number falls to 12% during the spring migration. Accordingly, a beluga caught in this area in the fall corresponds to 0.24 beluga of the 162 beluga quota (Mark O'Connor, pers. comm., 2015). The management plan was established for the whole Nunavik region. Each community manages its specific assigned quota that combined together make up the regional total. It allows communities to transfer their allowable catch from one year to the next within the three years covered by the system or until the 162 EHB beluga quota for Nunavik is reached (Rogers, 2014b).

Narwhal

The narwhal (*Monodon monoceros*) is a whale with black back, white sides and a mottled grey belly. Well adapted to pack ice, the narwhal has no dorsal fin, like the beluga. Narwhals enjoy deep water and feed on halibut, squid and octopus. The narwhal's helical ivory tusk, an elongated tooth that can measure up to 3 m long, has contributed to the lore surrounding this species. Right from the first recorded observations of this tusk in 1495, hypotheses and conjectures have proliferated regarding the functions of the tusk (Nweeia *et al.*, 2014), including that it serves a role in sound transmission, to defend against predators and even to break ice to permit the animal to breathe (Nweeia *et al.*, 2014). Since only males develop tusks and occasionally two, it was suggested by several authors that the tusk plays a role in male mating competition. In fact, the tusk has a secondary sexual characteristic among males, permitting a social dominance hierarchy to be established in a non-violent manner according to the relative size of the tooth, i.e. by comparing the length of their tusks (Best, 1981; Nweeia *et al.*, 2014). More recently, scientists have discovered

that narwhal tusks have sensory capacities, although its specific functions have not yet been determined (Nweeia *et al*., 2014). The helical form of the tusk ensures it grows straight and does not impede the animal's swimming ability (Kingsley and Ramsay, 1988). Males grow to an average length of 4.7 m and weigh 1,600 kg; females to an average length of 4 m and weigh 900 kg (Richard and Prescott, 2005; DFO, 2010. Although only rarely seen along the coasts of Québec, the narwhals that may be observed in Nunavik belong to two subpopulations: that of eastern Baffin Island and that of northern Hudson Bay. The former is estimated at 80,000 individuals and the latter 5,000 (White, 2012). Ungava Bay represents the southern limit of the narwhal's range and the latter population winters in the waters of Hudson Strait. In the study area, narwhals that may be observed offshore belong solely from the northern Hudson Bay population. These two populations of narwhals in Canada are assessed jointly by the COSEWIC and the species has been designated *of* ***special concern*** since 2004 (COSEWIC, 2004). This status reflects the many uncertainties regarding their numbers, life-history traits, etc. Narwhals are threatened by hunting, environmental contaminants, climate change and industrial activities. Among these threats, hunting is probably the most consistent constraint for these populations.

Killer Whale

The killer whale (*Orcinus orca*) is one of the most common whales. It is found in every ocean and in all the seas of the globe, from the Arctic to Antarctic. The killer whale is also the largest and heaviest marine predator. Its prey includes seabirds, seals, belugas, narwhals, bowhead whales, minke whales, fish and squid. Killer whales have black backs with a grey saddle patch behind the dorsal fin and an oval white patch behind the eyes. Their throats, bellies and the underside of their tails are white. Killer whales are quick swimmers. They can travel at speeds of 45 km/h and make short dives of four to ten minutes. Hunting in groups, killer whales are nicknamed "wolves of the sea" and have no known predators. The absence of predators means that killer whales can live more than 50 years. However, as the mortality rate for killer whale calves (from birth to six months) is 50%, the life expectancy of this species is from 19 to 31 years old for males and from 30 to 46 years old for females. Little is known about the populations of killer whales in the eastern Canadian Arctic. Their numbers are low although observations in general are increasing, especially in the Hudson Bay region (Higdon *et al*., 2012; DFO, 2015). The high mortality rate is one factor that pushed the COSEWIC in 2008 to designate the killer whale of the northwestern Atlantic and the eastern Arctic as a species *of* ***special concern*** (COSEWIC, 2008). It seems that this population could be threatened by acoustic and physical disturbances. Increasing shipping traffic and other anthropogenic activities in the Arctic due to reduced sea ice, for example, will probably expose these whales even more to these types of disturbances. Prey depletion and chemical contaminants also pose a threat to killer whales (COSEWIC, 2008).

Minke Whale

The minke whale (*Balaenoptera acutorostrata*) has a slate-coloured grey back, a white belly, as well as a small, narrow and flat head. Smaller than other whales, females are on average 7.6 m long and weigh 6,000 kg; males for their part are slightly smaller (Richard and Prescott, 2005). This whale has long baleen and feeds mainly on capelin, as well as cod, squid and crustaceans (Richard and Prescott, 2005). Curious by nature, they will approach vessels which have their engines turned off. One of the minke whale's most remarkable behaviours, and to this day not well understood, is breaching. It involves the whale leaping completely out of the water several times in a row and falling flat on its back (Richard and Prescott, 2005). The populations of minke whales are in better condition than those of most other large whale species. The chances of observing them in the region of the study area are good.

Bowhead Whale

The third largest whale on earth, the bowhead whale (*Balaena mysticetus*) weighs on average 90 t and grows on average to a length of 15 m. Its colouring is entirely black and, like the narwhal and the beluga, the absence of a dorsal fin is an adaptation to ice-covered oceans (Richard and Prescott, 2005). The bowhead whale has from 230 to 360 baleen that can reach a length of up to 450 cm and it feeds mainly on planktonic crustaceans. This whale has an exceptional life span with individuals living up to more than 150 years (DFO, 2008). Primitive harpoon heads used by the Inupiat of Alaska have been found in harvested bowhead whales. Yet this type of harpoon head has not been used for more than a century (Richard and Prescott, 2005). Although there is little data on the number of bowhead whales in the eastern Canadian Arctic, it would seem that several whales winter in Davis Strait and Hudson Strait. For a long time, the bowhead whale was hunted heavily. In the Hudson Bay region, bowhead whaling began around 1860, but had already been conducted in the region of Davis Strait and Baffin Bay since as early as the late 1600s and early 1700s (COSEWIC, 2009). The pressure of this hunt almost led to the extinction of the bowhead whale in the 1900s. Due to the commercial hunt of this species and the uncertainty of how it is adapting to climate change, the COSEWIC designated it of ***special concern*** in 2009 (COSEWIC, 2009). Today, the population is doing better and has even been subject to an annual subsistence hunt in Nunavut since 1996 (DFO, 2008). Nunavik Inuit have also obtained a few hunting permits for bowhead whales since 2008. A permit

is valid for only one year and only one whale (DFO, 2008). In 2017, the community of Kangiqsujuaq carried out its third bowhead whale hunt since 2008: a 14m whale was harpooned by an 18-year-old woman. This catch provided *muktuk*, a traditional Inuit food of whale skin and blubber, for the 14 communities in Nunavik (Bernhardt, 2017).

Pinnipeds

Seals are extremely valued in Inuit culture and are especially important for subsistence. Five pinniped species can be observed in the coastal part of the study area: the ringed seal (*Pusa hispida*), the bearded seal (*Erignathus barbatus*), the harbour seal (*Phoca vitulina*), the harp seal (*Pagophilus groenlandicus*) and the walrus (*Odobenus rosmarus*). Among these species, ringed seals and bearded seals are the most common in the region and the most hunted by Inuit.

Seal spp. in background and thick-billed murre in foreground
Credit: Marianne Ricard

Joanasie Kakayuk holding a ringed seal that he hunted
Credit: Alain Thibault

Ringed Seal

The ringed seal is the most abundant pinniped species in the Canadian Arctic (Prescott and Richard, 2004). Adult ringed seals have dark grey backs with light blotches or rings and a silvery grey belly. Juveniles are uniformly grey but newborn pups are white (Prescott and Richard, 2004). Ringed seals are observed throughout the year along the coasts of Labrador and Ungava Bay, and in the bays, coves and fjords of Hudson Strait (Cuerrier, 2003). From November to July, during the freeze period, ringed seals are found on pack ice. From April or May to June or July they remain far off shore, but return closer to it in August to feed and to avoid killer whales (Cuerrier, 2003). In March, pups are born in small snow dens located near breathing holes. Inuit hunters say that females prefer the mouths of rivers, the middle of bays, and coves where they can take advantage of smooth sheets of ice to build their dens. In June, when their coats turn grey, juveniles start feeding and travelling on their own (Cuerrier, 2003). The ringed seal's diet is primarily made up of small planktonic crustaceans, such as mysids, amphipods and shrimp. It also eats Arctic cod (sometimes known by the term "saida") and occasionally sculpins (MFFP, 2014a). Ringed seals have been hunted for subsistence purposes since the beginning of the Dorset culture. In addition to being a very important food source, their skins were and still are used for various purposes, including the making of *pualuks* (mitts) and *kamiks* (boots). In the past, ringed seal skins, like those of bearded seals, were particularly valued for making *qajaq*. This vessel is a fundamental feature of

Inuit culture. About 22 ft long, *qajaq* possessed a wooden frame and were covered with impermeable seal skins (Heyes and Helgen, 2014). Prior to making a *qajaq*, the skins would be stacked until sufficiently decomposed for the hair, flesh and muscle to be scraped off with a wood, ivory or metal tool. Then, the skins would be soaked until they again became malleable and pliable enough to be stretched over the *qajaq* frame. The skins were then stitched together, taking care to have as few seams as possible below the waterline, since they represented a weakness in terms of impermeability. This seal skin cover would remain effective for two or even three years before drying and losing its impermeability. In general, *qajaqs* were used for marine mammal hunting (Heyes and Helgen, 2014).

Inuk man and child in a *qajaq* near Inukjuak, circa 1920
Credit: Samuel Herbert Coward. McCord Museum. MP-1976.25.135

Inuit group builidng a *qajaq*, circa 1919
Credit: Capitain George E. Mack. McCord Museum. MP-0000.597.527

and Richard, 2004). From March to June, males emit song-like sounds under water that, carrying up to 30 km, identify their presence to females and mark their territories (Prescott and Richard, 2005). Bearded seal is an essential species for Inuit, as its skin is stronger and thicker than those of other species. Bearded seal skins were therefore used in the making of *qajaq*, *umiaq* and *tupik* (the Inuit tent). While the *qajaq*'s lightness, length and speed made it an ideal vessel for hunters, the *umiaq* for its part was the preferred means of transport for equipment and travel between camps. Between 6 and 12 bearded seal skins were required to completely cover an *umiaq*: given the difficulties involved in hunting this species, it might sometimes have taken more than a year to collect enough skins to build an *umiaq* (Heyes and Helgen, 2014).

Bearded Seal

Compared to other species of seal, the distinguishing features of the bearded seal are its relatively small head, its heavy snout with conspicuous white whiskers, and its square-shaped front flippers, which give this animal its other moniker: square-flipper seal. Adult bearded seals have a dark, almost black, coat; newborn pups are greyish-brown with scattered patches of white, and juveniles are silvery grey. When bearded seals dive, they typically arch their backs and show their rear flippers. Bearded seals are solitary animals not easily observed. They prefer shallow water and generally avoid coastal fast ice. In winter, they are mostly found on ice floes, while in summertime they rest on sandbanks and reefs, feeding in the shallows. Their diet is chiefly composed of shrimp, bivalve molluscs and gastropods, but they may also eat crabs, marine worms and fish, such as Arctic cod, sand lance and sculpins. In April or May, females give birth to one or two pups (Prescott

Harp Seal

The harp seal has a black or dark brown head and white body with two black bands, one running along each side of its body, that meet on its back. This coloration makes it unique from other seal species. Females give birth to one pup in late February or early March. Females gather on the pack ice for calving and to nurse their pups. Harp seal is a gregarious and migratory species. Harp seals feed mainly on fish that swim in schools, such as capelin and herring. They also consume a variety of crustaceans (for example, krill and shrimp). A characteristic behaviour of this species is to form in groups as they travel, and it is possible to observe harp seals leap out of the water, like dolphins (Richard and Prescott, 2005).

Harbour Seal

The harbour seal is mainly blue-grey in the north with small black spots and white stripes forming loops and rings. Pups

are silvery grey. Distinguishing features of the harbour seal are its short snout the end of which is equidistant from the eye and the ear, its close nostrils and its dark colour. In summer, harbour seals spend long hours on sand bars; in winter, they tend to remain in the water and emerge only when temperatures grow milder. Although occurring only infrequently, harbour seals can dive up to a depth of 200 m and remain under water for up to 30 minutes (Richard and Prescott, 2005).

Walrus

The walrus is the largest of the pinnipeds: an adult male can grow on average to 360 cm in length and weigh 900 kg. Walruses range widely in the Canadian Arctic archipelago. In the region of the study area, they are mainly found on Akpatok, Nottingham and Salisbury islands in August and September whereas, in northern Hudson Bay, they are mostly migratory. A survey conducted in 2014 estimated the population of northern Hudson Bay and Davis Strait to be 7,100 individuals (DFO, 2016c). The walrus has a thick skin that may be brown, blackish or beige-pink, more or less covered with sparse hairs. This variation in skin colours is the product of an impressive adaptation to the cold. In fact, the lower the temperature, the more blood flow is restricted to the animal's epidermis producing a darker skin colour. Conversely, when the temperature is higher, blood flow to the epidermis colours the skin pinkish (Richard and Prescott, 2005). Males and females possess ivory tusks up to about 40 cm in length. Although walruses mainly feed on bivalve molluscs using the long vibrissae (tactile whiskers) on the end of their snouts to search the seafloor, pieces of ringed seal, bearded seal and beluga whale have also been found in the stomachs of walruses (Richard and Prescott, 2005). Hunters are able to identify seal-eating walruses by their more yellowed tusks; this phenomenon is in fact more common in areas where walruses have little or no access to molluscs (DFO, 2016c). Of a gregarious nature, there is significant segregation according to age and sex in walrus herds. In summer, walruses congregate by the hundreds, if not the thousands, in areas known as "haulouts" or *uglit* in Inuktitut. Generally, walruses are hunted in summer and fall. The flesh is then buried for a few months under gravel to allow it to age until the meat becomes more tender. It is then retrieved to be consumed during the winter, a traditional delicacy known as *igunak*. Walrus hunting has regularly been practised in the vicinity of Nottingham and Salisbury islands, as well as in Hudson Strait between Ivujivik and Salluit for hundreds of years. Observations since the late 1930s indicate that walrus numbers have dropped considerably. More information is needed, however, on the size and composition of their populations, their seasonal movements and their life cycle. Hunting, in particular at the northern and southern limits of its range, represents the biggest threat to this species. In Canada, the COSEWIC classified the walrus a species of ***special concern*** in 2006, although it almost qualifies as ***threatened*** (COSEWIC, 2006). In Québec, the walrus appears on the list of wildlife ***likely to be designated threatened or vulnerable*** (MFFP, 2018).

Walruses
Credit: Robert Fréchette

Umiaq from Nunavik, *circa* 1909
Credit: Gift by M. Richard H. Peck. McCord Museum. L103.30

Polar Bear

The polar bear (*Ursus maritimus*), a species that is important culturally, spiritually and economically, is the largest terrestrial carnivore. It is moreover the only land mammal to be situated at the top of the marine food chain (Environment Canada, 2012; IUCN/SSCPBSG, 2012; Government of Canada, 2014). With a thick layer of fat and a dense waterproof coat, the polar bear is well insulated from the cold. The colour of its fur is also excellent camouflage for hunting on the snow and ice. In fact, the fur is transparent to allow the sun's light to reach the animal's black skin and its heat to be absorbed. Unlike other bear species, the paw pads of this species are fur-covered to protect them

from the cold and help the polar bear keep its footing on ice. Polar bears are also excellent swimmers thanks to their long bodies and large front paws, which serve as paddles. They can swim at speeds of more than 11 km/h (Prescott and Richard, 1999). Polar bears can sometimes be found over 200 km off the coast (Government of Canada, 2014). The total population of polar bears in Canada is estimated at 15,500 and these are divided into 13 subpopulations. The polar bears found in the study area for the Parc national Iluiliq Project belong to the Foxe Basin subpopulation, which has been estimated at 2,580 individuals (GN, 2012). This subpopulation is stable and even increasing according to local knowledge (PBTC, 2015). The range of the polar bear matches that of its chief prey, the ringed seal, in accordance with seasonal ice cover (Government of Canada, 2014). Polar bears therefore spend a lot of time on pack ice, where they hunt seals, venturing onto land when the ice melts (Prescott and Richard, 2004) where they feed on fish (Cuerrier, 2003). They return to the sea ice when it starts to freeze again in the fall, with the exception of pregnant females, which build their maternity dens around the end of October (Government of Canada, 2014). These dens are usually on land near the coast, dug into snow banks or frozen ground, but occasionally on pack ice (Government of Canada, 2014) in sectors where seals congregate densely in spring (COSEWIC, 2008; Government of Canada, 2014). Although pregnant polar bears spend the winter in their dens without food, they still have to meet the energy requirements of pregnancy and nursing while other polar bears remain active on the ice. The energy requirements during this period, lasting up to eight months, can cause some females to lose up to 43% of their body mass (COSEWIC, 2008). The reproduction rate of polar bear is in fact very low, so it is difficult for a population to recover quickly if its numbers decrease. Female polar bears reach sexual maturity from four to six years of age and generally give birth to one or two cubs every three years, while males become sexually mature around eight to ten years of age. Few polar bears live over the age of 25. Cubs are born between November and early January and are nursed by their mothers in their dens up until late February to mid-April. As a rule, polar bears do not attack humans, except to protect their cubs or unless they are starving (Government of Canada, 2014).In the coming years, climate change will dramatically alter ice thickness and, consequently, polar bear habitat. Studies of the western Hudson Bay subpopulation seem to have established a correlation between early ice retreat and declining births and body condition among polar bears (Hunter *et al.*, 2010; Peacock *et al.*, 2011). Bears with restricted access to ice must spend more time on land during the open water season. Individuals must sometimes travel long distances, helping to explain the wide variation in the size of home ranges, from 940 km^2 to 540,700 km^2 (COSEWIC, 2008). The polar bear has the remarkable ability to fast for long periods of time, which is especially useful during open water season when the species is forced to stay on land. It is estimated that adult bears lose one kilogram per day while fasting. The polar bear is associated with the vast open spaces of the Arctic and is thus one of the most important symbols of climate change. About 70% of the global population of polar bears lives on Canadian soil, conferring an important responsibility on the country for the management of this resource (COSEWIC, 2008; Peacock *et al.*, 2011).

In Canada, the polar bear has been a species of ***special concern*** since 1991 while, in Québec, it is designated ***vulnerable*** (COSEWIC, 2008; MFFP, 2018b). Climate change has an impact on numerous limiting factors affecting polar bear range and abundance, as well as food availability. These include temperature increases, reduced sea ice, and a longer open water season (COSEWIC, 2008). The lengthening of annual ice-free periods and decrease in multiyear ice coverage (ice that does not melt completely every year) are linked to an increase in nutritional stress in polar bears because they need the ice to gain access to seals (Environment Canada, 2009; Hunter *et al*., 2010). Due to climate change, a great deal of uncertainty currently exists regarding the future of the polar bear in Canada (COSEWIC, 2008).

LARGE LAND MAMMALS

Black Bear

The black bear (*Ursus americanus*), the smallest bear species in North America, uses different habitats but prefers areas near watercourses or swamps (Prescott and Richard, 2004; Gauthier Schampaert and Théau, 2010). The northern limit of this bear's range roughly corresponds to the forest tundra, i.e. well south of the study area (Feldhamer *et al.*, 2003). Black bears may however occasionally be observed in the study area, as was the case in 2015, during knowledge acquisition fieldwork when a bear was observed along the Rivière Guichaud. Salluit residents also reported some sightings near the community in the summer of 2017 (Jobie Tuniq pers. comm., 2017). Black bears hibernate, which means their heart rate drops considerably and their body temperature decreases. They remain in a state of light sleep but they can still become alert quickly. During this winter rest period, females give birth to their cubs, in January or February (Prescott and Richard, 2004). Litters usually comprise two cubs, but have been known to have any number from one to five (FFDP, 2013). Black bears are omnivores and eat stems, buds, roots, leaves, nuts, fruits and new shoots. They also occasionally eat fish or attack certain cervids, such as caribou calves (National Audubon Society, 1996; Samson, 1996). Black bears must build up sizeable fat reserves to survive the winter in their dens and, in the case of females, to nurse their cubs. Foraging is therefore a constant activity for six months. Male black

bears have a home range of between 60 and 173 km^2; female black bears for their part have a home range of between 5 and 50 km^2. The black bear is a very good swimmer, and is also a fast runner that can reach speeds of up to 55 km/h over short distances (Richard and Prescott, 2004). Since they are very opportunistic, black bears can be destructive if food left by humans becomes available ; otherwise, it is relatively rare for bears to show signs of aggression or attack humans (Pelton, 1982; Cadieux, 2001).

Caribou

The caribou (*Rangifer tarandus*) is a cervid with an average size between the white-tailed deer (*Odocoileus virginianus*) and the moose (*Alces alces*). It also exhibits significant sexual dimorphism. In fact, like most cervids, female caribou are smaller (average weight from 80 to 140 kg) than male caribou (average weight from 120 to 200 kg). The size of a bull is particularly important during mating season, since the larger and more stocky the male, the greater its access to a large number of cows during this period. Unlike other cervids, both male and female caribou possess antlers. The antlers of caribou bulls are longer, project forward and have a paddle at the front (shaped like a hand), while those of caribou cows are smaller and simpler. Bulls lose their antlers in late November, early December, while cows only lose their antlers after calving, in July. The timing of this loss of their antlers can help differentiate between bulls and cows.

The caribou is well adapted to winter conditions and long migrations. Its large and very wide hooves work like snowshoes in thick snow. They also allow the caribou to dig in the snow for lichens, its main food. Long hairs interspersed through their coats help caribou float when they swim across rivers. Caribou are recognized as a key species that structures northern ecosystems and are highly valued in the culture of Aboriginal people and for their subsistence (Hummel and Ray, 2008). In the tundra, an ecosystem where the soil is poor in nutrients and the rate of decomposition is slow, caribou faeces are an important source of nutrients. In fact, a caribou produces about 220 kg of faeces annually, making the nutrient contribution of a herd of hundreds of thousands of individuals obvious (Hummel and Ray, 2008). Inuit have relied for hundreds of years on caribou as an essential source of food, but also for clothing and shelter. It is said that, in former times, about eight to ten caribou skins were needed to meet the clothing needs of an adult (Heyes and Helgen, 2014). Still today, caribou are an important food source recognized in both the *James Bay and Northern Québec Agreement* (JBNQA) and the *Northeastern Québec Agreement* (NEQA). These agreements provide Inuit, Cree and Naskapi with a guaranteed minimum total harvest of 6,407 caribou.

In Canada, caribou are classified into four distinct ecotypes according to their behaviour, their preferred habitat and certain morphological characteristics (Table 4.13).

In general, migratory caribou live in large herds, while forest and mountain caribou are fairly solitary or live in small groups. Only the migratory and mountain ecotypes are present in Nunavik. In the study area for the Parc national Iluiliq Project, the migratory Leaf River herd (LRH) may be observed. This herd is characterized by its major migration, covering hundreds of kilometres over the tundra and through the boreal forest. A distinguishing feature of this caribou herd is the use by cows of isolated areas on the tundra to calve while in dense groups. The study area for the Parc national Iluiliq Project overlaps part of the calving grounds of the migratory LRH and it is primarily occupied during the summer season (Figure 4.3).

The caribou of the LRH generally winter in the region of the La Grande hydroelectric complexes as well as in the region of the Rivière Grande Baleine. Then, in order to take advantage of seasonal food resources and avoid

Caribou cow and calf (foreground) and bull (background) in the study area
Credit: Nathalie Girard

Female caribou (left foreground) and male caribou (right background)
Credit: Heiko Wittenborn

Table 4.13 Different caribou ecotypes of Canada

ECOTYPE	MIGRATORY	WOODLAND	MOUNTAIN	PEARY
Range	Northern Québec/ Labrador	Boreal forest (between the 49th and 54th north parallel)	Peaks of Monts Chic-Chocs and Torngat Mountains	Arctic archipelago
Calving	In herd	Solitary (small groups in winter)	Solitary	Solitary
Migration type	Long seasonal migration	Movements over short distances and seasonal	Altitudinal and seasonal migration	Nomadic
Population	Extremely variable (from 800,000 to 5,000 individuals)	Small: less than 8,000 individuals across Québec	Very small (130 individuals in the Chic-Chocs region and less than 930 individuals in the Torngat Mountains)	Small: about 7,250 individuals

Source: Taillon in Prescott *et al.* (2013)

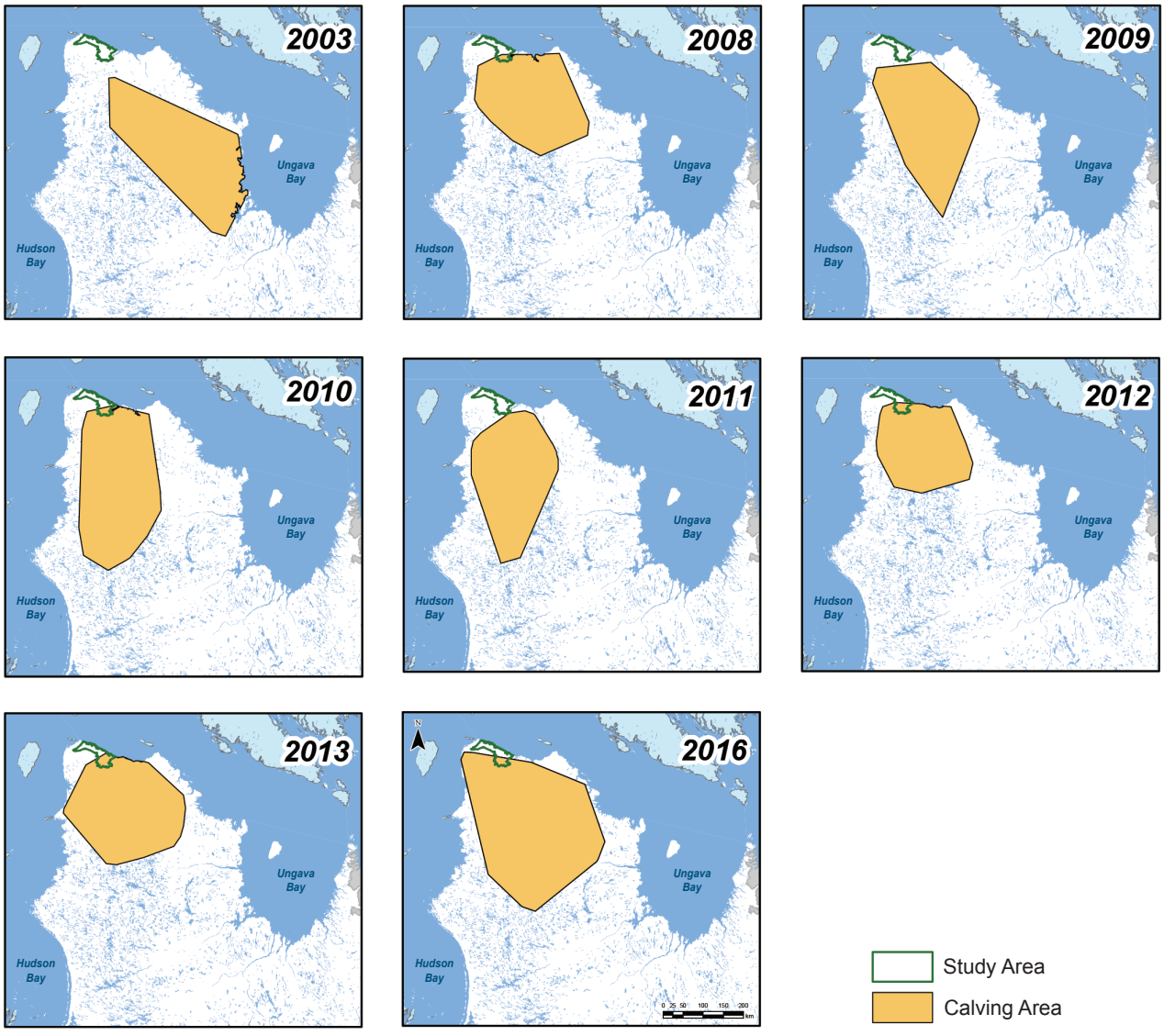


Figure 4.3 Geographical Distributions of the Calving Grounds of the Leaf River Herd

Based on telemetric observation of females fitted with satellite collars

Cartographic data: MFFP, Direction de la gestion de la Faune Nord-du-Québec (2016)

predation, they undertake a roughly 689km migration, travelling between 15 and 50 km per day. The caribou of the LRH conduct one of the longest land migrations of any mammal (Taillon *et al.*, 2016). Cows usually undertake this migration in April in order to reach their calving grounds. Notwithstanding, the actual timing of the start of their migration can vary widely (from between mid-February and mid-May). Consequently, individuals may spend anywhere between 20 and 100 days in migration before reaching their calving grounds. Caribou cows give birth at the beginning of June to a single calf per year. The cows are followed by the bulls a little later. The bulls stop their migration further south and join the cows only after the calves begin to incorporate plants into their diet, in late July when they are 40 to 45 days old (Taillon *et al.*, 2016).

The fall migration, for its part, is preceded by a pre-migratory movement in September, when caribou bulls and cows gather in the Rivière aux Feuilles area. Mating takes place in late October, early November, during the fall migration (Figure 4.4). During the rut, which lasts for about a month, bulls practically stop feeding and consequently expend a significant amount of their stored energy. They can lose about 20% of their body mass (Taillon *et al.*, 2016).

Historical observations and herd monitoring show that caribou can experience significant fluctuations in population (Gunn, 2003). The population of the LRH has declined significantly in recent years (Table 4.14). In fact, the size of the LRH has decreased by more than 50% since 2011 and was estimated at 199,000 individuals in July 2016 (Taillon *et al.*, 2016). Further to a fall survey conducted in November 2016, the herd was estimated at 181,000 individuals (Brodeur *et al.*, 2016). As adult survival is low (less than 85%) and the proportion of calves was only 11% in the fall, the LRH population is expected in all likelihood to continue to decline (Brodeur *et al.*, 2016).

Table 4.14 Assessment of the size of the Leaf River herd by year (refer to Taillon *et al.*, 2016)

SURVEY YEAR	ESTIMATE (NO. OF CARIBOU)[1]
1975	56,000
1983	101,000
1986	121,000
1991	276,000
2001	628,000
2011	430,000
2016	199,000

[1] Survey methodology has varied from year to year; however, since 2001, the same technique has been applied (i.e. "post-calving").

Source: Taillon *et al.* (2016)

Several factors limit caribou population growth. Caribou are vulnerable to changes in their habitat and avoid places where predators and parasites are abundant (Bergerud *et al*., 2008; Courbin *et al*., 2009). Migratory tundra caribou also avoid industrial sites, roads, pipelines and buildings, and run from vehicles and aircraft (Wolfe *et al*., 2000; Cameron *et al.*, 2005; Vistnes and Nellemann, 2008). In response to these disturbances, caribou expend a greater amount of energy and spend less time feeding, which affects their energy reserves. This impact is all the more significant if caribou are subject to other environmental stresses (Festa-Bianchet *et al*., 2011). For example, climate change is affecting snow cover and therefore forage availability for caribou (Sharma *et al*., 2009). The abundance and distribution of predators, alternative prey, and parasites or diseases are also likely to be affected by climate change and have an impact on tundra caribou populations (Festa-Bianchet *et al*., 2011).

Figure 4.5 shows the annual range of the LRH, represented by a minimum convex polygon based on all telemetry locations (MCP 100%) from June 1, 2013, to May 31, 2014, of males and females with satellite telemetry collars that were recorded by the MFFP Nord-du-Québec Wildlife Management Service and by the Caribou Ungava research program. This annual range indicates that Leaf River herd caribou use the study area for the Parc national Iluiliq Project during their migration.

The study area is situated in the sport hunting zone 23 west where, prior to 2018, caribou hunting was open to Québec and non-Québec hunters from August 17 to October 7 through the services of an outfitter (MFFP, 2014b). However, after numerous interventions by the Hunting, Fishing and Trapping Coordinating Committee (HFTCC)[24], the government agreed to close the fall and winter sport hunting starting in the 2018–2019 season.

Muskox

Although it resembles a bison and its name refers to an "ox" , *Ovibos moschatus* is in fact a ruminant, more closely related to the mountain goat than oxen. The muskox does not stand very tall at the withers, reaching about as high as

[24] The HFTCC is established pursuant to the JBNQA. It is an expert panel of representatives of Cree, Inuit and Naskapi as well as the governments of Canada and Québec. The HFTCC has a mandate to manage the hunting, fishing and trapping regime created under Section 24 of the JBNQA and Section 15 of the NEQA for the territories covered by these agreements. In its capacity as a consultative body to responsible governments, the HFTCC is the preferential and exclusive forum used by Aboriginal and governmental delegations to develop pertinent regulations and supervise the administration and management of the hunting, fishing and trapping regime.

Figure 4.4 Seasonal movements of the migratory LRH, from 2008 to 2014 according to the locations of male and female caribou with telemetry satellite collars.

Source: Taillon *et al.* (2016)

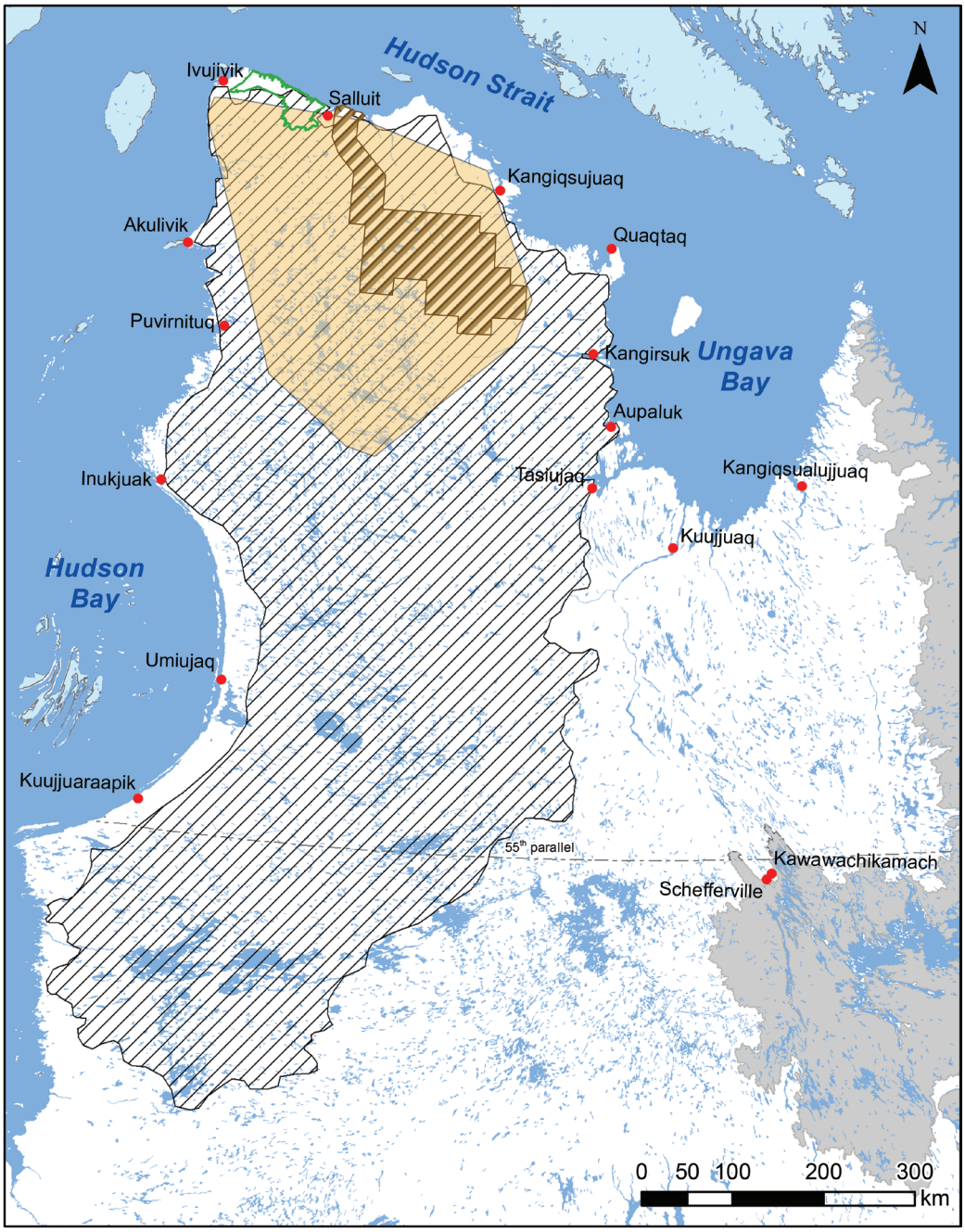


Figure 4.5 Annual Distribution of the Leaf River Caribou Herd (2016)

Note: Annual distribution of the Leaf River herd is represented by a minimum convex polygon based on all of the telemetric observations (MCP 100%) generated between June 1, 2015 and May 31, 2016 by males and females fitted with satellite collars.

Cartographic data: MFFP and Caribou Ungava Research Group (2016)

a human chest. Despite this size, their body mass is very stocky and compact; adult males can weigh from 270 to 315 kg and females about 90 kg less. Males and females possess impressive horns that can measure more than 70 cm long. In males, the horns meet at the base to form a hard bump of horn and bone up to 10 cm thick. This is particularly useful during the rut when adult males must defend their harems consisting of a few adult cows and their offspring. In fact, males, after having rubbed their preorbital glands against their forelegs, will advance slowly towards one another, take several steps back, and then rush forward butting heads violently in the same way as big horn sheep (Prescott and Richard, 1996).The wool coat of the muskox is extraordinarily insulating. No mammal in North America has a coat as long as that formed by the rougher outer kemp layer, which protects the fleece. It can grow up to 62 cm long. Muskox wool, or *qiviut*, is eight times warmer than that of sheep and thinner than cashmere. The muskox is called *umimmak* by Inuit, meaning «the animal that is bearded». Its wide hooves prevent it from sinking into soft snow; while the hooves of its forelegs, wider than those of the hind legs, allow it to dig into the snow to search for food: sedge, mosses and lichens. In summer, it also eats the leaves and stems of willows, birches and other shrubs (Prescott and Richard, 1996).The muskox was introduced in Nunavik in 1967 after 15 young individuals (12 females and 3 males) were captured on Ellesmere Island, Nunavut, and transported to the Umingmaqautik experimental farm at Old Chimo, a few kilometres from Kuujjuaq. The farm had been created to promote *qiviut* production (CEN**,** 1981; Jean *et al.*, 2004 and 2006). The husbandry project failed in the end and, from 1973 to 1978, 55 animals were released (Le Hénaff, 1986). After their release, survey and classification work by the Québec government from 1983 to 1991 confirmed their successful introduction to the wild. Since 1986, the MFFP has been keeping a record of all muskox sightings (Figure 4.6).

Surveys conducted in 2003 and 2014 estimated the population at 1,400 individuals. However, the surveys were not carried out over the animal's entire range; therefore, it is reasonable to assume that the current population is higher. The habitat capacity of the study area for the Parc national Iluiliq Project for muskox is very low, due in particular to the rugged topography and the scarcity of grasses. There have, however, been three reported sightings of one individual in 2010 and 2014 south of Baie Déception, about 60 km south of the study area (Vincent Brodeur, MFFP, per. comm., 2016).

FUR-BEARING ANIMALS AND SMALL LAND MAMMALS

Eleven species of fur-bearing mammals and small land mammals use the study area or are likely to be found there (Appendix 5). Among these species, the arctic hare (*Lepus arcticus*), foxes (red [*Vulpes vulpes*] and arctic [*Vulpes lagopus*]) and the gray wolf (*Canis lupus*) are possibly the most numerous (SNC-Lavalin, 2015).

Arctic Hare

The arctic hare mostly inhabits the tundra and is well adapted to this cold, barren habitat. Entirely white in wintertime, its back is a greyish colour in summer. Features distinguishing the arctic hare from the snowshoe hare are its black tipped ears and white tail, plus its larger size (Bittner and Rongstad, 1982). The arctic hare is the largest hare in the Americas, with males and females weighing from 2.7 to 6.8 kg and females generally larger than males. In comparison, the snowshoe hare weighs between 1.3 and 2.3 kg (Prescott and Richard, 1996; Kaufman *et al.*, 2004). Remaining active year-round, the arctic hare are especially lively at night and sundown. When surprised, arctic hares stand on their hind legs, alert. If pursued, they scamper on all fours for shelter or to the top of a hill. Sometimes, the arctic hare will hop on its hind legs like a kangaroo (Prescott and Richard, 1996).

Canidae

The **gray wolf** is a social animal that lives in hierarchical packs. They are found in a wide range of environments, from arctic tundra to deciduous forest (Hénault and Jolicœur, 2003). According to a classification based on habitat and prey distribution, gray wolves found north of the 55th parallel belong to the tundra ecotype; these wolves are large and have a light-coloured coat (Jolicœur and Hénault, 2002; Hénault and Jolicœur, 2003; Musiani *et al.*, 2007). Ungulate numbers are believed to influence the presence of gray wolves (Hénault and Jolicœur, 2003). In summer, micromammals, hares, beavers, birds, insects and berries are sometimes added to their diet (Prescott and Richard, 2004). Gray wolves have territories ranging from 39 km^2 to more than 13,000 km^2. Capable of moving rapidly, gray wolves can reach speeds of 50 km/h over short distances, and travel up to 72 km in a day at a trot (Prescott and Richard, 1996; Kaufman *et al.*, 2004).

The **red fox** usually has a reddish-coloured coat but it may also be silver, black or brown. The tip of its tail is always white (Prescott and Richard, 2004). There are important variations of colouring in this species. The bases of the hairs of the silver-fox variety are black and their ends white; the cross-fox variety has a cross pattern on its back. These varieties may occur within the same litters (Prescott and Richard, 1996; Kaufman *et al.*, 2004). Found throughout Québec, the red fox uses a variety of habitats (Prescott and Richard, 1996). Its home range generally has a diameter of less than 9 km. The red fox will cover on average 12–13 km during its daily scavenging (Prescott and Richard, 1996). The abundance of prey, which includes snowshoe hares and micromammals, appears to be an important factor

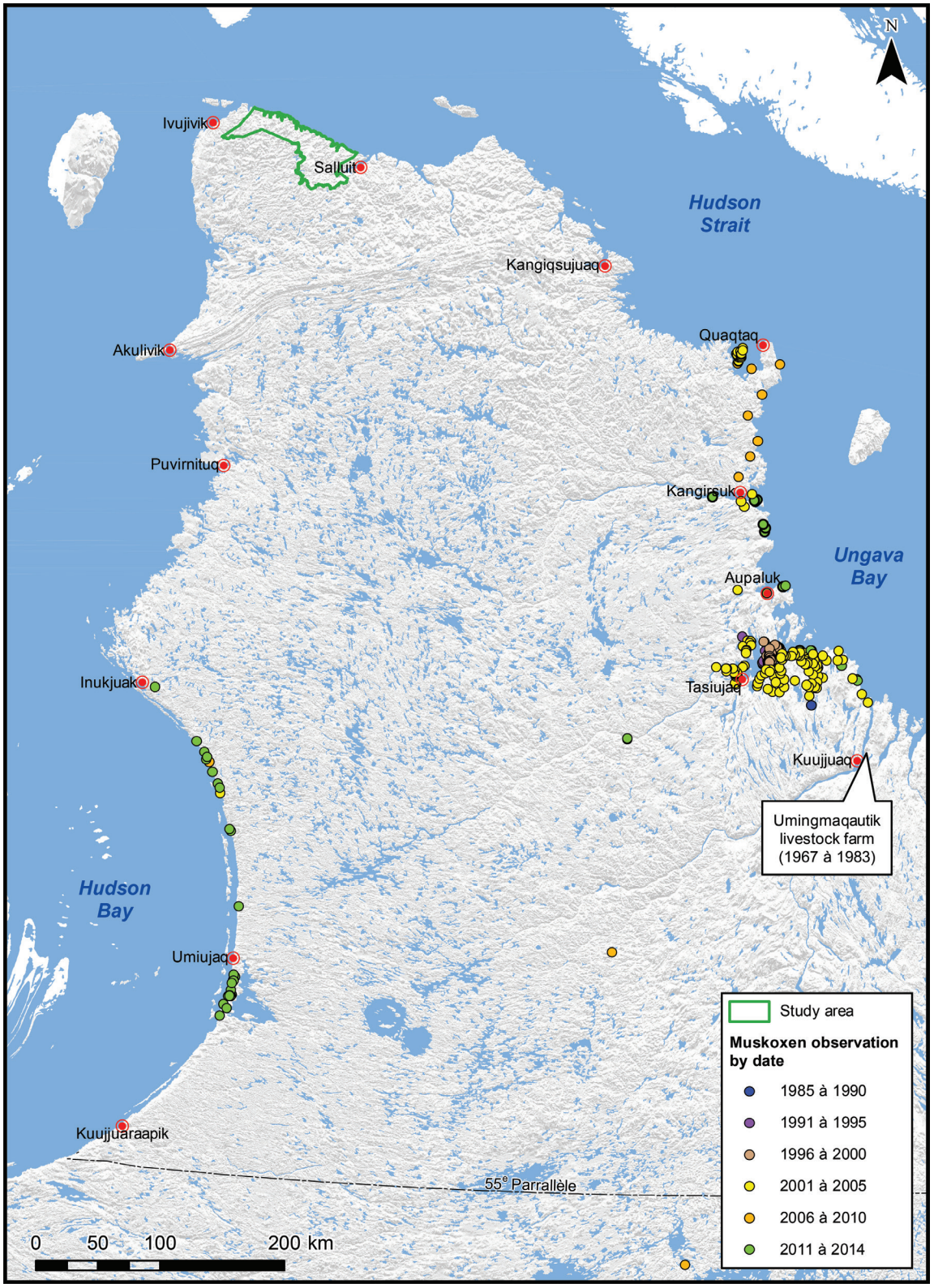


Figure 4.6 Muskoxen Observations in Québec

Note: Data come from individuals' observation reported to the ministry, telemetric monitoring and surveys; observational effort is therefore variable from year to year. Many moskoxen might have been seen in one observation.

Cartographic data: MFFP (2014)

Red fox near the study area
Credit: Robert Fréchette

determining the presence of red foxes. In summer, they are mainly found in riparian areas used by small mammals (GREBE, 1990).

The **arctic fox** is well adapted to the harsh arctic environment. Its squat, rounded body, as well as its paws, muzzle and short ears help to reduce heat loss (Prescott and Richard, 1996; Kaufman *et al.*, 2004). The arctic fox has two distinct morphs: white and blue. The latter varies from blue-black to pearl-gray in winter and both are slate-brown or yellowish in summer. Unlike the red fox, the colour of the tail of the arctic fox is uniform (Prescott and Richard, 1996; Kaufman *et al.*, 2004). The southern limit of its range is the tree line. Arctic foxes live chiefly on the tundra, where they use several categories of habitat, such as coastal sites, pack ice, inland areas and alpine areas. Predator as well as carrion eater, it is an opportunistic species with a varied diet (Garrott and Eberhardt, 1987). In winter, arctic foxes follow polar bears across the ice and feed on seal carcasses left behind by the polar bears. When food is rare, they make do with bear faeces. In summer, they eat micromammals, squirrels, hares, birds, eggs and fish, as well as berries, grasses and algae (Garrott and Eberhardt, 1987; Prescott and Richard, 2004).

Mustelidae

Although the **least weasel** (*Mustela nivalis*), the smallest carnivore in North America, lives almost everywhere in Canada, sightings have rarely been reported in Québec. In fact, knowledge on the species in Québec is virtually nonexistent. The least weasel has brown fur on its back and white fur on its belly in summer and is white all over in winter. Its tails is much shorter than that of the ermine, and without the black tip. Least weasels use different habitats, where they feed almost exclusively on mice and voles. The home range of the least weasel is approximately one hectare (MFFP, 2014a). Like other weasels, it kills its prey by biting it at the base of the skull, and often piles the carcasses of its prey in an underground hiding place (Prescott and Richard, 1996).The small size and discreet way of life of the least weasel make it difficult to capture; there is therefore little available related data. It is possible that the least weasel is more abundant than current data suggest, given that sightings are only very rarely recorded in Québec. The least weasel is currently considered a species ***likely to be designated threatened or vulnerable*** and is being monitored (MFFP, 2018b).

The **wolverine** (*Gulo gulo*) is the largest land-dwelling species of Mustelidae in North America. Resembling a small bear with a long bushy tail, its dark brown fur features two golden stripes that start at the shoulders and meet at the rump. Wolverines are prized for their fur, which is very valuable (Government of Canada, 2014). They are found throughout the boreal forest and tundra. Their vast home ranges are approximately 400 km^2 (Prescott and Richard, 1996; Kaufman *et al.*, 2004). The habitats most suitable for wolverine populations in Québec are the northern areas used by the George River and Leaf River caribou herds, including the study area. Wolverines are primarily carrion eaters, feeding on the carcasses of animals that have either died naturally or been killed by predators such as wolves (Fortin *et al.*, 2005). Sightings of wolverines in Québec have not been confirmed since 1978 (Fortin *et al.*, 2005; MFFP, 2018b). In April 1989, the wolverine population in eastern Canada, restricted to Québec and Newfoundland and Labrador, was declared ***endangered*** by the COSEWIC. The status was renewed in May 2003 (COSEWIC, 2018; Environment Canada, 2014c). The species currently appears on the *List of Wildlife Species at Risk* in Canada. In March 2000, the wolverine was also designated as a ***threatened*** species in Québec (MFFP, 2018b). The decline in wolverine numbers in eastern Canada is explained primarily by the trapping and hunting carried out in the 19th century, the decline of caribou herds in the early 20th century, and disturbance of the species' habitat by anthropogenic activities (such as hydroelectric development and mining) and the reduced number of wolves that normally generate animal carcasses (Environment Canada, 2014; MFFP, 2018b). In addition, the misuse of poison bait to kill wolves adversely affected wolverines that consumed the poisoned wolf carcasses (Environment Canada, 2014c). In order to promote its conservation in Québec, hunting and trapping of this species have been prohibited since 1981, except by Aboriginal people in the territories covered by the agreements in the James Bay and northern Québec regions. There are no reports of any recent catches (Fortin *et al.*, 2005).

The range of the **ermine** (*Mustela erminea*) extends throughout Québec. Ermines mostly inhabit ecotones,

scrubland, peatland, and herbaceous areas with bushes (Fagerstone, 1987; Prescott and Richard, 2004). The ermine is brown in summer and white in winter, except for the tip of its tail which remains black and is charactertistic of the species. Small mammals are the principal components of the ermine's diet and their abundance appear to be the main factor determining ermine numbers (Fagerstone, 1987). Ermines usually move by small 50cm leaps, but can jump from 150 to 180 cm, which is very impressive given its total length of between 22 and 32 cm (Prescott and Richard, 1996).

Like the ermine, the **river otter** (*Lontra canadensis*) is found all over Québec. It is adapted to a wide range of aquatic environments and notably found in rivers, streams, small lakes, marshes, estuaries and marine bays. Its diet is made up of fish, crustaceans, aquatic insects, birds and small mammals (Toweill and Tabor, 1987; Prescott and Richard, 2004).

MICROMAMMALS

Micromammals play an important role on the tundra: they are said to be key species of this ecosystem. In fact, they are an important food source for several predators and, as herbivores, consume a large amount of plants (Krebs, 1996; Krebs *et al.*, 2002; Ims and Fuglei, 2005; Krebs, 2011). Some studies even suggest that, in some tundra areas, lemmings consume three to six times more primary production than caribou (Krebs, 2011). They therefore contribute significantly to soil enrichment through faecal and urine production as well as seed dispersal (Ims and Fuglei, 2005; Krebs, 2011). Burrow construction also aerates the soil (Ostfeld *et al.*, 1996). The majority of species remain active year-round, circulating mainly under the snow in winter; they are mainly a nocturnal species (Prescott and Richard, 2013). Micromammal populations, especially those of lemmings, follow a roughly four-year cycle (Gunn, A., 2003; Ims and Fuglei, 2005; Krebs, 2011). This cycle has a significant impact on their many predators (carnivorous mammals and birds of prey), as well as on the entire ecosystem. The fox, ermine, least weasel, snowy owl and short-eared owl are all affected by this cycle (Ims and Fuglei, 2005). Additionally, certain tundra species that are not lemming predators have cycles that are synchronized with the lemming's. Ims and Fuglei (2005) suggest this is the case with geese and some wading birds.

Although no studies have yet been conducted in the study area for the Parc national Iluiliq Project, studies conducted in the area of the Raglan mine and in the Parc national des Pingualuit have confirmed the presence of **Ungava collared lemming** (*Dicrostonyx hudsonicus*), **meadow vole** (*Microtus pennsylvanicus*) and **northern bog lemming** (*Synaptomys borealis*) (Fortin and Caron, 2015; SNC-Lavalin, 2015). Interestingly, the mention of the northern bog lemming in that study is the northernmost sighting for this species, specifically 311 km farther than the previous northernmost sighting (Fortin and Caron, 2015).

AVIFAUNA

The study area for the Parc national Iluiliq Project possesses a wide variety of habitats: sheer cliffs, coastal regions, vast plateaus, etc., all of which are suitable for a wide variety of birds. A list based on the *Atlas of Breeding Birds of Québec* and a survey carried out in 2015 in the framework of operations at the Raglan mine identified the possible presence of 51 bird species in the study area. Of these species, 32 are confirmed or probable breeding birds in the study area. These species are described in more detail in the following text. Three avian species considered at-risk, either at the provincial or federal levels, are present in the study area for the Parc national Iluiliq Project: the harlequin duck, the golden eagle and the peregrine falcon.

Family: Anatidae

Anatidae are a family of birds that include swans, ducks and other related species such as geese. The study area may be used by 14 species belonging to this family; the nesting of eight of these species is probable or confirmed. This family of birds has the greatest number of species in the study area, in particular because Anatidae are birds with a strong link to water (streams, bodies of water, coastal regions, etc.) and this type of environment is common in the study area. These species are described briefly below.

The **Canada goose** (*Branta canadensis*) is common in Nunavik. Its long and irregular «V» formation in migratory flight is a characteristic sight, marking the arrival of spring and winter. This species is of great economic and cultural importance for the whole of the Nord-du-Québec region (Cotter *et al.*, 1995). It has been reported that the highest densities recorded in Québec are on the tundra of the Ungava Peninsula (Cotter *et al.*, 1995). The Canada goose

Geese migrating southward, over Ivujivik
Credit: Alain Thibault

Canada geese taking flight near the study area
Credit: Marianne Ricard

is primarily a herbivore feeding on roots, shoots, seeds and, in season, berries.

The **tundra swan** (*Cygnus columbianus*) is one of the rare species to have recovered after being practically eradicated as a breeder in Québec. The tundra swan is a breeding species north of the tree line and is a known breeder in the Cap Wolstenholme area. It breeds early in the season on slightly elevated snow-free terrain, providing the pair with a view of their surroundings (Alvo, 1995).

Tundra swans near the study area
Credit: Robert Fréchette

The **blue-winged teal** (*Anas discors*) is recognizable by its small size, rapid flight and the chalky blue colour of its forewings. Although rare north of the 49th parallel, this species is likely a breeding bird in the study area for the Parc national Iluiliq Project (Benoit and Dauphin, 1995).

Although the **king eider** (*Somateria spectabilis*) resembles the common eider (*Somateria mollissima*), the head of the male possesses remarkable colouring. Specifically, it is bluish gray with an orange patch. The king eider is a northern breeding duck in the Arctic and the subarctic tundra zone. It is the most abundant of the four species of eider. Like the common eider, the king eider occupies the coast, and is rarely seen more than 50 km inland (Munro, 1995).

The **common eider** is the largest duck in Québec, with the male weighing roughly 2,218 g and the female 2,315 g. It is one of the most spectacular species of waterfowl, in particular due to its elegant colours, the male's courtship behaviour and the way it flies in straight-lined groups directly above the water (Lamothe and Choinière, 1995). The species is abundant throughout its range. It comprises three subspecies: *Somateria mollissima borealis* in Labrador, Nunavik and Nunavut; *Somateria mollissima sedentaria* around Hudson Bay; and *Somateria mollissima dresseri* on the shores of the St. Lawrence (Lamothe and Choinière, 1995). An estimate of the breeding population along Hudson Strait (excluding Ungava Bay) prepared from 1980 to 1983 put the population at 24,000 pairs, with the majority nesting on the north coast of the strait (Gaston and Cooch, 1984). During the breeding season, the female chooses a depression in the ground where she places her down. Incubation lasts about 26 days with the female almost never leaving her nest. After incubation, females will have lost close to half of their weight (Lamothe and Choinière, 1995). Eiders feed mainly on molluscs, amphipods and *qopirquit* (an Inuktitut term referring to worms and probably several other invertebrates) (Nakashima, 1986). It is the only duck species subject to a sport and traditional hunting, in addition to producing down (Lamothe and Choinière, 1995). The French word édredons (English: comforter) refers to a bed covering filled with the down of geese, eider, etc. Inuit have harvested the common eider for centuries; this traditional subsistence activity remains important to this day (Reed, 1986). During the spring and summer, Inuit hunt adult common eiders and consume their eggs. In some communities, the down

Common eider pair
Credit: Robert Fréchette

is collected and used as insulation in clothing and other equipment (Nakashima, 1986; Reed, 1986). Over the years, Inuit have accumulated important knowledge about common eiders. Eider migration to the north begins in May and, by early June, snow and ice melt is generally well enough advanced to allow pairs to begin looking for a nesting site (Nakashima, 1986). Most pairs nest on islands along the coast; when this is not possible, they nest along the coasts of the mainland, as is the case near Salluit (Nakashima, 1986).

The **harlequin duck** (*Histrionicus histrionicus*) is a magnificent duck. The very colourful male has a blue and white back, while his sides and the top of his head are russet. For her part, the female is brown with a white spot between the eye and the beak and another near the ear. The harlequin duck is a small duck: the male weighs only about 700 g and the female about 600 g. This represents half the average size of a mallard duck (Environment Canada, 2007; MFFP, 2017). Harlequin ducks that nest in Nunavik belong to the eastern population, and migrate to the southwestern coast of Greenland to moult and spend their winters. The species is gregarious, i.e. it gathers in large flocks when moulting. In spring, harlequin ducks move from salt water to fast-flowing streams where large populations of invertebrates are present, including black fly larvae. Harlequin docks may be observed at this time diving into rapids to feed. The species uses these streams to breed generally in late May or early June. The reproduction rate of the harlequin duck, compared with other aquatic birds, is low due to factors such as its late breeding age, its small clutch size, and the high proportion of non-breeding birds some years. This situation does not help populations to recover after a decline and is one reason that the species has been designated of ***special concern*** by the federal government (Environment Canada, 2007). Notwithstanding, little surveying of the species has been conducted in Nunavik, in particular due to its wide dispersion during the breeding season.

Harlequin duck
Credit: Camille Le Gall-Payne

The **long-tailed duck** (*Clangula hyemalis*) breeds in northern Québec. In winter, it is the most abundant duck in Québec second only to the common eider. The male has two long tail feathers measuring about 25 cm each. It is a very garrulous duck and the male's distinctive song may be heard from far away. The species breeds along the coasts of Nunavik and is more abundant on the Ungava coast than on the Hudson coast (Lamothe, 1995).

Male (left) and female (right) long-tailed ducks
Credit: Robert Fréchette

The **common merganser** (*Mergus merganser*) is a large diving duck present throughout Canada. It is an early spring migrant that feeds almost exclusively on young trout and salmon (Alvo, 1995a).

Family: Phasianidae

The **rock ptarmigan** (*Lagopus muta*) is the sole representative of its family in the study area for the Parc national Iluiliq Project. It is easily observable throughout its range, despite its cryptic brown plumage in summer and white plumage in winter that serve to camouflage it in its

Rock ptarmigan in summer
Credit: Alain Thibault

Rock ptarmigan in winter
Credit: Robert Fréchette

habitat (Cotter, 1995). All ptarmigan species have feather-covered legs and are monogamous. Rock ptarmigans typically breed in tundra-like terrain, i.e. on uneven ground with scattered rocks. It has a varied diet, although it is highly dependent on the leaves and buds of shrubs, such as those of birch and willow. The species can experience major fluctuations in population every ten years. In the Arctic, it is hunted year-round, without any apparent impact on its abundance (Cotter, 1995).

Order: Charadriiformes

The order of Charadriiformes in the study area mainly comprises plovers, sandpipers, guillemots and gulls. In total, eight species are confirmed or probable breeding birds in the study area.

The **semipalmated plover** (*Charadrius semipalmatus*) is a small wading bird with one black breast-band, a black-tipped yellow beak and short black legs. This plover breeds in northern Québec, generally in sand on coastal beaches or on gravel river banks. During the breeding season, parents are noisy and anxious defenders of their nests against intruders.

Pluviers semipalmés
Crédit : Robert Fréchette

The **semipalmated sandpiper** (*Calidris pusilla*) is a small, sparrow-sized wading bird that nest in Québec and is relatively common. Breeding takes place in the arctic tundra, in particular along streams with dense vegetation (Cotter and Lafontaine, 1995).

Two members of the family **Alcidae**, in the order of Charadriiformes, use the study area, specifically the thick-billed murre and the black guillemot. The former is without a doubt the emblematic species of the Parc national Iluiliq Project, as it breeds in very dense colonies on the cliffs along the coast of Cap Wolstenholme, next to the study area of the park project, and around Digges Islands across from the community of Ivujivik. The presence of these colonies explains in part the interest for establishing a national park in this region.

The **thick-billed murre** (*Uria lomvia*) is the largest species in the family Alcidae (weighing about 1 kg and measuring 43 to 48 cm). The black plumage on its back and white on its abdomen make this murre hard to see when in the sea. The species is long-lived and has a high survival rate (CAFF, 1996). Its distribution is circumpolar and breeding takes place only in arctic and subarctic waters (Gaston *et al.*, 2011; Frederiksen *et al.*, 2016). Murres breed for the first time around four or five years of age and have a reproduction success rate of 70 to 80% (CAFF, 1996). Females lay only one egg (weighing about 100 g) which they brood directly on the rock ledges of high cliffs (Gilchrist and Gaston, 1997). As the egg is piriform (pear-shaped), it tends to turn on itself when moved, reducing the chance of it rolling off a ledge (Chapdelaine, 1995).

Feeding Habits

Thick-billed murres mainly feed on fish, crustaceans, molluscs and annelids (Gaston and Noble, 1985). They fish in groups that range from 20 to 200 individuals. Approaching a school of fish, the murres attack from underneath as the fish are silhouetted against the faint light from the surface. A study on thick-billed murre feeding practices has shown that the stomach content of this species is dominated by fish, and that it represents 90% of the energy value contained in their stomachs (Gaston and Noble, 1985). Thick-billed murres expend a great deal of energy, i.e. about 1500 kJ per day (Gaston and Noble, 1985). Individuals will spend about 24 hours feeding away from the colony; this period drops to 12 hours while parents have a nestling (Gaston and Noble, 1985). Interestingly, parents feed their nestlings by carrying in their beaks a single fish at a time; they can not rely on the capacity of their stomachs for this purpose,

Thick-billed murres on cliffs near the study area
Credit: Camille Le Gall-Payne

Egg of a thick-billed murre
Credit: Marianne Ricard

Thick-billed murres on a cliff ledge near the study area
Credit: Robert Fréchette

Thick-billed murres nesting on cliffs near the study area
Credit: Robert Fréchette

as is the case for other bird species (Croll *et al.*, 1991). Murres of the Digges Islands colony travel long distances to feed, sometimes up to 125 km from the colony. This is undoubtedly a result of the huge size of colony (Gaston and Noble, 1985; Gaston, 1985). The size of the colony also affects the growth rate of nestlings. One study has shown that nestlings in larger colonies have a slower growth rate than those in colonies with fewer individuals (Hipfner *et al.*, 2006). This would suggest that the individuals in a same colony are competing for food.

Wings: Tools to Fly and to Swim

The thick-billed murre uses its wings both to fly and swim: a process of natural selection promoting effective diving has produced short wings in this species. Of all flying birds, the thick-billed murre, the common murre (*Uria aalge*) and the razorbill (*Alca torda*) are the species with the highest wing load, i.e. the ratio of body mass to the lifting surface of their wings (Croll *et al.*, 1991; Croll *et al.*, 1992; Frederiksen *et al.*, 2016). Their wings are proportionally smaller than those of other birds of the same size. For the thick-billed murre, taking flight and landing can be problematic. When taking flight, they may be observed flapping their wings very quickly and building up as much speed as possible on the surface of the water, while when landing they may occasionally be seen colliding with the crests of waves. Although clumsy, this species may attain an exceptional average speed of 65 km/h in flight, which is to say more than 10 km/h quicker than a wolf or a black bear can run over short distances (Jones *et al.*, 2002).

On the other hand, the thick-billed murre is a particularly talented swimmer and diver, especially given its small size (Croll *et al.*, 1992). Most diving takes place in the evening and at night, as its prey migrates at the surface. The species generally dives to depths between 21 and 40 m for an average of 55 s, but can dive to depths of up to 200 m (Croll *et al.*, 1992). They are among the deepest-diving birds. A higher blood-oxygen level, compared with terrestrial bird species, is one of the ways thick-billed murre has adapted to accomplish this feat (Croll *et al.*, 1992).

Leaving the Nest

When the time has come for the fledgling to leave its nest, it steps to the edge of the ledge with its father. It hesitates for several moments before making the leap. While its

Thick-billed murre in flight
Credit: Marianne Ricard

father encourages it with noises and by gently pushing its head, the fledgling finally steps away from the ledge (Gilchrist and Gaston, 1997). Unable to fly, it nonetheless flaps its wings frantically and glides to the sea. The father follows and guides the fledgling during the descent. Once at sea, the fledgling and parent recognize one another by their distinctive cackling and complete a series of circles around one another (Gilchrist and Gaston, 1997). A study has shown that nestlings develop the ability to recognize the distinct cackles of their parents as early as three days of age, an adaptation that is very important in large colonies (Lefevre *et al.*, 1996).

One study has estimated that about 20% of fledglings do not make it to the sea after leaving their nests. In colonies where fledglings must cross some ground to reach the ledge, they may be preyed on by foxes and gulls (Gilchrist and Gaston, 1997). Waiting for nightfall to leave their nests helps fledglings to avoid the risk of predation. However, where the ledge gives direct access to the sea, it seems that the fledglings mortality rate is the same. This study has shown that non-breeding adults may act aggressively towards fledglings sometimes causing the fledglings to drown (Gilchrist and Gaston, 1997). Once they have successfully made it to the sea, each father and its fledgling undertake a migration. For its part, the mother returns to her nest for a few days before beginning the same migration.

Migration

Every year, thick-billed murres travel hundreds of kilometres from their nesting sites to their wintering area in the northwestern Atlantic. The winter distribution of the thick-billed murre is extensive, ranging from western Greenland to the northeastern coast of the United States (Gaston *et al.*, 2011; Tranquilla *et al.*, 2013). Some colonies may even migrate thousands of kilometres (Gaston *et al.*, 2011). For example, thick-billed murres from Digges Islands migrate first to Hudson Bay between mid-November and early December, heading next to their wintering area in the north-central Labrador Sea and off the coast of Newfoundland (Tranquilla *et al.*, 2013). At the start of this exceptional migration, fledglings, aged between 15 and 30 days old, leave their colony unable to fly. Their weight is only between 12 and 27% that of an adult, i.e. about 150 g (Gaston *et al.*, 1983; Gilchrist and Gaston, 1997). The males are moulting at this time, and neither they nor the fledglings can fly (Gilchrist and Gaston, 1997; Jones *et al.*, 2002; Frederiksen *et al.*, 2016). This first part of the migration, lasting about a month and a half and sometimes covering a thousand kilometres, is carried out by swimming until the fledgling is able to fly (Frederiksen *et al.*, 2016). Thick-billed murres return to the region of the study area in April or early May, shortly after the sea ice has begun to break up, although a good deal of ice remains in the Ivujivik area (Gaston *et al.*, 2015a).

Thick-billed murre fledgling with a parent after leaving its cliff ledge for the first time
Credit: Marianne Ricard

Archaeology

Among the early inhabitants of Nunavik, birds played a secondary role compared to land and marine mammals. Notwithstanding, archaeological studies near the study area for the Parc national Iluiliq Project (on an island at the mouth of the Fjord de Sugluk and on the northernmost island of the Nuvuk Islands, southwest of Ivujivik) suggest that birds played an important economic role among the Dorset people (refer to Section 5: Human Occupation under the Pre-History to History heading) (Monchot *et al.*, 2016). Birds, including the thick-billed murre, are an important source of food, but also raw materials for making tools and clothing. It is estimated that a murre provides about 0.7 kg of meat (Monchot *et al.*, 2016).

Population

Roughly five million thick-billed murres breed in the eastern Canadian Arctic, i.e. about one-quarter of the world's population (Provencher *et al.*, 2010). It constitutes the most abundant breeding species in the Canadian Arctic, representing over 85% of the seabirds that breed in the area (Gaston *et al.*, 1983; Gaston and Noble, 1985). In the Hudson Strait region, there are five colonies of thick-billed murre and they are among the largest in the world (Gaston *et al.*, 1983, CAFF, 1996). The colony of Digges Islands is the closest to the study area for the Parc national Iluiliq Project. Observations by scientists suggest that thick-billed murres around Cap Wolstenholme and Digges Islands behave in fact as a single colony. Half of the colony's population is on the islands and the other half on the north coast of Nunavik (Gaston *et al.*, 1983). The overall

size of the Digges Islands population, i.e. on the islands and on the mainland combined, was estimated at about 872,000 individuals in 2013 (Tranquilla *et al.*, 2013).

Conservation

In general, seabirds are among the most threatened vertebrates. Many species have been designated of special concern (Frederiksen *et al.*, 2016). They are a bioindicator of anthropogenic disturbances in the marine environment (Tranquilla *et al.*, 2013). In fact, seabirds including thick-billed murres are visible, easy to count and the traits of their life history are intimately connected to their environment (Provencher *et al.*, 2012). Some colonies of thick-billed murre in the Canadian Arctic archipelago, in particular that of Digges Islands, have been monitored since the 1970s: population size, the presence of contaminants, their diets and other characteristics have been tracked (Provencher *et al.*, 2010). These studies enhance understanding of some impacts of human activity on this species and of climate change on the arctic ecosystem, in addition to monitoring the conservation status of thick-billed murre populations.

The Canadian Arctic is considered a relatively pristine environment, sparsely populated and far from major sources of pollution. This pollution nevertheless collects in the Arctic because of atmospheric and oceanographic processes (Provencher *et al.*, 2010). A survey on thick-billed murres revealed that 11% of the individuals sampled had ingested plastic (either as microplastics or microbeads). These birds were from five Nunavut populations scattered over more than 11 degrees of latitude (Provencher *et al.* 2010). Although the quantity of plastics found in these birds was 80 times lower than quantities found in northern fulmars (*Fulmarus glacialis*), which were the subject of a similar study, the results illustrate how contaminants can be carried to a remote environment such as the Arctic and have a significant impact on the ecosystem (Provencher *et al.*, 2010).

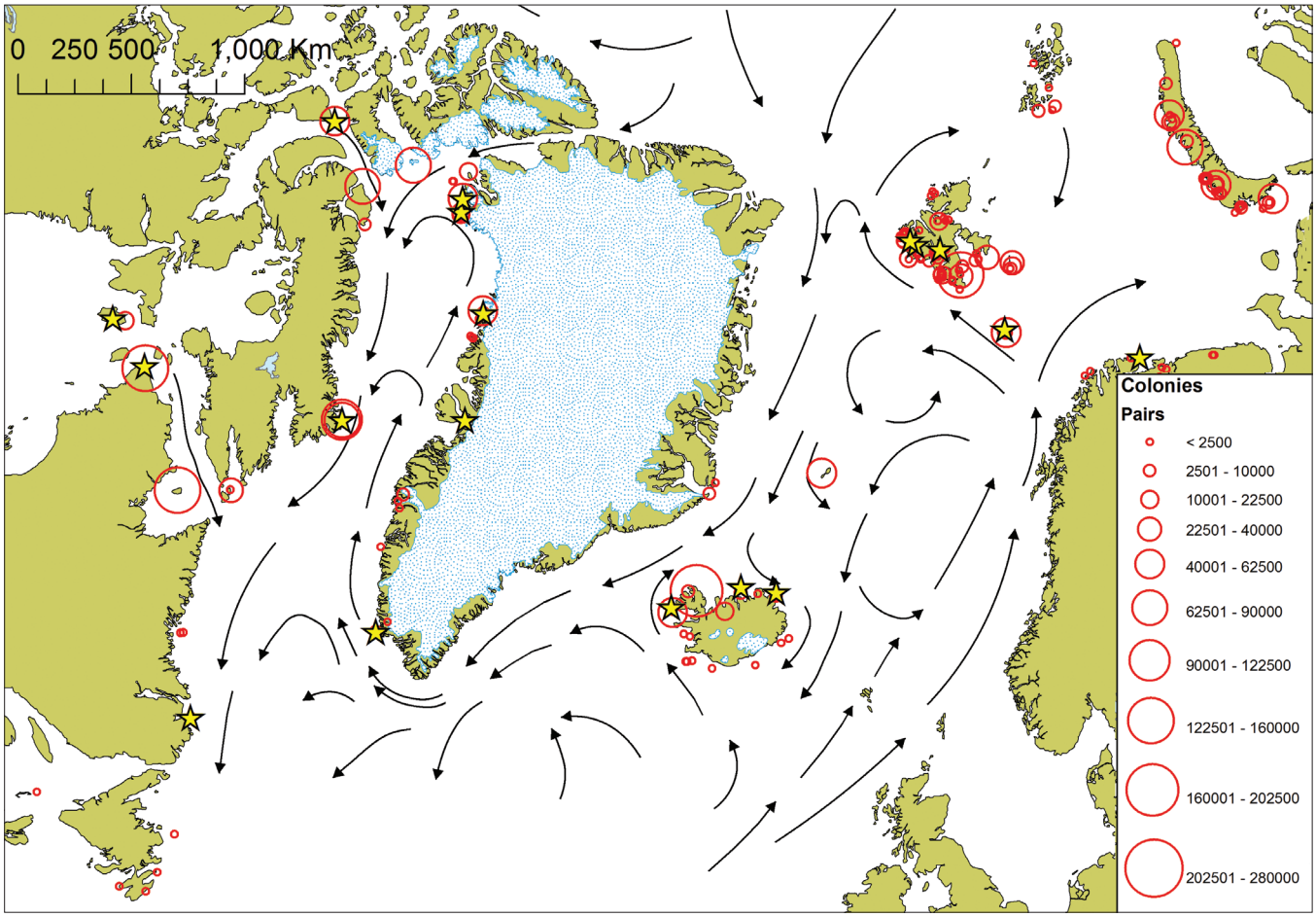


Figure 4.7 Distribution of colonies of thick-billed murre in the North Atlantic Ocean (the diameters of the red circles represent the size of each colony; the yellow stars indicate colonies in which data recorders were installed; the black arrows indicate the direction of prevailing sea currents).

Source: extracted from Frederiksen *et al.* (2016)

Thick-billed murres on cliffs near the study area
Credit: Alain Thibault

Tracking changes in marine Arctic ecosystems improves understanding of their dynamics and the possible effects of climate change on polar regions (Provencher *et al.*, 2012). Another study by Provencher *et al.* (2012) demonstrated a significant change in the diet of thick-billed murres due to declining ice cover in areas around some low arctic colonies, including the Digges Islands colony. Specifically, in the 1970s and 1980s, more than 30% of the fish consumed by thick-billed murres was arctic cod (*Arctogadus glacialis*), a species closely linked to cold water and under-ice breeding. Today, Arctic cod make up less than 5% of the diet of thick-billed murres, while sand lance and capelin are the dominant species. In parallel, ice cover in the area around Digges Islands on July 16 was 33% from 1971 to 1993, but dropped to 7% after 1993 (Provencher *et al.*, 2012).

With a global population of around 16 million birds, there are many colonies of thick-billed murre. Most of the colonies in Canada have stable populations, while some colonies on the coasts of Iceland, Greenland and Norway have experienced significant declines in recent decades (Frederiksen *et al.*, 2016). Their migrations leave them

Thick-billed murres taking flight near *Anaulirvik*
Credit: Camille Le Gall-Payne

vulnerable to several threats, such as hunting, hydrocarbon spills and by-catching. These threats are particularly common in their wintering areas (CAFF, 1996, Frederiksen *et al.*, 2016). For example, it has been estimated that hunting pressure off the coast of Newfoundland, Labrador and Greenland has led to the death of one million thick-billed murre in 1996 (CAFF, 1996). That same year, the Conservation of Arctic Flora and Fauna (CAFF), a working group of the Arctic Council, published an international conservation strategy to establish consistent actions among nations to protect the thick-billed murre (CAFF, 1996). The strategy contains a list of recommendations to deal with the main threats. In particular, it emphasizes that an ecosystemic approach targeting protection of thick-billed murre habitat is essential and that research and population monitoring are necessary to enhance related knowledge (CAFF, 1996).

The eventual creation of Parc national Iluiliq could encourage and facilitate research and monitoring of the thick-billed murre population of Digges Islands. As well, a park near the colony would entail responsibility for monitoring the impacts of tourism. Since females lay only one egg on cliff ledges several hundred metres high, the population is vulnerable to disturbances that might result in eggs being knocked from the cliffs. Thick-billed murres are also sensitive to noise (gunshots, motor boats, airplanes, helicopters, etc.). Preventive measures could be set up by staff of the future park to minimize impacts on the birds while allowing visitors a unique opportunity to observe the huge colony.It is nonetheless important to recall that the study area for the Parc national Iluiliq Project does not include any thick-billed murre colony; but the colony is adjacent to the study area it is. Efforts will therefore need to be made by all stakeholders to ensure consistent and ecosystemic protection of this population.

The **black guillemot** (*Cepphus grylle*) of the family Alcidae is a small diving bird with black back and white wing patch. It nests in rock crevices for protection against predators (Cairns, 1995). It is in this habitat that pairs brood two eggs at a time. Both males and females develop a featherless patch on their breasts to better transfer their heat to the eggs. Pairs usually remain together for life and return to the same nesting site each year. In general, adults feed on fish and invertebrates, at the floe edge as well as in open, shallow water. The black guillemot spends most of its time, about 90%, far from the colony feeding and 10% of its time flying (Cairns, 1987). In Québec, black guillemots breed in large numbers along the coasts of Hudson Strait (Cairns, 1995).

Four species of gulls are confirmed breeders in the region of the study area for the Parc national Iluiliq Project: the

Black guillemot taking flight
Credit: Camille Le Gall-Payne

herring gull (*Larus argentatus*), the **Iceland gull** (*Larus glaucoides*), the **glaucous gull** (*Larus hyperboreus*) and the **great black-backed gull** (*Larus marinus*). All have a varied diet that depends on the resources they can obtain through predation, scavenging carrion and pilfering.

The herring gull is the most common gull in Québec, breeding along all the coasts of the province. For its part, the great black-backed gull is a formidable predator. It can snatch young eiders and swallow them in flight, even while fending off attacks from mothers trying to defend their fledglings. Great black-backed gulls will even chase eagles from their territories and pilfer food from them. Iceland and glaucous gulls may be found in northern Québec, near the study area. In particular, the two species nest in the

Immature gull spp. on the cliffs at *Naujaakallak*
Credit: Camille Le Gall-Payne

Gulls in flight at *Naujaakallak*
Credit: Camille Le Gall-Payne

Gulls *spp* in the study area
Credit: Robert Fréchette

same colony at *Naujaakallak*, which means "gull island". Iceland and glaucous gulls feed on the eggs and fledglings of thick-billed murres which nest nearby. Moreover, this is the only location in Canada where Iceland gulls are the main scavenger in a large seabird colony in association with glaucous gulls.

Family: Gaviidae

Generally similar in size to ducks but not related to that group, two species of loons are confirmed breeders in the study area. The **red-throated loon** (*Gavia stellata*) nests on small mounds near salt water up to a few kilometres inland. The smallest of the five loon species, it is recognizable by its uptilted beak and the red throat patch displayed by adults during breeding (Blanchard and Alvo, 1995). The **Pacific loon** (*Gavia pacifica*) only breeds in Nunavik, on ponds and lakes of the forest and arctic tundra (Alvo, 1995b).

Family: Accipitridae

The **rough-legged hawk** (*Buteo lagopus*) is the most common hawk in the North American arctic. Its legs are feather-covered to conserve heat in cold arctic conditions (hence the name *rough-legged*). The colouring of rough-legged hawks varies widely from one individual to the next, ranging from light brown with generous amounts of white plumage to uniform dark brown. Their main prey are lemmings and voles, which can constitute 80 to 90% of their diet (Henderson and Bird, 1995).

The **golden eagle** (*Aquila chrysaetos*) is a diurnal bird of prey. Adults have a dark-brown plumage with a wash of gold on their hindnecks. As with most birds of prey, the female is larger than the male and may weigh up to 6 kg with a wingspan of 2.2 m (Équipe de rétablissement de l'aigle royal au Québec [golden eagle recovery group, ERARQ], 2005). For its part, the male weighs between 3.5 and 4.4 kg. Golden eagles feed on a wide variety of prey, according to abundance; it is therefore qualified as euryphagous. It may hunt birds (geese, ducks, crows, gulls, etc.), land mammals (marmots, hares, foxes, etc.) and less frequently fish. Golden eagle pairs are monogamous and always return to the same nesting site, although they generally keep one or more alternative nests. During the 20th century, the golden eagle population in North America declined significantly due to harmful human activities (ERARQ, 2005). This species is widely distributed in Québec, from north to south. According to the ERARQ, northern Québec is one of the main areas used by golden eagles during nesting season (ERARQ, 2005). The golden eagle is a ***vulnerable*** species in Québec. Individuals are so sensitive to disturbances in their breeding areas that they may abandon their nests if disturbed. Anthropogenic activities affecting their habitat are therefore one of the main threats to this species. Situated at an upper level of the food web, golden eagles are also threatened by bioaccumulation of contaminants in their food chain, in particular due to the use of lead shot shells for hunting waterfowl and large game (MFFP, 2018). By protecting breeding areas and reducing anthropogenic disturbances, the population is expected to increase (ERARQ, 2005).

Family: Falconidae

The **peregrine falcon** (*Falco peregrinus*) is a small bird of prey comparable in size to the crow. The plumage of the male and female is identical: slaty-backed with a whitish breast. They also have a distinct black mustache on each cheek. In flight, their wings are pointed and peregrine falcons are able to travel at an extraordinary speed of 200 km/h when diving to catch prey (Bird, 1997). Peregrine falcons prefer to nest on cliffs and may return year after year to a same site. Nesting sites close to bird colonies are choice locations for peregrine falcons, as birds make up a significant portion of their diet (Environment

Canada, 2015). Two subspecies of peregrine falcon are found in Québec: *anatum*, which nests in southern Québec up to the tree line, and *tundrius*, which nests throughout the tundra regions of Canada, Alaska and Greenland. Only *tundrius* should be present in the study area for the Parc national Iluiliq Project. Both subspecies winter in Argentina and Chile. Interestingly, those individuals breeding the furthest north are the ones that migrate the furthest south (Environment Canada, 2015). In the 1960s, the peregrine falcon was severely threatened by the use of pesticides, which caused the shells of their eggs to become more fragile. Since the ban imposed on organochlorine compounds, such as DDT, the Nunavik population of this species appears to have recovered. In Québec however, peregrine falcons remain vulnerable to habitat degradation caused by encroachment and anthropogenic disturbances, such as wind energy development in Nunavik and their use in falconry (Bird *et al*., 1995). In Québec only *anatum* is designated ***vulnerable***, while both subspecies currently appear on the *List of Wildlife Species at Risk* in Canada. The COSEWIC considers the species of ***special concern*** (COSEWIC, 2014; Government of Canada, 2014).

Peregrine falcon, Kangirsukallak
Credit: Marianne Ricard

Order: Passeriformes

In total, 13 passerine birds are probable or confirmed breeders in the study area for the Parc national Iluiliq Project.

Among these, the **common raven** (*Corvus corax*) may be observed around Nunavik. Adapted to human environments, it clusters near urban areas. Compared to the crow found further south, the common raven has a larger wingspan (117 to 142 cm) and a wedge-shaped tail. Common ravens do not migrate; they overwinter in Nunavik. As soon as fledglings are able to fly long distances, they join their parents to look for food in groups (Roy and Bombardier, 1995). Some individuals may travel up to 90 km per day in search of food. Whenever a carcass is located, common ravens will emit a special croak to call the other members of their group. This scavenging method makes it possible to search for food over wider areas. In winter, common ravens may sometimes follow carnivores, such as wolves or polar bears, and feed on the remains or carcasses of their prey (Roy and Bombardier, 1995).

The **horned lark** (*Eremophila alpestris*), the **northern wheatear** (*Oenanthe oeananthe*) and the **American Pipit** (*Anthus rubescens*) are all confirmed breeding birds in the study area where they nest on the ground in open areas, such as the tundra and rocky areas (Falardeau, 1995; Pelletier, 1995; Robert, 1995). The **American robin** (*Turdus migratorius*) may now be observed in the study area, in particular close to communities such as Salluit where it sometimes nests, near houses or structures (Tardif and Lanoue, 1995).

For its part, the **common redpoll** is one of the most abundant bird species on the tundra, nest mainly in shrubs and trees (Seutin, 1995). The **hoary redpoll** is another common passerine that breeds in arctic and subarctic regions, in particular in the study area. It nests in more open habitats than the common redpoll (Lanoue and Seutin, 1995).

The **Lapland longspur** (*Calcarius lapponicus*) and the **snow bunting** (*Plectrophenax nivalis*) are common tundra birds (Lanoue and Doyon, 1995; Vincent, 1995). Lapland longspurs nest on the tundra, preferably in wetland habitats (Lanoue and Doyon, 1995). For their part, snow buntings prefer rocky terrain, slopes and mountain sides (Vincent, 1995). They are easily observable in winter when most gregarious, flying in flocks sometimes consisting of hundreds of individuals. For Inuit, the return of snow buntings, known as *amaulligaaq*, means the end of winter (Vincent, 1995).

The **American tree sparrow** (*Spizelloides arborea*) nests in forest and shrub tundra, woodlands with lichens, and shrubby thickets of willow and alder (Limoges and Barrette, 1995). The **savannah sparrow** (*Passerculus sandwichensis*) nests in open habitats with dense herbaceous plant coverage (Bonneau, 1995). The **white-crowned sparrow** (*Zonotrichia leucophrys*) nests on the arctic tundra on the ground under shrubs. It is also found in forest tundra, among alders, dwarf willows and scrub birch along watercourses and in peatlands (Breton, 1995). Finally the **dark-eyed junco** (*Junco hyemalis*) is one of the most common gregarious passerines in North America and feeds in groups. Individuals generally nest on the ground in natural depressions, where their nests are hidden under vegetation (Lessard and Limoge, 1995).

FISH

The description of fish communities in a given geographical area can be complex since some species may migrate on a seasonal or even daily basis. In general, arctic fish are considered to have a less specialized diet, since the environment is not very productive and supports a reduced number of species (fish, other animals, plants, etc.) (Vanier, 1994). No ichthyofauna study has ever been conducted in the study area for the Parc national Iluiliq Project. A literature review of several works (D'Astous, 2017) served as the basis for this section. Thirty-seven species of fish are probably found in the study area, of which 18 have been confirmed. The subsections below provide detailed descriptions of these 18 species as well as lake trout, a species of cultural importance that might be present in the study area for the Parc national Iluiliq Project.

Salmonids

Salmonids are the most important family for subsistence fishing in Inuit communities, and also for sport fishing. Two salmonid species have been confirmed in the study area: Arctic char (*Salvelinus alpinus*) and brook trout (*Salvelinus fontinalis*). As well, the presence of lake trout (*Salvelinus namaycush*) is considered probable.

Arctic char, found in the eastern and northern parts of the province, is the most consumed fish species in northern communities (Power *et al*., 1989). Primarily anadromous throughout its range, it inhabits coasts, estuaries and rivers. There are also landlocked Arctic char populations in deep freshwater lakes. These populations may once have been anadromous but become trapped when the glaciers retreated (Desroches and Picard, 2013). In the Ungava region, anadromous Arctic char spend the first few years of their lives in freshwater. Once they have grown to a length of at least 200 mm, which takes between two and nine years, they undertake in June their first migration to the sea (Cuerrier, 2003). In and around the study area, Arctic char can be seen in saltwater in the summertime. At the end of summer or in the early fall, anadromous Arctic char return to freshwater for the winter (Power *et al*., 1989). Adults continue to migrate back and forth between freshwater and the sea for three to five years before they reach maturity and are able to reproduce in freshwater every two or three years (Power *et al*., 1989).

Jobie Tuniq holding an Arctic char caught in the Fjord de Salluit
Credit: Alain Thibault

Brook trout, also known as speckled trout, is another very common species in Québec, both in anadromous and solely freshwater forms (Desroches and Picard, 2013). They spawn in the fall in high-oxygen rapids and sometimes lakes (Desroches and Picard, 2013). This species is one of the most colourful freshwater fish species (Knopf, 2002). It may measure up to 70 cm and the record catch weighed 6.6 kg (14½ lb) (Knopf, 2002).

Brook trout
Credit: Patrick Graillon

Often called grey trout, **lake trout** is a much sought-after sport fishing species. Lake trout are common and widespread throughout Québec where waters are cold and oxygen-rich (Desroches and Picard, 2013). It is possible this species is found in the study area since it has been reported in the drainage basin of the Rivière Kovic, southwest of the Parc national Iluiliq Project (SNC-Lavalin, 2015; MFFP, 2017). Lake trout spawn in the fall usually in lakes at depths from 0.5 to 10 m and sometimes more than 50 m, and more rarely in rivers. They are very sensitive to habitat degradation, which is therefore important to protect (Desroches and Picard, 2013). This species is the largest trout in North America, with record catches measuring up to 1.3 m long and weighing 46 kg (102 lb) (Knopf, 2002).

Lake trout
Credit: Patrick Graillon

Cottidae

Cottidae is a northern fish family that generally inhabits the seafloor in shallow water. It is often a dominant species of fish communities in certain arctic ecosystems (Vanier, 1994). The members of this family have large mouths with dentition on the jaws as well as on the vomers (nasal bone) and the palatine (palatal bone) (Vanier, 1994). There are possibly eight sculpin species found in the study area, five of which have been confirmed, i.e the fourhorn sculpin, the Arctic sculpin, the shorthorn sculpin, the ribbed sculpin and the Arctic staghorn sculpin. All these species, except for the shorthorn sculpin, are considered arctic saltwater species, while the latter is considered a subarctic saltwater species (Vanier, 1994).

The **fourhorn sculpin** (*Myoxocephalus quadricornis*) lives mainly in saltwater or briny water and has a circumpolar distribution. This benthic sculpin may sometimes venture into freshwater (Desroches and Picard, 2013). It feeds on invertebrates, plant debris and fish eggs, and spawns at the end of summer and in the fall. Known to grow up to 34 cm long, it is the largest sculpin species (Desroches and Picard, 2013). The fourhorn sculpin is on the list of species ***likely to be designated threatened or vulnerable*** in Québec. At the federal level, however, the data needed to assess this species' status is considered deficient (COSEWIC, 2014). The saltwater form of the fourhorn sculpin is sometimes eaten by Aboriginal people but is of little interest for commercial or sport fishing. The fourhorn sculpin is sensitive to pollution, which makes it a bioindicator of environmental quality and a key species to monitor in arctic areas under development (Government of Canada, 2014).

In terms of diet, sculpins are generalists. This is also true of the **Arctic sculpin** (*Myoxocephalus scorpioides*) and the **shorthorn sculpin** (*Myoxocephalus scorpius*) which feed on amphipods, decapods, gastropods, fish, etc. (Vanier, 1994). The shorthorn sculpin is more colourful: the belly of the male is reddish and that of the female orange with white spots. Their fins have dark bands. During spawning, their bellies become very red (Fishbase Canada, 2017).

The **ribbed sculpin** (*Triglops pingeli*) grows to a length of no more than 20 cm and feeds on crustaceans, amphipods, other benthic animals and on rare occasions fish. It prefers muddy bottoms with some rocks, at depths between 0 to 930 m (Fishbase Canada, 2017c).

The **Arctic staghorn sculpin** (*Gymnocantus tricuspis*) feeds mainly on crustaceans (Vanier, 1994). It is frequently found burrowed into sand or more or less muddy substrate (Fishbase Canada, 2017a).

Gasterosteidae

The sticklebackss are bony fish that can live in saltwater, briny water or freshwater. Two stickleback species have been confirmed in the study area, i.e. the **nine-spined stickleback** (*Pungitius pungitius*) and the **three-spined stickleback** (*Gasterosteus aculeatus*). The nine-spined stickleback is found all along the coasts of Nunavik. It lives in coastal marshes or in lakes and slow-flowing rivers inland (Desroches and Picard, 2013). Stouter than the nine-spined stickleback, the three-spined stickleback is typically found in the shallow parts of major rivers but is also found in some lakes. It lives mostly in grassy habitats in freshwater, briny water or saltwater, but always spawns in freshwater. Both stickleback species reproduce in summer (Desroches and Picard, 2013).

Gadidae

Gadidae are cold-water fish found in temperate and arctic regions of the Northern Hemisphere. Their firm, lean white flesh is generally considered a delicacy. They are eaten fresh, dried or salted (Knopf, 2002). Two species of this family have been confirmed in the study area.

The **Atlantic cod** (*Gadus morhua*) is a saltwater fish found in cold, coastal or offshore waters. Its habitat requirements in terms of water temperature and food supply become more diverse as it ages but are still little known (Government of Canada, 2014). As with other species of this family, the Atlantic cod has three dorsal fins and two anal fins. Its skin colour, can vary widely from individual to individual, and it has a barbel on its lower jaw. Atlantic cod can measure up to 1.2 m long, but is more generally 61 cm in length and can weigh up to 27 kg (60 lb), while its average weight is around 4.5 kg (10 lb) (Knopf, 2002). The COSEWIC has assessed the status of the Atlantic cod by dividing the species into different populations. Atlantic cod in the study area may come from one of two populations, the Newfoundland and

Inuit removing an Atlantic cod from their fishing net in the Fjord de Salluit
Credit: Marianne Ricard

Atlantic cod caught in a fishing net
Credit: Marianne Ricard

Labrador population, which is designated ***endangered***, and the Arctic marine population, which appears in the ***data deficient*** category (COSEWIC, 2014; Government of Canada, 2014). Overfishing is the chief threat to Atlantic cod, but ecosystem degradation and climate change are additional threats (Government of Canada, 2014).

The **ogac** or Greenland cod (*Gadus ogac*) is smaller than the Atlantic cod (measuring up to 77 cm long). Unlike the Atlantic cod, the ogac has no dark patches on its body and does not possess a barbel on the lower jaw. The ogac is found near coasts and on rare occasions offshore. It feeds on capelin, tommycod, crabs, octopus and sea urchins. It has become much less abundant in recent years. It is possible that Atlantic cod and ogac may be competing for food (Fishbase Canada, 2017b).

Other Species

Fifteen other species have been confirmed in the study area and nearby. These species belong to various families and are not commonly known, have not been studied much and are of little interest to local communities. Most are small benthic fish.

The **kelp snailfish** (*Liparis tunicatus*) and the **gelatinous seasnail** (*Liparis fabricii*) are both small benthic fish that feed on small crustaceans such as amphipods. The kelp snailfish (measuring no more than 16 cm long) lives in kelp beds and prefers muddy bottoms with pebbles and rocks up to a depth of 620 m (Fishbase Canada, 2017d). The gelatinous seasnail is slightly larger (measuring up to 20 cm long) and can be found at greater depths (up to 1,800 m) (Fishbase Canada, 2017e).

The **daubed shanny** (*Leptoclinus maculatus*) is a small fish (measuring up to 20 cm long) with pale-coloured spots. It has a circumpolar distribution and is found on sandy or muddy bottoms at depths of less than 170 m. It feeds on crustaceans and small worms (Fishbase Canada, 2017f).

The **Arctic eelpout** (*Lycodes reticulatus*) lives at depths between 100 and 930 m, on bottoms with soft substrates. It can measure up to 36 cm long. Small eelpouts feed on small prey such as amphipods and bivalve molluscs, while larger individuals feed on shrimp and fish (Fishbase Canada, 2017g).

The **Arctic alligatorfish** (*Ulcina olrikii*) is a very small cold-water fish (measuring up to 8 cm long) that lives on the seafloor where it feeds on small crustaceans and worms. For its part, the **fourline snakeblenny** (*Eumesogrammus praecisus*) is a slightly longer fish (measuring up to 22 cm long) that prefers depths of less than 70 m. It feeds mainly on crustaceans. This species has been recorded on several occasions in Hudson Bay, Hudson Strait, Ungava Bay and around Labrador (Fishbase Canada, 2017i).

The **Canadian plaice** (*Hippoglossoides platessoides*) is a flatfish. Its laterally compressed body is oval and marked with a straight line running its length. It has a large mouth, its tail is rounded, and its body is covered with small, rough scales. Although the Canadian plaice can grow up to 50 cm long, it is typically about 30 cm long. Females may live from 17 to 20 years. The distribution of Canadian plaice in the western Atlantic Ocean extends from the south of Greenland to Newfoundland and Labrador and to New England. It can survive in deep water and has been found at depths of several thousand of metres. It is also tolerant of a wide range of temperatures from about 1.5°C to 5°C (DFOa, 2016). The Canadian plaice generally feeds on invertebrates and small fish (Fishbase Canada, 2017k). Its white and delicate flesh is considered a delicacy.

Over about 47 years, the abundance of the Canadian plaice has declined drastically, by about 96%. This decrease has been caused by overfishing, as well as by an increase in the species' natural mortality rate in the 1990s. Today, despite a moratorium on directed fishing, the population remains below the estimated precautionary threshold for this stock. It should however be noted that the bycatch of this species is high and poorly regulated. The federal government is currently conducting an assessment of the Newfoundland and Labrador population and the COSEWIC has recommended designating this species as endangered (COSEWIC, 2009).

HERPETOFAUNA

As part of operations at the Raglan mine, exhaustive herpetofauna inventory work was conducted in 2008, and no amphibian or reptile species were detected (SNC-Lavalin, 2015). Based on this work and current knowledge, it appears that the possibility of finding amphibians in the study area for the Parc national Iluiliq Project is zero.

MARINE INVERTEBRATES

The term "marine invertebrates" is used in this section to refer to those living organisms that do not have a spine and live in a marine environment. This group of organisms, including corals, jellyfish, annelids, nematodes, arthropods, crustaceans, molluscs, sponges and plankton, represents a large part of marine biodiversity. Invertebrates are often a staple food of many fish and marine mammals. Invertebrates are also a source of many developments in the scientific, industrial, economic and even food sectors. Modern medicine owes many discoveries to invertebrates such as king crabs, jellyfish and plankton. The following section provides general descriptions of the major marine invertebrate taxa likely to be present in the study area for the Parc national Iluiliq Project. It is important to note that the information available on this group of organisms in Nunavik is fragmentary and limited. Only species occurring near the study area have been included in the lists of species present. Some groups are not described in this section, such as corals and sponges which live offshore in Hudson Strait, as well as plankton due to its pelagic nature. In the study area, therefore, at least 180 species might be present and those are grouped into six phyla of the wider group of organisms called "marine invertebrates". In fact, for all these marine invertebrates, the lists of species should be considered incomplete basic lists, compiled according to current data. It should also be noted that no identified species of marine invertebrate has been designated as at-risk at either the provincial or federal levels. However, for the vast majority of the species discussed in this section, not enough information is available to properly analyze their situations.

Phylum *Mollusca*

Molluscs are non-hinged, soft-bodied animals with no internal skeleton. Generally possessing an external or internal shell holding the entire animal, the shell may be rudimentary or altogether absent. The phylum *Mollusca* comprises seven classes, of which only two are represented among the species present in the study area for the Parc national Iluiliq Project, i.e. gastropods and bivalve molluscs, for a total of at least 40 species.

Class Gastropoda

Gastropods make up the largest class of molluscs, totalling more than 75,000 species worldwide. All gastropods have a head with eyes and a radula (a tongue with several teeth like a rasp). Gastropods come in many different forms with many different bionomics. Land gastropods include snails and slugs, while marine gastropods include periwinkles and whelks (Barnes, 1980). In the study area, there may be a least 17 species.

Buccinum undalum
Credit: Nozères and Archambault (2014)

Class Cephalopoda

Cephalopods have a head surrounded by tentacles, a structure equivalent to the anterior part of the foot of other molluscs (Barnes, 1980). Cephalopods are adapted to swimming and are considered the most specialized and organized of all molluscs. Nautilus, octopus and squid are all cephalopods. In the study area for the Parc national Iluiliq Project, only one octopus (*Gonatus fabricii*) is potentially present (Gaston *et al.*, 1985a).

Class Bivalvia

Bivalve molluscs include mussels, oysters, softshell clams and giant clams. Their bodies are protected by a hinged two-valve shell. They are filter-feeding organisms that may be either sessile (oysters and mussels) or burrowing (razor clams and softshell clams). Marine bivalves have colonized every sea on earth, including those in the Arctic (Barnes, 1980). In the study area, there may be at least 22 species. The harvesting of **blue mussels** (*Mytilus edulis*) is a traditional activity practised intensively in Nunavik,

both in summer and winter. In winter, the high tidal range of Ungava Bay makes it possible to harvest mussels under the ice at low tide. This activity however presents certain risks, since the harvester must return to the surface of the ice ahead of the flood tide. Blue mussels in Nunavik grow at a considerably slower rate than in the Gulf of St. Lawrence. In fact, at the age of eight, Nunavik blue mussels are on average 5 cm in length, whereas in the Gulf of St. Laurence this size is reached on average at the age of two (Hudon, 1990). Whelks, nicknamed sea snails, are carnivorous molluscs but are less known than mussels. In Québec, they are often pickled.

Mytilus edulis
Credit: Nozères and Archambault (2014)

Hemithiris psittacea
Credit: Nozères and Archambault (2014)

Lepidurus arcticus
Credit: Per Harald Olsen, 2009. [https://commons.wikimedia.org/wiki/File:Skjoldkreps_(Lepidurus_arcticus).jpg]

Subphylum *Crustacea*

Crustaceans are animals whose bodies are enclosed in an exocuticle, i.e. an exoskeleton composed of a protein called chitin. Exoskeletons are more or less rigid, with some parts remaining flexible to allow movement, in particular of appendages. However, as they do not stretch, exoskeletons must be moulted as the crustaceans grow (Barnes, 1980). Crustaceans are a large and diverse group comprising more than 30,000 species, including the barnacle, the copepod, the lobster, etc. Four of the seven classes of the subphylum *Crustacea* are represented in the 72 species confirmed in the study area for the Parc national Iluiliq Project.

Class Branchiopoda

Branchiopods are small crustaceans that generally live in freshwater or in environments with variable salinity. They have stubby foliaceous appendages that permit swimming or locomotion. Most are benthic but there are offshore species that swim using their antennae (Barnes, 1980). At least six species of branchiopods are present in the study area. They are usually short-lived species. This is the case for *Daphnia pulex*, which is found abundantly in all sizes of ponds and pools (Ferguson and Mattox, 1939). For its part, *Lepidurus arcticus* exhibits significant sexual dimorphism: males are almost half the size of females. Males seem to emerge late in the summer (in August) and in very small numbers. As a result, the majority of the individuals usually observed are females (Ferguson and Mattox, 1939).

Class Malacostraca

This class comprises almost three quarters of crustacean species and contains the best known crustaceans, such as lobsters, crabs and shrimp. Malacostracans are usually large in size, and the head is fused to the thorax forming a cephalothorax, which is separate from the abdomen. At least 57 species of this class are present in the study area for the Parc national Iluiliq Project (Barnes, 1980, Hudon, 1990).

Eualus gaimardi *Hyas coarctatus* *Spirontocaris phippsi*
Credit: Nozères and Archambault (2014)

Class Maxillopoda

Maxillopodans have reduced abdomens and appendages. The barnacle, in particular, belongs to this class. Barnacles spend their lives attached to rocks or any other hard substrate, such as the shells of animals or the heads of whales (Barnes, 1980). At least eight species of maxillopodans are present in the study area.

Balanus crenatus
Credit: Nozères and Archambault (2014)

Class Ostracoda

Ostracods are very small crustaceans (0.5 to 2 mm long) that are abundant in all marine and freshwater environments. One species has been confirmed in the study area (*Acanthocythereis dunelmensis*). Its body is compressed and enclosed in a calcified bivalve carapace, resembling a mollusc shell. Although some ostracods are pelagic (living with plankton), the majority live near the bottom (Barnes, 1980).

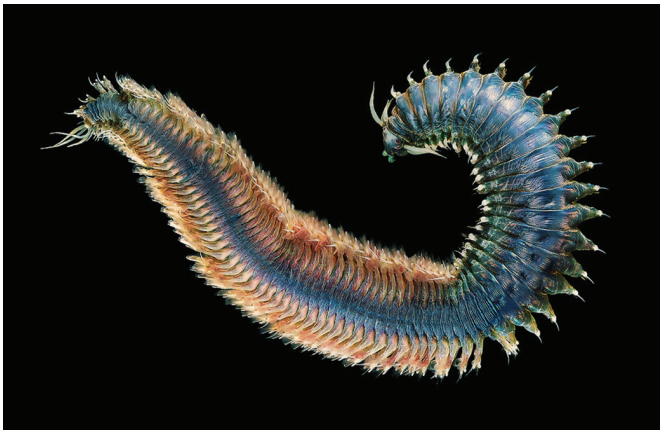
BENTHIC MARINE INVERTEBRATES

The following section provides descriptions of marine invertebrates other than molluscs and crustaceans, specifically those found on the seafloor such as annelids, lophophores, echinoderms and cnidarians. These animals are a staple food of many fish and other organisms. In fact, for all the invertebrates, the lists of species should be considered incomplete basic lists, compiled according to current data. The study area may include at least 68 species belonging to four phyla that can be qualified as benthic marine invertebrates.

Phylum *Annelida*

Annelids are vermiform organisms measuring 0.5 mm to 3 m long. For reference purposes, the earthworm on land and the leech in freshwater are members of the Phylum *Annelida*. Annelids have a cylindrical body that is bilaterally symmetrical and metameric, i.e. composed of a series of identical segments. Their epidermis is formed of a single layer of cells and covered with a cuticle of chitin. Most aquatic annelids have parapodia, a bilateral structure forming paddles, for locomotion. Others are sedentary, living in tubes in mud or sand (Barnes, 1980). All of the 41 annelid species inventoried in the area of the Parc national Iluiliq Project belong to the **class *Polychaeta***. This class is characterized by a body with many bristles and indirect postembryonic development with metamorphosis and larval stages (Barnes, 1980). In August in the study area, swarms of marine worms (*Nereis pelagica*) may be observed on the surface of the water (Gaston *et al.*, 2015a).

Pholoe minuta
Credit: Washington State Department of Ecology's Marine Sediment Monitoring Team. 2015 [www.ecy.wa.gov/programs/eap/psamp/index.htm]



Nereis pelagica
Credit: Alexander Semenov. 2008 [https://commons.wikimedia.org/wiki/File:Nereis_pelagica.jpg]

Phylum *Lophophorates*

Lophophores are for the most part sessile. They are bilaterally symmetrical and possess a "tuft" of ciliated tentacles forming a ring or lophophore around the mouth. The lophophore filters water and captures suspended food particles carried by the current. In stagnant water, it rotates and sways to create a slight movement of water allowing it to trap food particles in suspension. This process is referred to as filter feeding. There is one class of lophophores in the study area for the Parc national Iluiliq Project, i.e. bryozoans comprising at least 12 species.

Class Bryozoa

Bryozoans are sessile. They usually go unnoticed especially because of their small size (a few centimetres on average). The term bryozoa originates from the Greek word *bruon* (meaning moss) and *zoon* (meaning animal). Bryozoans live in colonies, which may be rigid or soft but are always very fragile, making it very difficult to distinguish individuals with the naked eye. They may look like corals or algae.

Phylum *Echidnodermata*

Echinoderms are benthic marine animals that may live at any depth. Their dermal endoskeleton composed of mono-crystal calcite (a chemical mineral of natural calcium carbonate [$CACO_3$]) is characteristic of this phylum. This endoskeleton may possess spirals or plates that are mobile (for example, the starfish) or fused (for example, the sea urchin). In some species, the endoskeleton includes projecting spines, which are not fused, but rather held in place at their base by connective ligaments formed mainly of collagen and controlled by nerve impulses. These allow echinoderms to become rigid or move flexibly, and especially to maintain positions without muscular effort. A striking feature of this phylum is its pentamerous radial symmetry (five-point central axis) in adults for most structures. While this feature is readily apparent in organisms such as the starfish, it is less so in organisms such as the sea cucumber or the sea urchin (Barnes, 1980). There are four classes of echinoderms in the study area for the Parc national Iluiliq Project: ophiuroids, asteroids, holothurians and echinoids.

Class Asteroidea

The members of this class are easily recognizable by their star shapes. Only one species has been confirmed in the study area: *Leptasterias groenlandica*. Asteroids have five or more arms around a central disc that contains most of the vital organs (digestive, nervous and other systems). They also have an anus located on the aboral surface of the central disc. The starfish is a predator. It mainly eats bivalve molluscs (mussels, oysters, etc.), but also crustaceans, worms and sea urchins. Some asteroids use their water vascular system (hydraulic) to feed on bivalve molluscs, directing water to pry open the shells. Subsequently, they evert their stomachs into the shell to feed on the mollusc (external digestion).

Class Ophiuroidea

Ophiuroids (brittle stars) are similar to asteroids (starfish), possessing five long and thin arms attached to a central disc. Unlike asteroids however, they do not have anuses (egestion via the mouth). Ophiuroids feed mainly on juvenile molluscs and annelids. At least six species of ophiuroids have been identified in the study area for the Parc national Iluiliq Project.

Gorgonocephalus arcticus *Ophiopholis aculeata* *Ophiura robusta*

Credit: Nozères and Archambault (2014)

Class Echinoidea

Echinoids, a class which includes sea urchins, have spherical bodies covered with spines. One species of echinoid (*Strongylocentrotus droebachiensis*) may be present in the study area. Like their close relatives sea cucumbers and starfish, these organisms have a planktonic larval stage before becoming benthic in adulthood. Most species of sea urchins possess spines called "radiola". These pivot at the base and serve for both locomotion and defense, protecting the carapace called a "test". Coastal species tend to graze on algae, while those living in deep water are more likely to be omnivorous, "scavenging" the seafloor for small animals and algae (Barnes, 1980).

Leptasterias polaris

Credit: Nozères and Archambault (2014)

Strongylocentrotus droebachiensis

Credit: Nozères and Archambault (2014)

Class Holothuroidea

Unlike other classes of echinoderms, holothuroids have soft, cylindrical bodies and tentacles around their mouths. Central symmetry may still be observed in some species in particular through five radii, which extend along the length of the body of the animal from the mouth to the anus. Often, holothuroids also have tube feet called "podia" attached to the anus which serve for locomotion. This class includes most sea cucumbers which are detrivorous feeding on carcasses on the seafloor, while certain species consume plankton (Barnes, 1980). One holothuroid species (*Psolus fabricii*) has been confirmed in the study area, and the *Cucumaria frondosa* may also be present (Hudon, 1990).

Cucumaria frondosa
Credit: Nozères and Archambault (2014)

Psolus fabricii
Credit: Nozères and Archambault (2014)

Phylum *Cnidaria*

Cnidarians are characterized by stinging cells, called "cnidocytes", that release venom at the slightest touch. Their bodies, which have a very high water content, resemble an empty bag with a digestive cavity and single orifice that serves as both mouth and anus. The orifice is surrounded by a row of venomous tentacles. These animals feed on phytoplankton, zooplankton and small animals. Cnidarians have existed for hundreds of millions of years, at least since the Cambrian (Figure 3.24) and have two basic body forms: a sessile form known as polyps (coral, sea anemone) and a swimming form known as medusae (jellyfish). As corals generally live offshore of Nunavik, they are not described in this section.

Class Anthozoa

This class of "flower animals" comprises sea anemones, stony and soft corals, gorgonians and sea pens. Anthozoans do not have a medusa phase. Attached to the substrate, polyps may be solitary or live in colonies. Polyps have tentacles with many stinging cells that allow them to catch prey: plankton, small crustaceans, and even some large fish. Some species, such as corals, secrete a hard skeleton, while others, such as anemones, do not. Anthozoans reproduce asexually by budding, fission or fragmentation, or sexually by releasing spermatozoa and ova into the water that, after fertilization, form swimming larvae, called "planulas". These very quickly attach themselves to a solid substrate to form a new polyp. Two species of this class are present in the study area for the Parc national Iluiliq Project.

Gersemia rubiformis
Credit: Nozères and Archambault (2014)

Class Hydrozoa

Hydrozoans are the largest class of cnidarians, but are generally not well known due to their unobtrusive behaviour and their primitive nature. Their behaviour and primitive aspect may explain that only one species has been confirmed in the study area, and two others may be present. The digestive cavity of hydrozoans is simple and not sectioned as in other cnidarians. A hydroid is a colony of animals (resembling plants) with reproductive polyps, known as gonozoids. They have neither mouth nor tentacle, but possess a fertile tube on which small medusae will bud. These are protected by an envelope: the gonotheca. Different colonies communicate with one another via stolons (creeping aerial stems that form a plant organ of vegetative propagation).

INSECTS (CLASS *INSECTA*)

Interestingly, not only are a majority of the insect species living on earth not yet named, but knowledge about those species that are is very limited (Groom *et al.*, 2006). The class *Insecta* contains about 5.5 million species out of which only roughly 1.5 million have been described. It is one of the most diverse classes on earth (Gaston, 1991; Stork *et al.*, 2015; Stork, 2017). Insect organisms are also very numerous: their combined biomass is about 30 times greater than that of humans. In other words, every kilogram of human is matched by 300 kg of insects; or for every human being, there are an estimated 200 million insects (Smithsonian, 2017). Recent studies show at least 94,000 insect species in Canada, almost double the previous estimate of 54,000 species (Hebert *et al.*, 2016). Scientists know very little about insects in Nunavik, which is paradoxical since more than 2,200 insect species have been identified north of the tree line in North America, not counting all the other species remaining to be discovered (Dansk, 2004)!

In and around the study area, there likely exists a large number of typically arctic species of land and freshwater arthropods. These species may mainly comprise dipterans, coleopterans, hymenopterans, lepidopterans and acarines

(Gagnon, 2012). Within the order *Diptera*, i.e. insects with a single pair of wings such as flies and mosquitoes, it is known that hoverflies are a well-diversified family in arctic regions and play a crucial role in pollinating northern angiosperms. Within the order *Hymenoptera*, i.e. insects with four transparent membranous wings such as bees and ants, a few species of bumblebees, including *Bombus polaris*, also play a proactive role in pollination (Gagnon, 2012). Ground beetles and rove beetles are very likely the main members of the order *Coleoptera*, i.e. insects with a hard pair of front wings protecting the hind wings. In addition, certain coleopterans such as water beetles may be found in aquatic environments. In general, arctic insects are excellent indicators of climate change. For example, the northern limits of the ranges of some butterfly species in eastern Canada have shifted a number of kilometres northward since the 1970s. They are therefore good indicators of climate change (Maxim Larrivée, pers. comm. in Berteaux *et al*., 2014).

Adaptations to Harsh Northern Conditions

The severe environmental conditions of the Arctic represent challenges to living organisms. Winters are long and cold, summers are short and cool, and seasons are generally unpredictable. In a context of climate change and considering that insects are the largest group of organisms in the Arctic, their adaptations to harsh northern conditions are of great interest. Unlike vertebrates, insects are cold-blooded animals that, for the most part, can not generate heat to counter the cold. For this reason, insects have developed a range of complex adaptations. These adaptations may be physiological, ecological or temporal. Moreover in order to survive, a species may sometimes even adopt more than one adaptation (Danks, 2004).

Several insect species survive the long arctic winters by burrowing themselves into frozen soil. A laboratory study showed that mites can survive for up to four years in soil frozen at -20°C (Coulson and Birkemoe, 2000 in Danks, 2004). Other insects survive by converting most of the water in their bodies to extracellular ice. Some species even produce cryoprotectants, such as glycerol or other polyhydric alcohols, to protect their tissues during freezing and thawing. A few species possess a permeable cuticle that allows them to tolerate drying. Finally, some species produce cocoons as a barrier against contact with snow and ice crystals.

Wintering locations are just as important to species as physiological adaptations to winter conditions. Some species choose protected microenvironments according to a series of elements: light, temperature, humidity, gravity, etc. As snow is an important insulator against severe temperatures, most species also choose locations protected by clumps of vegetation, under rocks or in depressions to avoid the dangers of abrasion caused by wind-blown ice crystals. Surprisingly, other species winter in locations relatively exposed to weather conditions, especially in the High Arctic (Danks, 2004). For example, mosquitoes deposit their eggs

Butterfly in the study area
Credit: Marianne Ricard

Bombus spp.
Credit: Marianne Ricard

Butterfly in the study area
Credit: Camille Le Gall-Payne

on the southern sides of ponds which melt earlier in spring (Corbet and Danks, 1975 in Danks, 2004). This allows species to develop rapidly and reproduce during the short summer. In many species, diapause (i.e. a period during which development and metabolic activity temporarily stops) helps to cut down energy use and synchronizes individuals for simultaneous emergence in the spring. Diapause can occur several times during the life cycle of a same species (Danks, 2004).

Survival during short, cool and unpredictable summers is also a challenge for insects. A myriad of physiological, ecological and temporal adaptations are therefore necessary. Several species are able to remain active in near-freezing temperatures. This is true for two mosquito larvae which have been found to still be active at temperatures near 1°C (Haufe and Burgess, 1956 in Danks, 2004). For their part, some bumblebees are able to generate heat by contracting the muscles they use for flight, which makes them appear to be shivering, and therefore fly at sub-zero temperatures. For many insects, the resources they need to survive are greatly reduced during a short summer. For example, female biting insects typically require blood from vertebrates to develop eggs, but the number of hosts is fairly limited in summer in the Arctic. As a result, a greater proportion of biting insects are autogenous reproducers, i.e. these species develop their eggs from larval food reserves rather than blood. Notwithstanding, accessibility to a greater quantity of blood is conducive to the development of a substantially larger number of eggs. Finally, some insect species have hairs or particular colouring that retain or absorb heat (Danks, 2004). As stated above, ecological adaptations in a northern environment are just as important as physiological adaptations for species survival. For insects, this is in particular reflected in specific microhabitat settings: sites that thaw early in the spring, sunny slopes in protected valleys, etc. (Danks, 2004). Many of these insect adaptations to the arctic summer are linked to the completion of full life cycles. Some species achieve this over several seasons while, for others, it happens in a single summer. In general, larger species do not fully develop in a single season, and must grow during the summer and survive at a larval stage for several seasons. This is true for some arctic moths which have a complete life cycle that lasts seven or more years. Conversely, accelerated development in summer may permit the completion an entire life cycle in one summer. This is true for some arctic species of mosquitoes, bumblebees and other groups that have a set and resistant development stage as an egg or adult that involves hibernation (Danks, 2004). Multiple adaptations make it possible for insects to tolerate hostile arctic conditions. In the context of climate change, new challenges are emerging for insects: the effects could lead to complex chain reactions impacting on different aspects of the arctic ecosystem (Danks, 2004).

Qupirruit in Inuit Tradition

This section examines the place of insects in Inuit culture as well as some of the insects that are more easily observed by visitors to the study area for the Parc national Iluiliq Project. In summer on the tundra, insects are very visible, especially the swarms of mosquitoes. *Qupirruit* is the Inuktitut term for all small creatures, including insects, crustaceans, spiders and worms (Laugrand and Oosten, 2010). According to Inuit elders, all small life forms must be treated with respect and are interrelated (Laugrand and Oosten, 2010). *Qupirruit* have the power to transform and are equivalent to several different species. They are considered powerful organisms that help the spirits, especially the bumblebee which is central to some shamanic practices. *Qupirruit* are also associated with youth and regeneration. It has been suggested that this belief is tied to the fact that some insects freeze in winter and come back to life in spring. They are even considered masters of life and death. This spiritual role would explain the representation of insects on amulets and in Inuit art (Laugrand and Oosten, 2010). Except for *kumak*, larvae that grow under the skin of caribou, Inuit do not consume insects (Laugrand and Oosten, 2010).

Biting Insects

Black flies are found everywhere in Canada, especially in northern woodlands. At least 110 species have been identified. Black flies are small, measuring from 1 to 5 mm in length, and belong to the family *Simuliidae* within the order *Diptera*. Despite their common name, some species are yellowish orange or brownish gray rather than black (Brust, 2015). To develop eggs, females must consume blood: for this purpose, they possess biting mouthparts with toothed stylets, small appendages capable of cutting skin. Males do not bite and are rarely observable. Both sexes feed on nectar, which provides the energy needed for flight. In arctic regions, large numbers of black flies in juvenile stages are found in most rivers and streams. Larvae live in running water where they collect fine particles of food by filtering the water with cephalic fans (modified antennae). While two to four generations may occur annually in southern Québec, only one occurs in Nunavik (Brust, 2015).

Mosquitoes are fragile flies belonging to the family *Culicidae* within the order *Diptera*. They are characterized by long, thin antennae comprising multiple sections and wings formed of scales. Females have rigid, elongated trunk-like mouthparts for biting and sucking. There are more than 3,500 species of mosquitoes worldwide, of which at least 82 are found in Canada. The second-oldest mosquito fossil, dating from 76.5 to 79.5 million years old, was discovered in Alberta (Monckton and Brust, 2016). Mosquitoes live and lay their eggs wherever fresh or brackish water is present, even temporary puddles. They have four development phases. The first three are aquatic and the final phase is aerial: egg,

larva (four larval stages), pupa and adult. The lifespan of an adult mosquito is three weeks during the summer. Mating occurs shortly after individuals emerge as adults; each female is fertilized once for her entire life. The characteristic whine of mosquitoes is only emitted by females so they may be found by males, and each species has a unique frequency (Monckton and Brust, 2016). Only females bite mammals to feed on their blood. They can absorb up to three times their own weight in blood, which contains essential elements for laying eggs. Males and females feed on fluids containing sugar and plant juices (nectar and sap). Some Canadian species hibernate as adults and can live for eight or nine months. Others can survive through the winter in egg form hatching in the spring or in larval form trapped in ice for six or seven months (Monckton and Brust, 2016).

Parasite Insects of Caribou

On the tundra in summer, insects are a major nuisance to caribou, especially some species belonging to the order *Diptera*. This is particularly true of botflies, large flies which at the larval stage develop in the warmth of a host, under its skin.

Oedemagena tarandi (or warble flies) is a bumblebee-like fly that is attracted to caribou at the end of summer where it lays its eggs under the mammal's fur, along its legs and sides. Hatching larvae penetrate under the skin of the caribou and migrate to their backs, forming cysts where they spend the winter and poke a hole in the skin in order to breathe. The following spring, the larvae emerge through these holes and morph into adult flies. Adults live for about a week during which time they seek out another caribou to lay their eggs and restart the cycle. Warble fly larvae are edible and some Inuit consider them a delicacy (Madsen, ND caribou project). Up to 1,000 larvae may winter under the skin of a single caribou.

Another known example, is the **caribou nostril fly** (*Cephenemyia trompe*), a species that lays its larvae in the nasal cavities of caribou. The larvae subsequently migrate towards the sinuses, which is painful for the animal and generates significant irritation that can lead to breathing problems. The maturing larvae gradually obstruct the sinuses for eight to ten months. During this time, the larvae feed on the host's mucous membranes and secretions. In the spring, having reached a size of 3 to 4 cm, the larvae are expelled to the ground where they begin their final phase of maturation. Since caribou nostril flies target the muzzle, they generate significant stress among caribou, which mainly reduces their time spent feeding.Larvae of this species are harmless to humans and do not directly threaten the quality of caribou meat (MFFP, 2017b). Caribou are particularly vulnerable to harassment by these insects during the summer season. Although the survival of an animal in good physical condition is not threatened by the parasites, they may adversely affect weaker individuals. Caribou congregate in large groups, in part, to help reduce the intensity of harassment by insects. Caribou parasite insects are a natural component of the northern ecosystem and influence the population dynamics of this species (MFFP, 2017b).

Although there is a diversity of insect species in the north, the distribution and ecology of many of these species are still poorly documented. Considering that arctic insects are excellent indicators of environmental change, it would be very interesting and relevant to study entomological

Caribou with subcutaneous parasites
Credit: Alain Thibault

Male caribou visibly affected by the heat
Credit: Nathalie Girard

Tableau 4.15 List of Known *Qupirruit* to Inuit of Iglulik (Nunavut)

ROMAN INUKTITUT CHARACTER	LATIN NAME	ENGLISH NAME	FRENCH NAME
Qikturiaq	*Aedes sp*	mosquitos	Maringouin (moustique)
Tagiut	*Cephenemya trompe*	Worm infesting nostril (nose) of caribou	Larve qui infeste le nez du caribou
Kumak	*Oedemagena tarandi*	Worm infesting under the caribou skin (warble flies)	Larve qui infeste la peau du caribou
Milugiaq	*Simuliidae*	Black flies	Mouches noires
Annanngiq	*Calliphora /Empididae*	Dung fly, house fly	Mouche
Tuktuujaaq ou tukturjuk	*Tipulidae*	Long leg, long-winged fly (crane fly)	Tipule
Iguptaq ou iguttaq	*Bombus sp*	Bumble bee	Bourdon
Tarralikisaq ou tarralikitaaq	*Boloria sp*	Butterfly, moth	Papillon
Kumak, kumait	*Pediculus sp*	Louse, lice	Pou
Minnguq	*Pterostichus sp, Amara sp*	Land beetle	Coléoptères
Tulugarmaq	*Dytiscus*	Diving beetle	Coléoptère dulcicole (puce d'eau)
Aasivak	*Alopecosa asivak*	Spider	Araignée
Ulikapaaq ou ulikappaalik	*Lepidurus arcticus*	Small horseshoe crab	Limule
Kinguk	*Gammarus sp*	Shrimp	Crevette

Source: modified from Randa (2003) *in* Laugrand and Ososten (2010)

diversity in the study area (Danks, 1992). For example, the northern limits of the ranges of some butterfly species in eastern Canada have shifted a number of kilometres northward since the 1970s. They are therefore good indicators of climate change (Maxim Larrivée, pers. comm. in Berteaux *et al.*, 2014).

FOOD CHAIN AND DYNAMICS OF THE CLIFFS AT ANAULIRVIK

The colony of thick-billed murre has a major influence on the cliff ecosystem at Cap Wolstenholme (*Anaulirvik*). Colony members are found scattered along the Nunavik coast over a distance of approximately eight kilometres. The work conducted by Gaston *et al.* (1985a) describes the food chain of Digges Sound, including the cliffs at Anaulirvik, focused around thick-billed murres (Figure 4.8). This section is based on this work entitled *A natural history of Digges Sound*.

A food chain (also called a trophic chain) consists of all the nutritional links within an ecosystem or, in other words, the *food* links between the living organisms that make up the ecosystem (Levin *et al.*, 2009). The species in an ecosystem are interdependent for their survival and reproduction. Predation of one species over another may also have significant indirect effects on other species in the food chain (Levin *et al.*, 2009).The food chain in this region is unique since the colony of thick-billed murre favours a substantial transfer of nutrients from the sea to the land. In most systems, nutrient transfer occurs in the opposite direction, usually unilaterally from the land to the sea. Typically, nutrients leach into waterways through run-off and ultimately end up in the sea: the food chain of the cliffs at *Anaulirvik* is therefore an exception to this rule.

Thick-billed murres introduce organic nutrients into the terrestrial ecosystem in three different ways. First, the colony produces a significant quantity of guano: this excrement accumulates on the cliffs and, once dried, can be carried by the wind long distances inland, where it acts as a fertilizer for plants. Next, land predators such as foxes, ravens and gulls integrate these nutrients into the terrestrial food chain by ingesting eggs, nestlings and adult birds. Finally, nutrients enter the terrestrial food chain via comestibles that are gathered by thick-billed murres either to feed themselves or their young or for courtship behaviours, and that are subsequently dropped or sometimes abandoned on land.

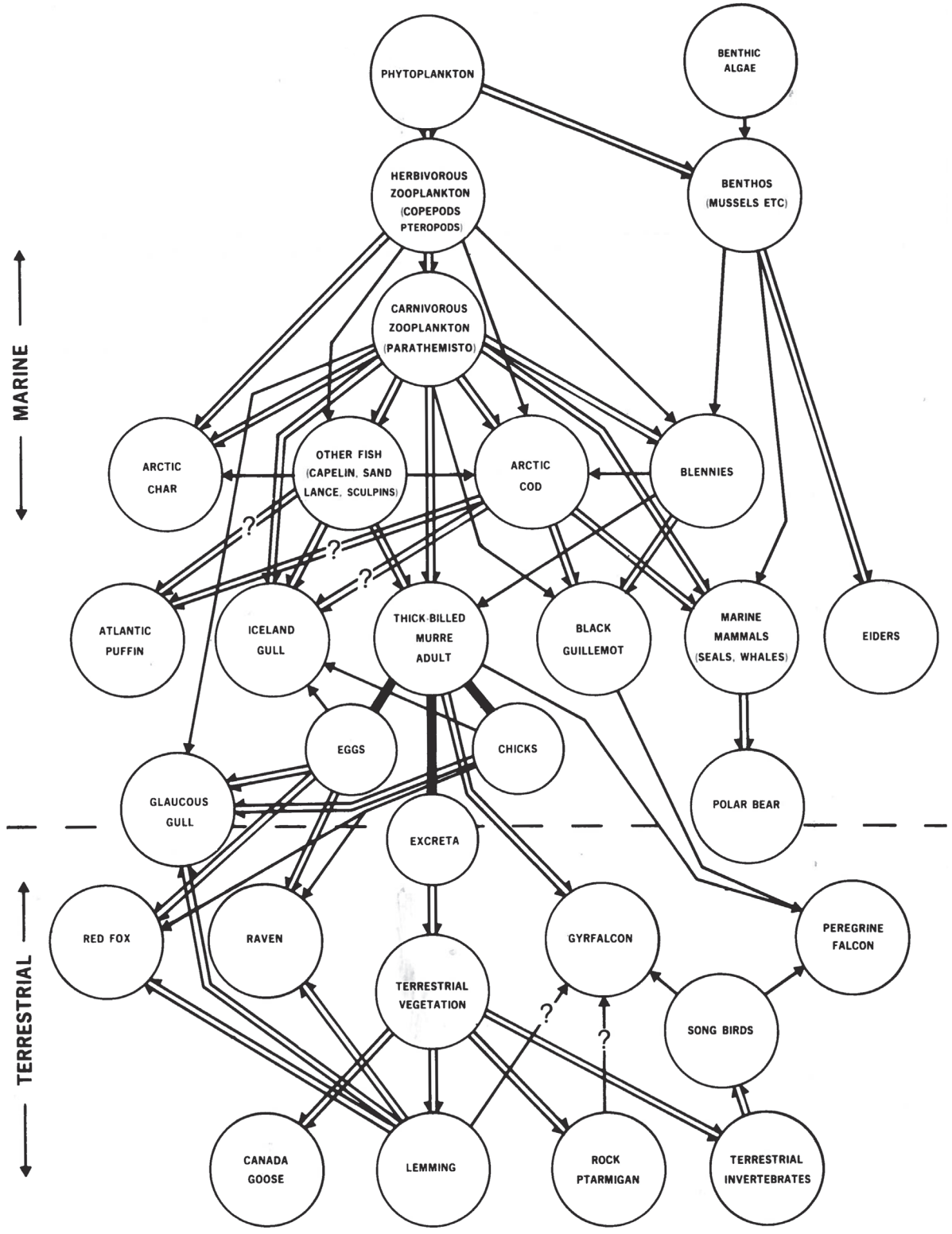


Figure 4.8 The food web centered on Thick-billed Murre colony at Digges Sound showing connections across the marine-terrestrial boundary

Source: Gaston *et al.* (2015a)

Figure 4.8 shows the food chain of Digges Sound focused around thick-billed murres and in relation to marine and terrestrial organisms.

The marine food chain has six trophic levels. The first levels comprise primary producers (for example, phytoplankton, benthic algae), herbivorous zooplankton (for example, copepods, *Limacina spp.*) and carnivorous zooplankton (for example, *Themisto libellula*). The next three levels comprise larger organisms: small fish (for example, Arctic cod, capelin, sand lance) which are the food supply for larger fish, seabirds and piscivorous marine mammals (for example, thick-billed murres, seals *spp.*, belugas) and carnivorous avifauna and land mammals (for example, gyrfalcons, glaucous gulls, red foxes). The terrestrial food chain has only three trophic levels: primary producers (for example, greenery), herbivores (for example, lemmings, geese, ptarmigans) and carnivores (for example, foxes, ravens, falcons). As illustrated in the food chain, the thick-billed murre is a key species in the cliff ecosystem at *Anaulirvik*.

Thick-billed murres have many prey. It is moveover said that the thick-billed murres in the cliff ecosystem of Digges Sound feed on an even greater variety of prey than those in colonies located further north in the Arctic. Several species also depend on thick-billed murres as a food source. Figure 4.9 illustrates the proportion of murre eggs lost to predators in the food chain, not including those collected by humans.

A large number of gulls and ravens regularly use the colony to feed on eggs and nestlings, as well as on the remains of eggs and nestlings and comestibles dropped by thick-billed murres. Foxes and gyrfalcons are the second main predators of the colony.

Right from the beginning of the thick-billed murre egg-laying season, around the latter half of June, ravens steal and hide a large number of eggs generally under moss within a radius of about one kilometre from the colony. It is however estimated that ravens are responsible for less than 10% of the total loss of thick-billed murre eggs (Figure 4.9). Gulls are responsible for a greater proportion of this egg loss, i.e. 20%. For its part, predation by gyrfalcons and foxes is negligible. In the first half of the 1980s, it was estimated that the residents of Ivujivik were responsible for removing about

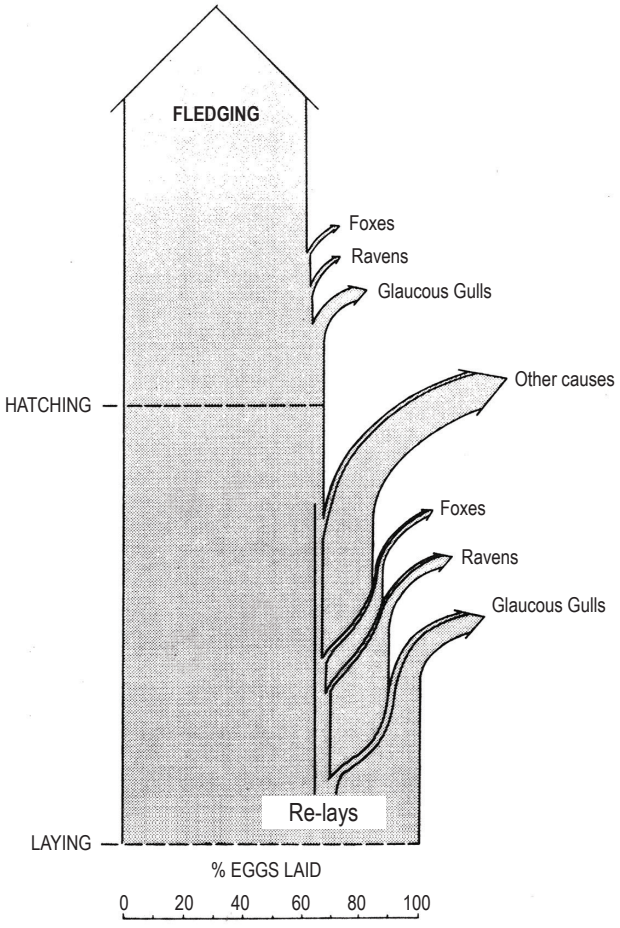
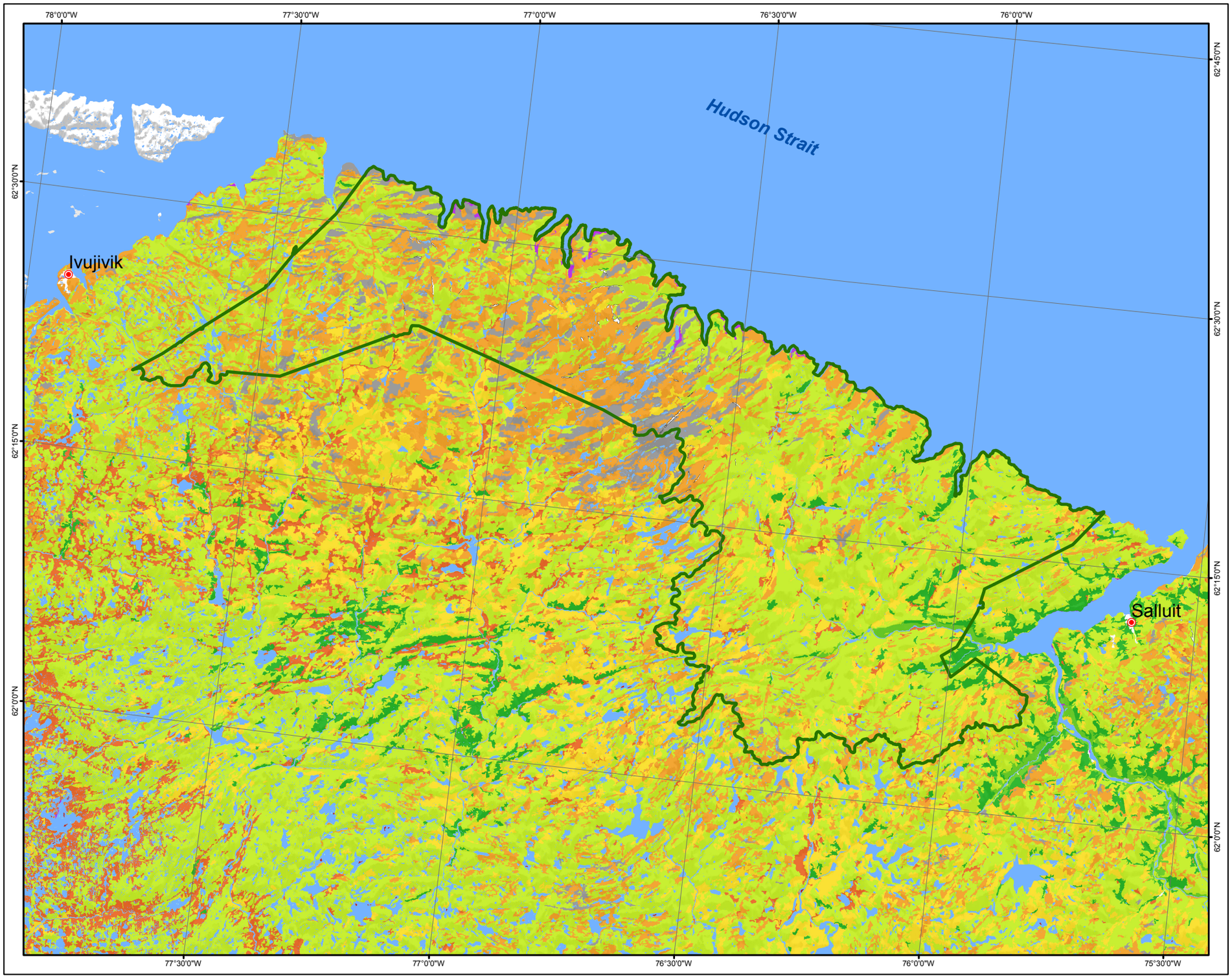


Figure 4.9 Loss of thick-billed murre eggs to predators (excluding humans) in percentage

Source: Gaston *et al.* (2015a)

2,000 to 3,000 eggs, well within a sustainable harvest for a colony of this size. In fact, a large majority of these egg losses are replaced in the summer during a second period of egg laying. As a result, the actual impact of all egg losses is undoubtedly less than represented by the numbers in this section. Notwithstanding, it would seem that the presence of hunters and repeated gunshots (using high-powered rifles such as the 0.303) can result in thousands of eggs and fledglings being dislodged. The losses are all the greater when the fledglings are well developed and able to fly prematurely. Consequently, unnecessary disturbances of the colony may have a greater impact than total annual predation of eggs, fledglings and adults.



PARC NATIONAL
ILUILIQ PROJECT

Vegetation

Study area

Land cover classes

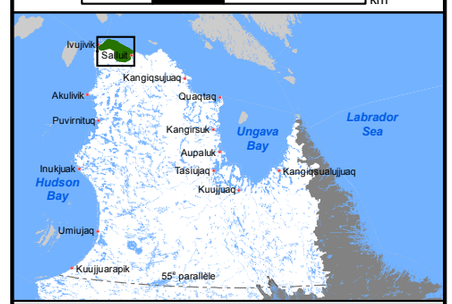
- Rock outcroppings/fragments
- Water
- Snow
- Bare surface
- Herbaceous tundra with prostrate shrubs
- Upright shrub tundra
- Prostrate shrub tundra
- Prostrate shrub tundra with ostioles
- Prostrate shrub tundra dominated by rock substrate
- Arctic peatland or tundra wetland
- Island

Note: This map must be consulted with table 4.1

Source : MFFP (2018)

Map Scale : 1:400 000

0 5 10 20 km



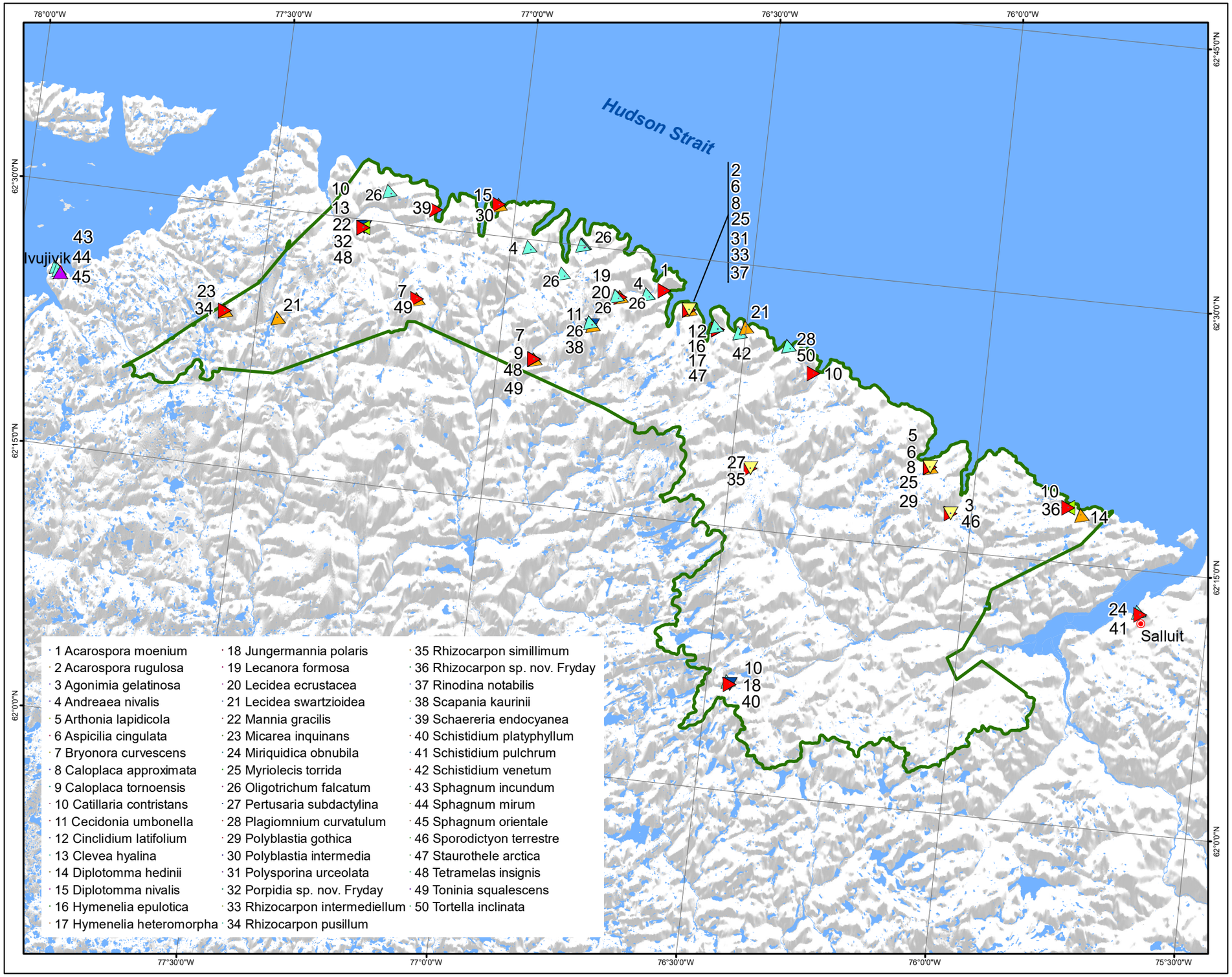
Geodetic datum : NAD 83
Coordinate system : Québec Lambert

August 2018

Map 4.1

Vegetation

Map 4.1



PARC NATIONAL
ILUILIQ PROJECT

Nonvascular Plants of Interest

- Study area
- Rare liverworts in Québec
- New lichens for science
- New lichens in Canada
- New lichens in Québec
- Rare lichens in Québec
- New mosses for science
- Rare mosses in Québec

Source : MFFP (2018)

Map Scale: 1:392,500

0 5 10 20 km

Geodetic datum : NAD 83
Coordinate system : Québec Lambert

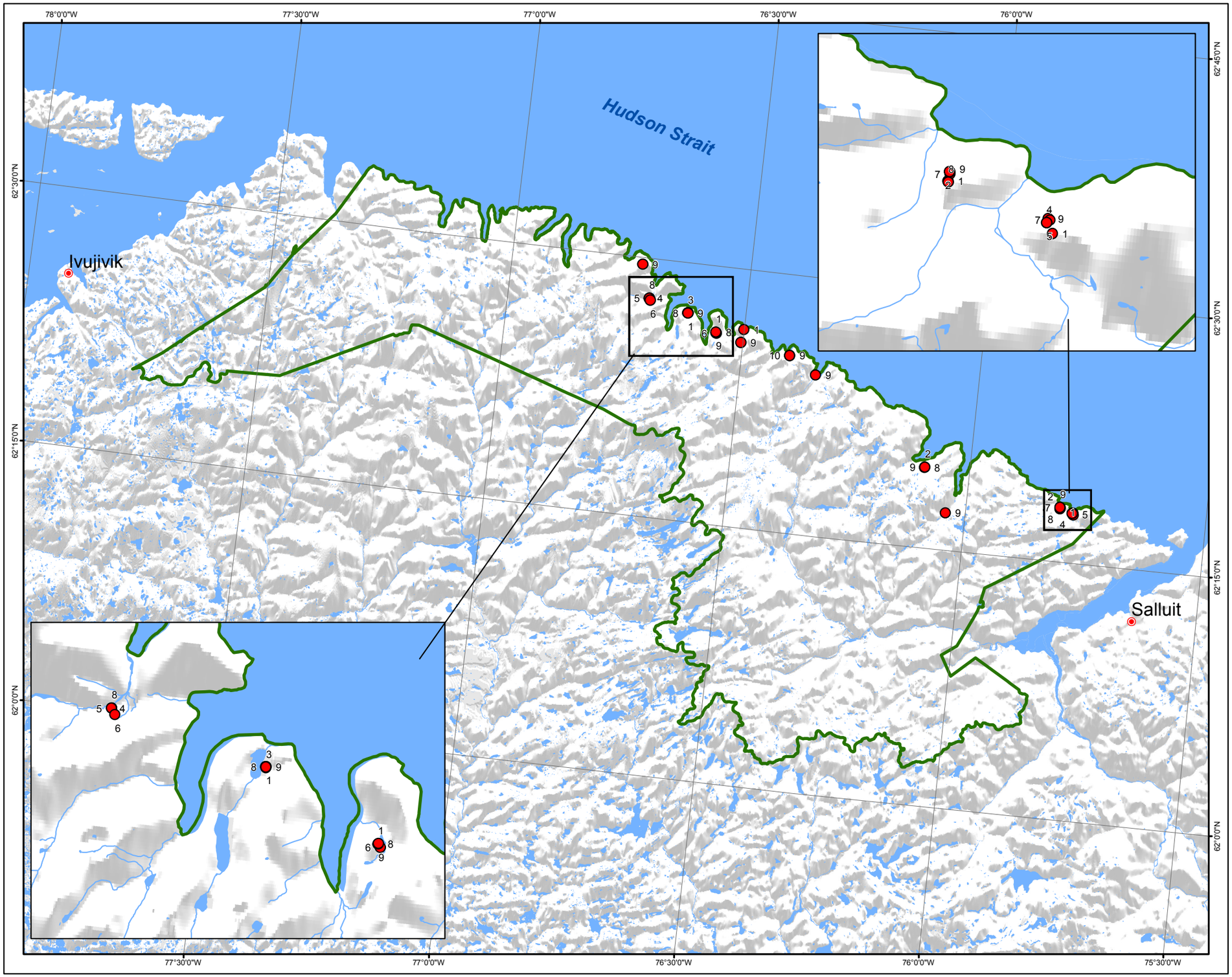
KATIVIK

August 2018

Map 4.2

Nonvascular Plants of Interest

Map 4.2



PARC NATIONAL
ILUILIQ PROJECT

Vascular Plants of Interest

Study area

Vascular plants of interest

1: *Cerastium arcticum*

2: *Draba arctica* subsp. *ostenfeldii*

3: *Draba cayouettei*

4: *Draba corymbosa*

5: *Draba subcapitata*

6: *Epilobium arcticum*

7: *Hulteniella integrifolia*

8: *Poa hartzii* subsp. *hartzii*

9: *Potentilla vahliana*

10: *Potentilla vahliana* X *Potentilla arenosa* subsp. *chamissonis*

Source : MFFP (2018)

Map Scale : 1:400 000

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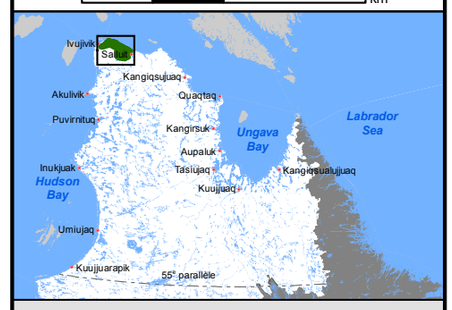


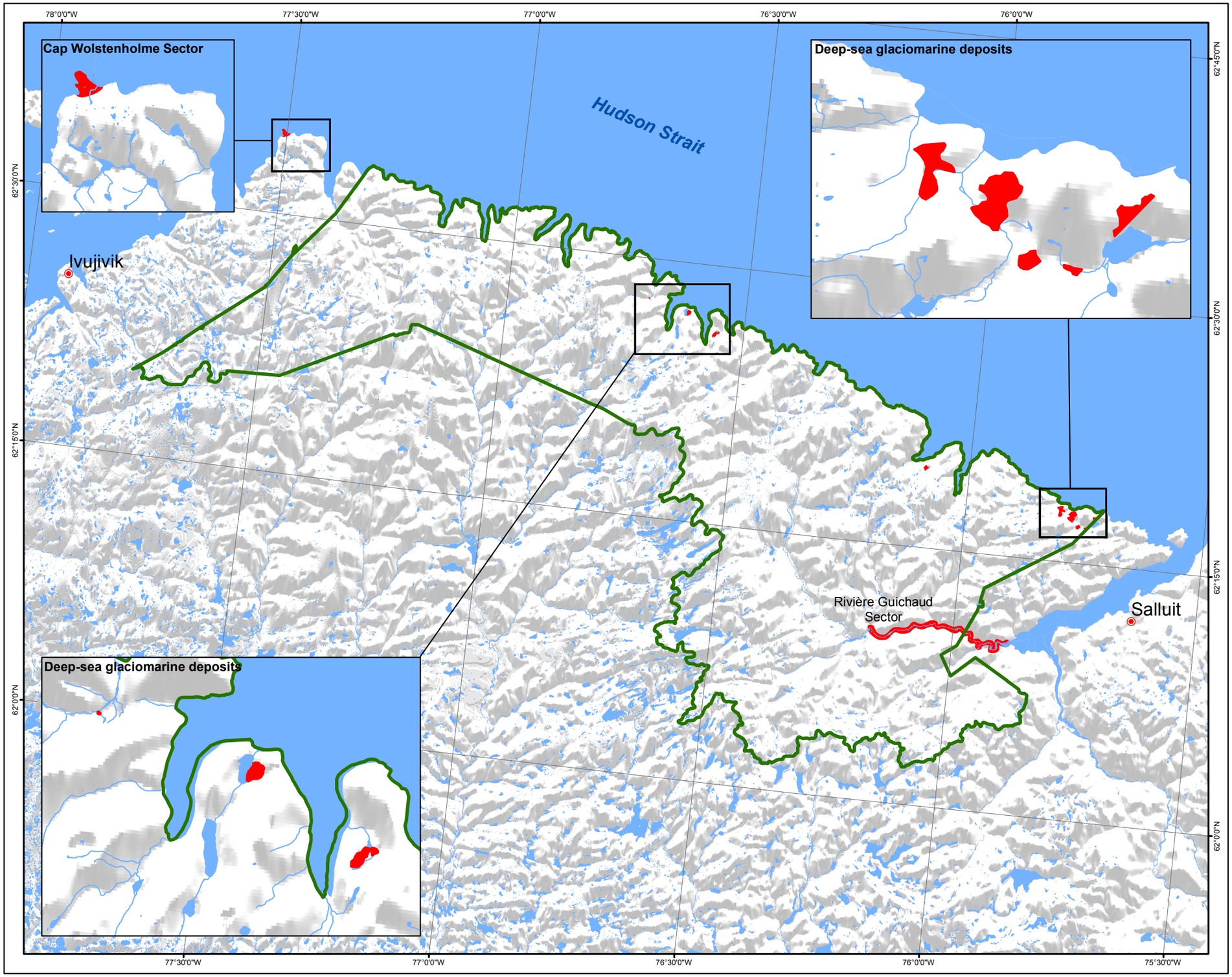
Geodetic datum : NAD 83
Coordinate system : Québec Lambert

August 2018

Map 4.3

Vascular Plants of Interest

Map 4.3



PARC NATIONAL
ILUILIQ PROJECT

Ecosystem of Interest

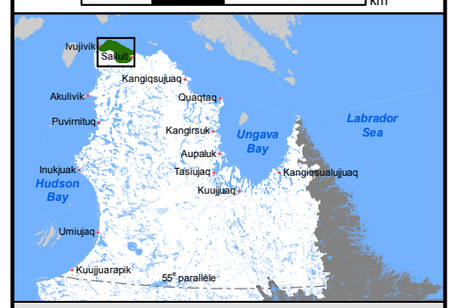
Study area

Ecosystem of interest

Source : MFFP (2018)

Map Scale : 1:400 000

0 5 10 20 km



Geodetic datum : NAD 83
Coordinate system : Québec Lambert

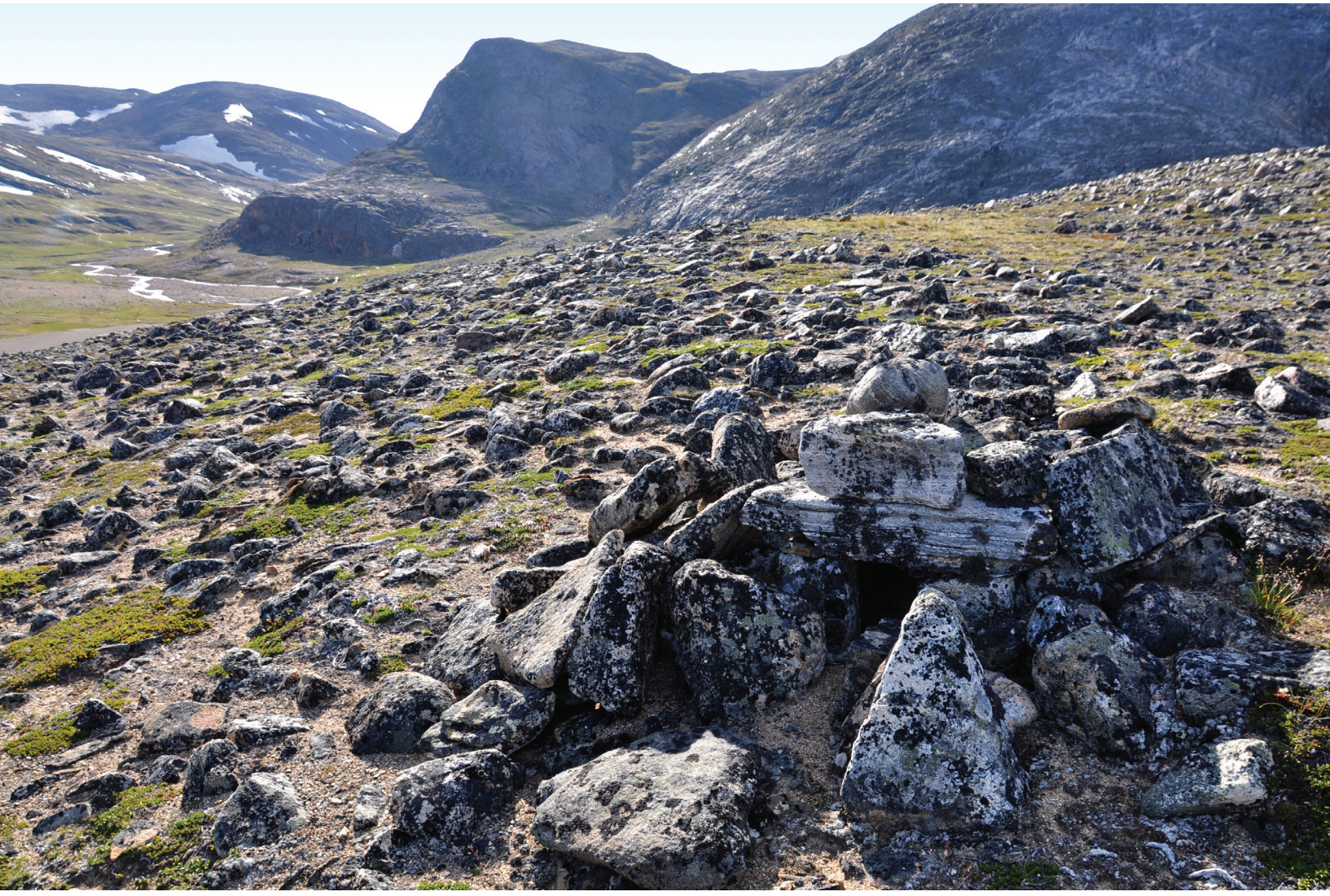
August 2018

Map 4.4

Ecosystem of Interest

Map 4.4

5 HUMAN OCCUPATION



Horizontal fox trap
Credit: Alain Thibault

The Quaternary was a period of major glaciations, and before the arrival of the earliest humans, Québec was mainly dominated by ice. During the last ice age, the Wisconsinan (80,000 to 10,000 years BP), more than half of North America was buried under ice (Occhietti, 1987). Because ice ages are accompanied by a significant lowering of ocean levels (glacio-eustasy), groups of hunter-gatherers from Siberia were able to migrate across the Bering Strait to the American continent. Over subsequent millennia and different migrations, these groups dispersed throughout America (Figure 5.1) (Dixon, 2000; Scarre 2009).

NUNAVIK: FROM PREHISTORY TO HISTORY

Since the glaciers dominated the north of the American continent during the last ice age, the human occupation of Nunavik is relatively recent. When the first migrants to North America, known as Palaeoindians, reached southern Québec nearly 11,000 years ago, the north of the province was still under Wisconsinan ice. After this ice had retreated from northern Québec, Palaeoeskimos occupied the East and Low Arctic around 4,500 years BP. Although Palaeoeskimos and Thule/Inuit are the main cultures that occupied Nunavik, it is possible to find traces of

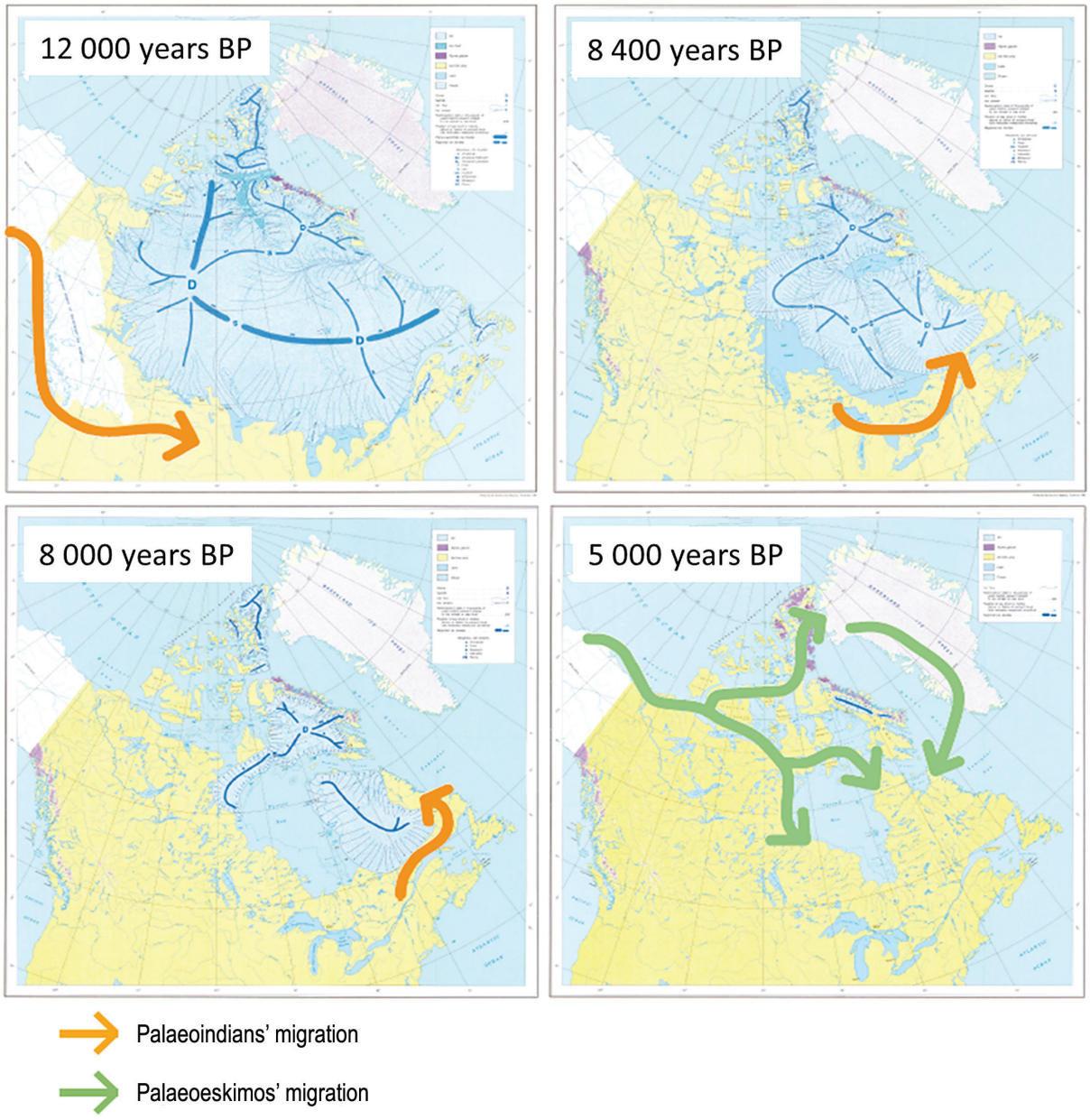


Figure 5.1 Waves of Migration Following Glacier Retreat

Sources: maps adapted from Dyke and Prest (1987), arrows by Daniel Gendron (Avataq Cultural Institute, pers. comm. to KRG)

Amerindian occupation dating to the Archaic, in addition to remnants of Protohistoric and Historic occupations by Cree (Eeyou), Innu and Naskapi (MCCCFQ, 2010, Avataq Cultural Institute, 2013).

OCCUPATION OF NUNAVIK

The occupation of the East Arctic began about 4,500 years ago with the migration of groups of hunters from Alaska in quest of game (Figure 5.2). Their migration eastward across the Arctic was probably facilitated by climate warming (Barry *et al*., 1977; Powers and Jordan, 1990; Savelle and Dyke, 2002). Nunavik had two main cultural migration sequences: first, Palaeoeskimos (Pre-Dorset and Dorset peoples), followed by Thule/Inuit (Gendron and Pinard, 2001; Pinard and Gendron, 2009).

The different peoples of the Arctic were all highly dependent on their environments for resources such as food, fuel and raw materials essential to their survival. Therefore, climate changes probably had a great influence on the cultural changes that occurred in the Arctic (Barry *et al*., 1977).

Pre-Dorset (4,000–2,500 Years BP)

Palaeoeskimos belonged to the microlithic Arctic tradition, a technological heritage characterized by the precise manufacture of small tools adapted to nomadic hunters. Palaeoeskimos are generally divided into three sub-groups: Independence I (the Canadian High Arctic and northern Greenland), Saqqaq (Disko Bay and southwestern regions of Greenland) and Pre-Dorset (Canadian Low Arctic, Nunavut, Nunavik and Nunatsiavut) (Pinard and Gendron, 2009; Maxwell, 1985). Pre-Dorset culture was therefore the first group to settle in Nunavik.

Between 4,000 and 2,500 years BP, Pre-Dorset people occupied the coasts of Hudson Bay as well as Ungava Bay and the Ungava Peninsula. They lived in small groups of nomadic hunters and exploited both land (mainly caribou) and marine resources, supplementing their diet with fishing and gathering. They travelled extensively and lived according to the availability of resources. Pre-Dorset people possessed a wide range of microlithic tools. Burins, small chipped points, scrapers and microblades are generally found

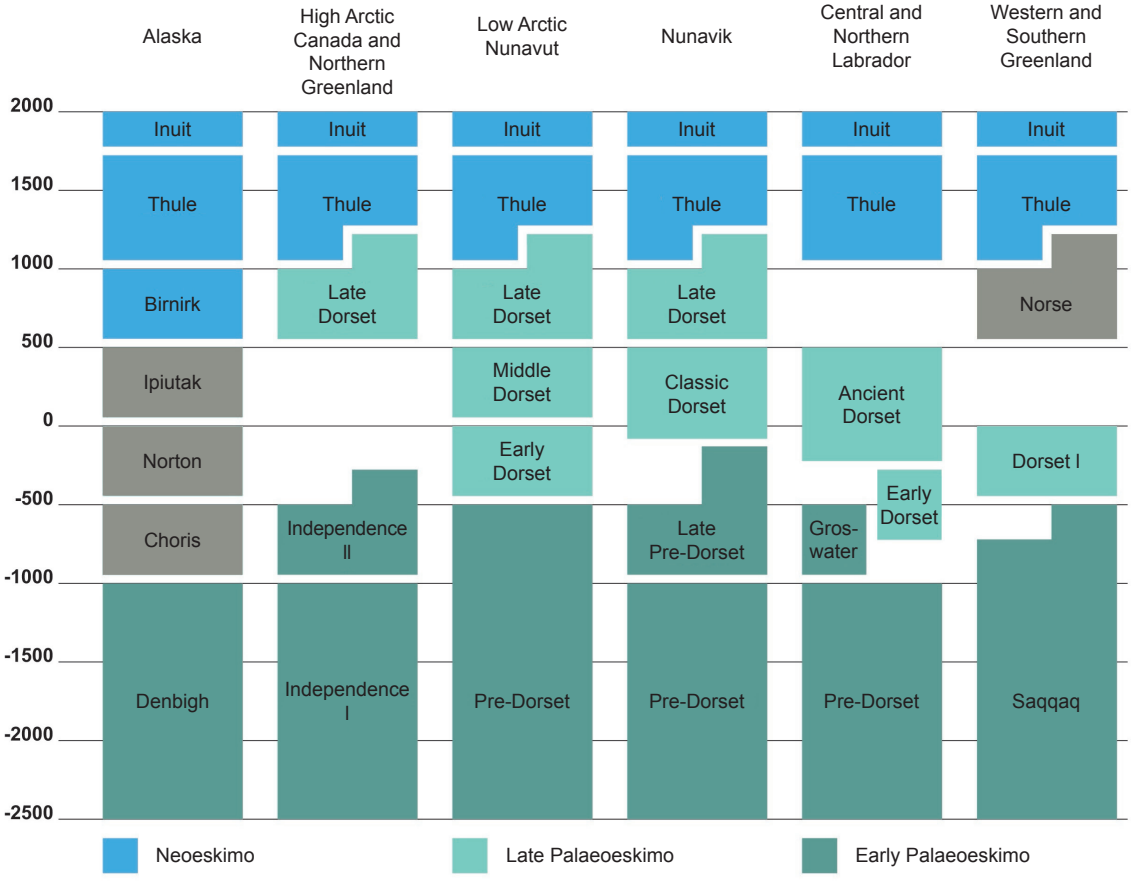


Figure 5.2 Chronology of the Arctic Settlement

Source: Avataq Cultural Institute (2015)

at Pre-Dorset sites (Maxwell, 1985; Gendron and Pinard, 2000). This group was also responsible for developing the soapstone (steatite) lamp, a circular or oval-shaped lamp in which seal fat was burned. It was an essential tool providing both light and heat (Maxwell, 1985). They used different types of dwellings depending on the season—small summer tents, semi-subterranean houses, and double-lobed structures composed of two parallel rows of stones with a central hearth. The dwelling structures found in the field today are generally poorly delineated because they are the remnants of short-term occupation. Tent structures with or without axial layouts and semi-subterranean structures are found mainly in boulder fields (Gendron and Pinard, 2001). The oldest known site in Nunavik was discovered in Kuujjuarapik and dates to 3,800 years BP (Gendron and Pinard, 2000).

The transition between Pre-Dorset and Dorset cultures is poorly documented, and its nature and causes are still largely unknown (Maxwell, 1985). It has been suggested that the transition was the result of climatic instability during the Holocene epoch between 3,400 and 1,900 years BP, which would have caused a change in their technology and settlement patterns (Maxwell, 1985; Kasper and Allard, 2001).

Dorset (2,500–900 years BP)

According to Taylor's (1968) cultural continuum theory, Dorset people descended directly from Pre-Dorset people. Although there are diverging opinions on the subject, it has been demonstrated that Dorset culture appeared in the East Arctic around 2,500 years BP. It has been suggested that there was regular contact between Pre-Dorset and Dorset peoples, and that migrations occurred from different Dorset culture development sources. Dorset people occupied the Low Arctic (i.e. Nunavut, Nunavik, Nunatsiavut and Newfoundland) before establishing themselves in the High Arctic towards the end of the Dorset period (Avataq Cultural Institute, 2013).

Dorset culture shows the influence of an economy that was heavily focused on hunting marine mammals (Maxwell, 1985), as evidenced by their wide variety of small, lithic tools made specifically for this type of hunt. They include microblades, scrapers, triangular points, semi-circular scrapers, pseudo-burins and adzes (Avataq Cultural Institute, 2013). Owing to the good state of preservation of organic remnants at some Dorset sites, archaeologists have been able to identify artifacts made from ivory, bone, antler and wood, such as harpoon heads and snow knives (Avataq Cultural Institute, 2015).

In addition to marine mammals, Dorset people also hunted small land mammals, caribou and migratory birds. They gathered and fished to supplement their diet (Maxwell 1985). Animal and human artistic representations sculpted from ivory, bone, antler and soapstone were produced during the Dorset period (Maxwell, 1985; Avataq Cultural Institute, 2013).

Dorset people used different dwelling structures of varying size depending on the season. In summer, they lived in tents, which sometimes had axial layouts, while in winter they probably lived in igloos as indicated by the many snow knives found at Dorset sites. In autumn when the sea ice was forming and in winter, they may have used shallow semi-subterranean houses, built in unconsolidated deposits and likely covered with a peat roof. Their longhouses, which appeared during the Late Dorset period, most likely served as community gathering places (Avataq Cultural Institute, 2013; 2015).

The transition between Dorset and Thule is a source of debate among archaeologists. Some are of the opinion that Dorset people had already disappeared when Thule arrived, while others believe that Dorset people persisted until about 1500 and may have been in contact with Thule (Maxwell, 1985; Park, 2000; Pinard and Gendron, 2009; Avataq Cultural Institute, 2013). However, current evidence suggests that in Nunavik, there would have been no contact between the two cultures. Dorset people most likely left or disappeared from the region around 900 BP, prior to the arrival of the first Inuit nearly 750 years ago (Pinard and Gendron, 2009; Avataq Cultural Institute, 2013).

Thule/Inuit (750 years BP–Historic Period)

Thule culture originated in northwestern Alaska approximately 1,000 years BP. Migrating to the Canadian Arctic, Thule people quickly made their way to Nunavik some 750 years ago and are the direct ancestors of today's Inuit. The earliest evidence of a Thule presence has been found at a site near Akulivik, where a dig uncovered some ancient Thule-Inuit objects, including a caribou bone dating the site from the 13th century. This is currently the oldest known Thule-Inuit site in Nunavik.

Although the terms Inuit and Thule culture are equally correct, archaeologists generally use the term Thule to describe pre-Historic Inuit populations and thus distinguish them from the Inuit of the Historic period, which began with first contact with Europeans (Pinard and Gendron, 2009; Avataq Cultural Institute, 2013).

Since the Thule subsistence economy consisted essentially of whale hunting, their settlement patterns reflected the practice of that activity. This also explains why Thule technology was vastly different from that of Dorset people—their tools were larger and more diversified and included the semi-circular blades used by women (*ulu*), the pointed blades used by men (*savituinnaq*) and points for harpoon heads (Avataq Cultural Institute, 2011). Central to Thule

subsistence activities was the hunt for large whales using *umiaqs*, large boats that could accommodate a number of people, and a fleet of *qajaqs*. To complement this activity, they hunted other marine mammals such as seal and walrus, land mammals such as caribou and fox, and birds, depending on the availability of these resources. Thule used different dwellings according to the season. In late autumn and early winter, they lived mainly in semi-subterranean structures with tunnel entrances, called *Qarmait*; in winter they lived in igloos, and in summer in tents made of animal skins (Maxwell, 1985; Avataq Cultural Institute, 2011, 2013, 2015). Thule/Inuit dwellings are generally well preserved and delineated because they are more recent (Avataq Cultural Institute, 2015).

About the 13th and 14th century, the Thule culture underwent some changes. More and more sites were positioned near shallow bodies of water, suggesting a diversification of the resources being used. It appears that the harvesting of large whales ceased in favour of seals, walruses and various land mammals. Archaeologists believe that the substantial cooling that occurred during the Little Ice Age (between the years 1400 and 1600) may have contributed in part to these changes (Avataq Cultural Institute, 2013).

ARCHAEOLOGICAL STUDIES

most of the known archaeological sites on the continent near Ivujivik and Salluit have been identified during studies related to urban, road and airport development. Most are located near the communities. Before 2015, only four sites had been inventoried in the study area for the Parc national Iluiliq Project: one by Barry Matthews in 1962 (KcFn-1[20] and three by Patrick Plumet's team during the 1977 Tuvaaluk mission (KcFm-1, 2, 3) (MCCQ, 2015). In the Arctic, archaeological sites are usually discovered and inventoried simply by visual inspection. Since the soil develops very slowly, archaeological structures and artifacts can be observed on the surface without the use of extensive archaeological surveys.

During the summer of 2015, the KRG mandated the Avataq Cultural Institute to study the archaeological potential of the study area for the Parc national Iluiliq Project by conducting a field study and literature review. This was to be the very first inventory of this area of Hudson Strait by Avataq archaeologists. Prior to the study and to better guide it, the Avataq Cultural Institute targeted various areas of interest according to topographic maps, place names and current land use.

Well-drained terraces, eskers, boulder fields and glacial valleys are generally conducive to setting up a site, whether to use as living space or for burials, butchering, storage or sharpening. In addition, Inuit place names are good indicators of archaeological potential: every place name is connected to a story, a belief or a description of the biotic or abiotic elements of a site. Table 5.1 and Map 5.1 present and show a list of place names in the study area.

The coastal portion of the study area consists of an elevated rocky plateau, bays and drainage basins with steep ravines. This suggests that the sector has poor archaeological potential, given limited options for landing and setting up camp. There are also few beaches in the area. Some of the place names support this hypothesis: *Namunngavissaqangituq* means no place to stop; Innaarualuk signifies cliffs; and Innaajuit, group of small cliffs (east of the study area) (Avataq Cultural Institute, 2015). However, archaeological potential is likely in some valleys and large bays, and near the Rivière Guichaud (*Kuuruk*).

The following sections present the archaeological sites inventoried in the study area and are based on the report prepared by the Avataq Cultural Institute (2015).

Archaeological Sites

During the 2015 field campaign, archaeologists of the Avataq Cultural Institute inventoried 34 archaeological sites in five days: a Pre-Dorset site, 32 Inuit sites, and one Historic Euro-Canadian/Inuit site. These sites are shown in the following section by geographic area (Table 5.2, Maps 5.2 A, B, C, D and E). By convention, the Historic period begins with the first contact between Inuit and Europeans towards the end of the 17th century. Within the Historic period, the Recent Historic corresponds to the era of the trading posts, beginning from the early 20th century until about the 1950s. The contemporary period extends from the 1950s to today (Elsa Cencig, pers. comm.).

The more ancient sites (Pre-Dorset and Dorset) are harder to locate because they contain less visible structures and small surface artifacts. Thus, the identification of mainly Inuit sites does not mean that Palaeoeskimos rarely came to the area in question. It is also important to bear in mind that seasonality introduces bias in archaeological research. Igloo camps are evidently short-lived and traces of them are rarely found. Most of the archaeological sites inventoried are therefore the remains of spring, summer or fall occupations (Avataq Cultural Institute, 2015).

[20] The Borden System is an archaeological site numbering system developed by Charles E. Borden in 1952. With letters and numbers, it is used to locate small areas in Canadian territory. The upper case letters represent intervals of two degrees of latitude or of four degrees of longitude which, when placed in a double-entry table, produce quadrilaterals (for example, the quadrilateral CF). The lower case letters represent new smaller quadrilaterals by subdividing the large quadrilaterals by ten minutes intervals (for example, the subdivision CdFm). The letters are followed by a number to designate each different site in the quadrilateral (Société des musées du Québec, 2015).

Table 5.1 Description of Inuit Toponyms in the Study Area

	TOPONYM	ENTITY TYPE	OFFICIAL NAME* AND/OR APPROXIMATE TRANSLATION	INUKTITUT SYLLABICS
1	Akuliaqattaq	point	Cap Tavernier*; it is in the middle	ᐊᔪᓕᐊᖅᑕᖅ
2	Akullirutaaluk	mountain	Big intervention	ᐊᔪᒻᓕᕈᒋᓗᒃ
3	Amarurtuuliariaq	route	Leads to Amarurtuuq (Amarurtuuq – always has lots of wolves)	ᐊᒪᕈᖏᑐᓕᐊᓇᐊᖅ
4	Anngiik Tulliq	bay	Nearer Anngiik	ᐊᖏᖏᑭᒃ ᑐᒻᓕᖅ
5	Anngiik Ungalliq	bay	Farther Anngiik	ᐊᓐᖏᑭᒃ ᐅᖏᒪᒻᓕᖅ
6	Anngiiliariaq	route	Leading to Anngiik	ᐊᓐᖏᑭᓕᐊᓇᐊᖅ
7	Anngiit	bay	Anngiik that has the semblance of a lake	ᐊᖏᖏᑭᑦ
8	Anngiit Kuunga	creek	Anngiit's river	ᐊᓐᖏᑭᑦ ᑰᖏᒪ
9	Anngiit Nuvukallaalua	point	Cap Tiblemont*; Anngiit's big fat point	ᐊᓐᖏᑭᑦ ᓄᐅᒃᓱᓗᐊ
10	Aupartualuk	cliff	Big red	ᐊᐅᕐᖏᑐᓗᒃ
11	Ikkarujaalik	bay	It has a long reef	ᐃᒃᑲᕈᒋᓕᒃ
12	Imirtavik	creek	Place to tend water	ᐃᒥᖏᑕᕕᒃ
13	Innaajuit Nuvua	point	Cap de l'Estre*; Innaajuit's point (Innaajuit – group of small cliffs)	ᐃᓐᓇᓱᐃᑦ ᓄᐅᐊ
14	Innaajuit Qarqanga	mountain	Innaajuit' mountain (Innaajuit – group of small cliffs)	ᐃᓐᓇᓱᐃᑦ ᖃᖏᖏᒃᖏᒪ
15	Innaajuit Qutialunga	shore	Innaajuit's big bayish (Innaajuit – group of small cliffs)	ᐃᓐᓇᓱᐃᑦ ᖏᑎᐊᓗᖏᒪ
16	Innaajuit Ungalliit	cliff	Farther Innaajuit (Innaajuit – group of small cliffs)	ᐃᓐᓇᓱᐃᑦ ᐅᖏᒪᒻᔪᑦ
17	Innaarualuk	cliff	Huge cliff	ᐃᓐᓇᑭᐊᓗᒃ
18	Inuit Nunaviningat	site	Inuit's old land (Inuit – people)	ᐃᓄᐃᑦ ᓄᓇᕕᓂᖏᒪᑦ
19	Iqalulik	lake	It has fish	ᐃᖏᓗᓕᒃ
20	Iqaluttuup Akullirutaalunga	mountain	Iqaluttuuq's big center (Iqaluttuuq – it always has fish)	ᐃᖏᓗᑦᑐᑦ ᐊᔪᒻᓕᕈᒋᓗᖏᒪ
21	Iqaluttuuq	lake	It always has fish	ᐃᖏᓗᑦᑐᖅ
22	Iqiattavik	fishing place	Jigging place	ᐃᖏᐊᑦᑕᕕᒃ
23	Itivia	bay	It is an entrance	ᐃᑎᕕᐊᐊ
24	Itiviata Nuvua	point	Pointe du Saint-François*; Itivia's point (Itivia – it is an entrance)	ᐃᑎᕕᐊᐊᑕ ᓄᐅᐊ
25	Iviangirnaq	hill	Colline Iviangirnaq*; breast	ᐃᕕᐊᖏᕐᓇᖅ
26	Ivitaarqiap Tasinga	lake	Lac Ivitaarqiap*; Ivitaarqiaq's lake	ᐃᕕᒋᖅᑭᐊᑦ ᑕᓂᖏᒪ
27	Kampanirtaliviniq	site	It had the company (Hudson's Bay Company)	ᑲᒪᕐᓂᖅᑕᓕᕕᓂᖅ
28	Kangirsualuup Itivia	shore	Kangirsualuk's entrance (Kangirsualuk – big bay)	ᑲᖏᕐᓯᐊᓗᒍᑦ ᐃᑎᕕᐊᐊ
29	Kangirsukallak	bay	Baie Kangirsukallak*; fat bay	ᑲᖏᕐᓯᑲᒻᓓᒃ
30	Kangirsukallaup Nuvua Ungataaniittuq	cape	Cap Dalmas*; place behind Kangirsukallak's point (Kangirsukallak – fat bay)	ᑲᖏᕐᓯᑲᒻᓓᐅᑦ ᓄᐅᐊ ᐅᖏᒋᔭᑦᑐᖅ

Table 5.1 Description of Inuit Toponyms in the Study Area

	TOPONYM	ENTITY TYPE	OFFICIAL NAME* AND/OR APPROXIMATE TRANSLATION	INUKTITUT SYLLABICS
31	Kangirsukutaak	bay	Long bay	ᑲᖏᕋᓱᑯᒃ
32	Kangirsuumak	bay	Bayish	ᑲᖏᕋᓱᒪᒃ
33	Katinniq	confluence	It met (where entities meet, either land or water)	ᑲᑎᓐᓂᖅ
34	Katinniq	confluence	It met (where entities meet, either land or water)	ᑲᑎᓐᓂᖅ
35	Kuuguluk	creek	Poor river	ᑭᒍᓗᒃ
36	Kuuk Ivujiviliariaq	river	River leading to Ivujivik (Ivujivik –place to be messy)	ᑭᒃ ᐃᕐᔨᐱᓕᐊᓕᐊᖅ
37	Kuuk Umiakkuvik	landing	River for boats	ᑭᒃ ᐅᒥᐊᒃᑯᐱᒃ
38	Kuukallak	creek	Fat river	ᑭᑲᓪᓚᒃ
39	Kuurqusaap Kuunga	river	Kuurqusaq's river (Kuurqusaq – river in the valley)	ᑭᖅᖅᑯᓴᑦ ᑭᖏᒐ
40	Kuuruit Isuaniittuq	lake	At the end of Kuuruit (Kuuruit – valleys with rivers)	ᑭᑭᐃᑦ ᐃᓯᐊᓂᓪᑐᖅ
41	Kuuruk	river	Rivière Guichaud*; valley	ᑭᑭᖅ
42	Kuuruup Isua	lake	Kuuruk's end (Kuuruk – river in the valley)	ᑭᑭᑦ ᐃᓯᐊ
43	Majurqaaluk	creek	Big slope	ᒪᔪᖅᓚᒃ
44	Majurqakallak	slope	Short slope	ᒪᔪᖅᑲᓚᒃ
45	Namunngavissaqangitualuk	point	Bad place to have nowhere to go	ᓇᒧᓐᖏᒪᐃᓵᖅᓴᖏᑐᐊᓗᒃ
46	Namunngavissaqangituq	cliff	It has no place to go	ᓇᒧᓐᖏᒪᐃᓵᖅᓴᖏᑐᖅ
47	Namunngavissaqangituup Nuvua	point	Pointe Marest*; Namunngavissaqanngituq's point	ᓇᒧᓐᖏᒪᐃᓵᖅᓴᖏᑐᑦ ᓄᑦᐊ
48	Napirvik	point	Cap Boisseau*; place to break	ᓇᐱᕋᐃᒃ
49	Naujaakallak	island	Staffe Islet*; fat island has baby seagulls	ᓇᐅᔨᑲᓚᒃ
50	Naujaakallaup Nuvua	cape	Cap Routhier*; Naujaakallak's point (Naujaakallak – chubby baby seagulls)	ᓇᐅᔨᑲᓚᐅᑦ ᓄᑦᐊ
51	Naujaaq	cliff	Baby seagull	ᓇᐅᔨᖅ
52	Naujaat	cliff	Falaise Naujaat*; baby seagulls	ᓇᐅᔨᑦ
53	Naujaat Akulliq	cliff	Middle Naujaat (Naujaat – baby seagulls)	ᓇᐅᔨᑦ ᐊᑯᓪᓗᖅ
54	Naujaat Nuvua	point	Cap Brassier*; Naujaat's point (Naujaat – baby seagulls)	ᓇᐅᔨᑦ ᓄᑦᐊ
55	Navvaataaq	lakes	Discovered	ᓇᕐᕿᑦᖅ
56	Navvaataaq	lake	Discovered	ᓇᕐᕿᑦᖅ
57	Nuluarniavik	fishing place	Place to net	ᓄᓗᐊᖅᓂᐊᕕᒃ
58	Nuvualuk	terrace	Big point	ᓄᑦᐊᓗᒃ
59	Nuvvuqiulaap Tikirakutaanga	point	Nuvvuqiulak's long point (Nuvvuqiulak – it has a sharp point)	ᓄᕐᑦᖏᑎᐅᓪᓚᑦ ᑎᑭᕋᑯᑦᓚᒐ
60	Nuvvuqiulak	bay	It has a sharp point	ᓄᕐᑦᖏᑎᐅᓪᓚᒃ
61	Nuvvuqiulak	cliffs (2)	It has a sharp point	ᓄᕐᑦᖏᑎᐅᓪᓚᒃ

Table 5.1 Description of Inuit Toponyms in the Study Area

	TOPONYM	ENTITY TYPE	OFFICIAL NAME* AND/OR APPROXIMATE TRANSLATION	INUKTITUT SYLLABICS
62	Puijisiurviapik	bay	Small place to hunt seal	ᓴᐃᓕᓂᐅᖅᐱᒋᐊᓗᒃ
63	Puijisiurvik	bay	Place to hunt seal	ᓴᐃᓕᓂᐅᖅᐱᒃ
64	Puijisiurviup Nuvua	promontory	Promontoire Colbert*; Puijisiurvik's point (Puijisiurvik – place to hunt seal)	ᓴᐃᓕᓂᐅᖅᐱᐅᓕ ᓄᕐᕋ
65	Qairajurtaq	mountain	Le Dome*; low and smooth	ᖁᓕᖅᔪᖅᑕᖅ
66	Qairajurtaup Qutialunga	shore	Qairajurtaq's big and bay-like (Qairajurtaq – low and smooth)	ᖁᓕᖅᔪᖅᑕᐅᓕ ᖃᑎᒋᓗᓐᓚ
67	Qairajurtaup Tikiranga	point	Cap Jurie*; Qairajurtaq's point (Qairajurtaq – low and smooth)	ᖁᓕᖅᔪᖅᑕᐅᓕ ᑎᑭᕐᓚ
68	Qairajurtaup Tikirangata Ungallinga	point	Cap Josselin*; behind Qairajurtaq' point (Qairajurtaq – low and smooth)	ᖁᓕᖅᔪᖅᑕᐅᓕ ᑎᑭᕐᓚᑕ ᐅᓚᑦᓗᓚ
69	Qairarjutaliariap Tasinga	lake	Qairarjutaliariaq's lake (Qairarjutaliariaq – leading to Qairajurtaq)	ᖁᓕᖅᖁᔪᑕᓗᓀᒋᐊᓕᓴᐅᓚ
70	Qairartaup Tasinga	lake	Lac Napirviik Tasingak*; Qairartaq's lake (Qairartaq – smooth mountain)	ᖁᓕᖅᖁᑕᐅᓕ ᑕᓂᐅᓚ
71	Qarliik	bays (2)	Pants	ᖁᓕᖅᓯᒃ
72	Qarliik Kisarvinga	anchorage	Qarliik's anchorage (Qarliik – pants)	ᖁᓕᖅᓯᒃ ᑭᓴᓕᐅᓚ
73	Qarliik Kuunga	creek	Qarliik's river (Qarliik – pants)	ᖁᓕᖅᓯᒃ ᑯᓚ
74	Qarliik Nuvua	cape	Cap Qarliik Nuvua*; Qarliik's point (Qarliik – pants)	ᖁᓕᖅᓯᒃ ᓄᕐᕋ
75	Qarliik Qaninnisaq	bay	Nearer Qarliik (Qarliik – pants)	ᖁᓕᖅᓯᒃ ᖁᓂᓐᓂᓴᖅ
76	Qarliik Qitinga	cape	Cap Gobin*; farther Qarliik (Qarliik – pants)	ᖁᓕᖅᓯᒃ ᖁᑎᓚᓗ
77	Qarliik Tikiranga	point	Qarliik's point (Qarliik – pants)	ᖁᓕᖅᓯᒃ ᑎᑭᕐᓚ
78	Qarliik Ungasinnisaq	bay	Baie Qarliik*; farther Qarliik (Qarliik – pants)	ᖁᓕᖅᓯᒃ ᐅᓚᔪᓐᓂᓴᖅ
79	Qarliini	site	In the Qarliik (Qarliik – pants)	ᖁᓕᖅᓯᓂ
80	Qarqaaluk	mountain	Big mountain	ᖁᓕᖅᖁᕕᓗᒃ
81	Qikirtaarulik	coast	It has a tiny island	ᖁᑭᖅᑖᑭᓕᒃ
82	Qikirtaaruliup Kangirsunga	bay	Qikirtaarulik's bay (Qikirtaarulik – it has a tiny island)	ᖁᑭᖅᑖᑭᓕᒃᐅᓕ ᒃᖅᑎᖅᔪᖅᓚ
83	Qikirtaaruliup Kuungata Sangummanga	bend	Elbow of Qikirtaarulik's river (Qikirtaarulik – it has a tiny small island)	ᖁᑭᖅᑖᑭᓕᒃᐅᓕ ᑯᓚᒪ ᓴᖅᔭᒪᖅᓚ
84	Qikirtaaruliup Siukkaalunga	cliff	Qikirtaarulik's big shelving coast (Qikirtaarulik – it has a tiny island)	ᖁᑭᖅᑖᑭᓕᒃᐅᓕ ᔪᐅᑲᕕᓗᓚ
85	Qikirtaaruliup Tupirvituqaaluttalinga	site	Qikirtaarulik's place that has an old, worn campsite	ᖁᑭᖅᑖᑭᓕᒃᐅᓕ ᑐᐱᖅᐃᑐᖅᕕᓗᒋᑦᑕᓕᓚ
86	Qikirtaaruq	island	Tiny island	ᖁᑭᖅᑖᑭᖅᖁᖅ
87	Qikirtalik	lake	It has an island	ᖁᑭᖅᑖᓕᒃ
88	Qilalukkisiivik	campsite	Place to wait for whales	ᖁᓕᓗᒃᑭᓯᐃᒃ
89	Qilalukkisiivik	shore	Place to wait for whales	ᖁᓕᓗᒃᑭᓯᐃᒃ
90	Qimittulik	lake	It has (something) strangled	ᖁᑎᑦᑐᓕᒃ

Table 5.1 Description of Inuit Toponyms in the Study Area

	TOPONYM	ENTITY TYPE	OFFICIAL NAME* AND/OR APPROXIMATE TRANSLATION	INUKTITUT SYLLABICS
91	Qinnguaq	cliff	The end	ᖁᑭᓐᓄᒍᕐᕆᖅ
92	Qurlutualuk	falls	Big waterfall	ᖁᓕᖅᓗᑐᓗᒃ
93	Qurlutualuk	falls	Big waterfall	ᖁᓕᖅᓗᑐᓗᒃ
94	Sajjugiittuq	cliff	It can't be walked on	ᓴᔪᔾᑦᑐᖅ
95	Saliangajaaq	slope	Smooth slope	ᓴᓕᐊᓐᓄᒍᔨᖅ
96	Salluliariaq	river	Leading to Salluit (Salluit – thin people)	ᓴᖅᓗᓕᐊᓇᐊᖅ
97	Sangummakallak	point	Fat bend (of a river)	ᓴᓐᒍᒫᒪᓕᒃᓪᓗᒃ
98	Sangummaq	bend	The bend (of a river)	ᓴᓐᒍᒫᒪᓕᖅ
99	Sijjakutaaq	shore	Long beach	ᓯᔪᔭᑦᑕᖅ
100	Sinaaliariaq	route	Leading to the shore	ᓯᓇᓕᐊᓇᐊᖅ
101	Sirmiq	bay	Soil	ᓯᕙᒥᖅ
102	Sirmiup Tasinga	lake	Rivière Kuuk Sanningajuq*; Sirmiq's lake (Sirmiq – soil)	ᓯᕙᒥᐅᑦ ᑕᓯᓐᓚ
103	Siturqaaluk	creek	Big slope	ᓯᑐᖏᓚᓗᒃ
104	Siukkaaluk	cape	Cap Hébert*; big shelving coast	ᓯᐅᒃᓚᓗᒃ
105	Siukkaq	mountain	Colline Siukkaq*; shelving coast	ᓯᐅᒃᓚᖅ
106	Tasialuk	lake	Big lake	ᑕᓯᐊᓗᒃ
107	Tasialuk	lake	Big lake	ᑕᓯᐊᓗᒃ
108	Tasialuk	lake	Big lake	ᑕᓯᐊᓗᒃ
109	Tasialuk Allipaaq	lake	Lowest big lake	ᑕᓯᐊᓗᒃ ᐊᓪᓚᒋᖅ
110	Tasiit Tukiliriit	lakes	Lakes aligned with one another	ᑕᔾᑦ ᑐᑭᓚᓂᑦ
111	Tasikuluk	lake	Poor lake	ᑕᓯᐊᓗᒃ
112	Tasikuluuk	lakes (2)	Two poor lakes	ᑕᓯᐊᓘᒃ
113	Tasikutaaq	lake	Lac Cotin*; long lake	ᑕᓯᐊᑦᑕᖅ
114	Tasikutaaq	lake	Long lake	ᑕᓯᐊᑦᑕᖅ
115	Tasiujaq	inlet	Lake-like	ᑕᓯᐅᔭᖅ
116	Tinujjaumavik	river mouth	Place to wait for the tide to come in	ᑎᓄᔪᔭᐅᒪᕕᒃ
117	Tupirvituqaaluttalik	site	It has a very old, worn campsite	ᑐᐱᖅᕕᑐᖏᓗᑦᑕᓚᒃ
118	Ullugumitarvik	cove	Place to have supper	ᐅᖅᓗᒍᒥᑕᖅᕕᒃ
119	Ullugumitarvik	shore	Place to have supper	ᐅᖅᓗᒍᒥᑕᖅᕕᒃ
120	Ullugumitarvikutaaq	lake	Long place to have supper	ᐅᖅᓗᒍᒥᑕᖅᕕᐊᑦᑕᖅ
121	Umiannguaq	shore	Looks like a boat	ᐅᒥᐊᓐᓄᒍᕐᕆᖅ
122	Umiarjuap Imirtavinga	reservoir	Umiarjuaq's water tending place (Umiarjuaq – huge boat; ship)	ᐅᒥᐊᖅᓪᓚᐊᑦ ᐃᒥᖅᑕᕕᓐᓚ
123	Upirngasarsiutik	route	It is for spring	ᐅᐱᖅᓐᓚᖅᓪᓚᐅᑎᒃ
124	Utarqiuviik	sites (2)	Both places to wait	ᐅᑕᖏᑭᐅᐊᒃ

*: Name recognized by the Commission de toponymie du Québec

Source: Avataq Cultural Institute (2015)

Table 5.2 Archaeological Sites Identified in the Study Area

SITE NUMBER	BORDEN CODE	SITE NAME	SECTOR	DESCRIPTION	CULTURE	PERIOD
1	KcFm-7	-	Anngiit	Small site consisting of only 1 tent structure	Inuit	
2	KcFm-8	Anngiik Tupirvilinga	Anngiit	2 tent structures, 1 blind, 1 cache	Inuit	
3	KbFm-5	-	Anngiit	1 tent structure (with 2 guying ropes)	Inuit	Recent Historic
4	KbFm-6	-	Anngiit	1 cache	Inuit	
5	KbFm-7	Anngiit Kuunga	Anngiit	3 caches	Inuit	
6	KcFm-9	Anngiik	Anngiit	1 cache and 1 tent structure (visible), other possible structures	Inuit	
7	KcFm-5	Kuukallaup Tupirvilinga	Anngiit	4 heavily stoned structures, 5 tent structures	Inuit	
8	KcFm-6	Kuukallaup Tupirvilinga Ungalliq	Anngiit	5 heavily stoned structures	Inuit	
9	KbFm-8	Anngiik Tulliq	Anngiit	1 tent structure	Inuit	
10	KbFm-1	Majurqaaluk	Anngiit	3 heavily stoned structures, 1 cache	Inuit	
11	KcFm-4	Anngiit	Anngiit	1 heavily stoned structure, 1 cache, other possible structures	Inuit	
12	KaFm-3	Kuuruk	Kuuruk	2 tent structures	Inuit	
13	KbFm-9	Kuuruup Tupirvilinga	Kuuruk	2 tent structures (1 with interior hearth), 1 exterior hearth, 1 cache, 3 blinds	Inuit	
14	KbFm-2	-	Kuuruk	1 hunting blind, 1 tent structure	Inuit	
15	KaFm-1	-	Kuuruk	2 tent structures	Inuit	
16	KaFm-2	-	Kuuruk	1 tent structure	Inuit	
17	KbFm-3	-	Kuuruk	1 tent structure	Inuit	
18	KbFm-4	-	Kuuruk	1 tent structure	Inuit	
19	KbFn-1	Ippiit	Kuuruk	2 traditional tent structures, 2 caches	Inuit	
20	KbFn-2	-	Kuuruk	1 tent structure (with guying ropes); disturbed	Inuit	Recent Historic
21	KbFm-10	Kuuruup Nunaturlinga	Kuuruk	4 tent structures	Inuit	
22	KcFn-3	Qikirtaaruliuup Tupirvituqaaluttalinga	Qikirtaaruliup Kangirsunga	5 caches, 1 exterior hearth, 1 tent structure	Inuit	
23	KcFn-4	-	Qikirtaaruliup Kangirsunga	1 small hunting blind (poorly preserved, active soil erosion)	Inuit	
24	KcFn-2	Qarliiuup Qaninnisanga Nunaturlik	Qarliik	1 heavily stoned structure (tent), probably more	Inuit	
25	KcFo-1	Qarliini	Qarliik	3 locus from lithic materials	Pre-Dorset	
26	KcFo-2	Qarliiuup Mippivinga	Qarliik	1 hunting blind	Inuit	
27	KcFo-3	Qarliiuup Kuungata Tupirvilinga	Qarliik	2 tent structures	Inuit	
	KcFo-3	-	Qarliik	Beluga and walrus bones on surface	Inuit	
28	KcFo-4	Qarliiuup Nunaturlik	Qarliik	5 tent structures, 2 traps, 1 cache; wind deposits (sand)	Inuit	

Table 5.2 Archaeological Sites Identified in the Study Area

SITE NUMBER	BORDEN CODE	SITE NAME	SECTOR	DESCRIPTION	CULTURE	PERIOD
29	KcFo-5	Qarliiuup Tirigannianiutinga	Qarliik	Fox trap (horizontal)	Inuit	
30	KdFq-1	-	Kangirsukallak	3 tent structures	Inuit	
31	KdFq-2	Kuuk Ivujiviliariaq Nunaturlinga	Kangirsukallak	At least 9 structures, heavily stoned; 2 tents	Inuit	
32	KcFq-1	Salluliariaq	Kangirsukallak	1 heavily stoned tent structure; 1 hunting blind	Inuit	
33	KcFq-2	-	Kangirsukallak	1 cache	Inuit	
34	KdFq-3	Kampanirtaliviniq (Aire A)	Kangirsukallak	Site of HBC buildings		Historic
	KdFq-3	Illuviit Kampanirtalivinirmi (Aire B)	Kangirsukallak	16 graves, and fencing around cemetery		Historic
	KdFq-3	Illutuqaq (Aire C)	Kangirsukallak	Root cellar-type storage		Historic

Source: Avataq Cultural Institute (2015)

Given the size of the study area and constraints caused by time, access and the cost of this type of work, the team was not able to visit the entire study area. For a more accurate and complete profile of human occupation in the area, further studies beyond the 2015 campaign should be considered.

Anngiit ("Anngiik that has the semblance of a lake")

Located about 25 km directly west of Salluit, the *Anngiit* sector contains two large bays, *Anngiik Ungalliq* (farther *Anngiik*) and *Anngiik Tulliq* (nearer *Anngiik*) (Map 5.2A). The ends of the bays have good archaeological potential, being composed of beaches of coarse sand, gravel and pebbles. Eleven sites were identified, including four during a helicopter flyover.

Anngiik Ungalliq (farther Anngiik) - Map 5.2A

Eight sites were identified in the *Anngiik Ungalliq* sector.

Cache made of boulders, KbFm-7 (view towards the southwest)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

Site 1, a small Inuit structure, possibly dating from the pre-contact period according to its appearance, is located on a ridge of the beach on the east shore of the bay. ***Anngiik Tupirvilinga*** **(Site 2)**, meaning "the tents at Anngiik", is an ancient Inuit camp located on an elevated terrace, also on the bay's east shore. It contains two tent structures (one heavily stoned and the other featuring a sleeping platform), a cache, a hunting blind, and an undetermined structure, resembling a miniature tent structure that may have been a dollhouse. **Site 3** is a Recent Historic Inuit camp, as confirmed by the presence of a canvas tent structure with guy ropes. This site is on the current beach of the bay's eastern shore, in close proximity to **Site 4**, which is slightly more elevated. ***Anngiit Kuunga*** **(Site 5)**, meaning "the river at Anngiik," is a storage site erected on a boulder field between the two arms of that river. Three caches were found along with two other structures that could also be caches, or judging from their size, shelters. In a small cove on the west bank of *Anngiik Ungaliq*, a tent structure was found at ***Anngiik*** **(Site 6)** (meaning "that has the semblance of a lake").

A flyover of the east bank of *Anngiik Ungalliq* revealed two additional sites at Kuukallak ("fat river"), a stream that cuts through a large boulder field on an elevated terrace.

Aerial view at *Kuukallaup Tupirvilinga* (KcFm-5) (view towards the northeast)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

Kuuruk (Rivière Guichaud) (view towards the west)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

The first site, ***Kuukallaup Tupirvilinga*** **(Site 7)**, located in the northeast, features at least four heavily stoned structures and five traditional Inuit tent structures. At the southern extremity, ***Kuukalaup Tupirvilinga Ungalliq*** **(Site 8)** consists of at least five heavily stoned structures identified during a helicopter flyover. As these findings are generated from aerial observations, it would be appropriate to study them directly on the ground.

Anngiik Tulliq (nearer Anngiik) - Map 5.2A

Although some potential had been suggested for this sector, which features a cove with benches and elevated terraces, only three sites were identified. The first, **Site 9**, comprising a tent structure, is the only site identified in the cove on the eastern slope, near a small stream. A second, isolated tent structure was observed on a small plateau on the east side of the bay, called **Majurqaaluk** ("big slope") **(Site 10)**. A flyover of the area revealed a third site, **Site 11**, containing at least three heavily stoned structures and a cache.

Other sites may exist at *Anngiit* (*Anngiik Ungalliq* and *Anngiik Tulliq*), but archaeological exploration of the area was limited by time constraints. The area could be better documented subsequently.

Kuuruk ("valley"; Rivière Guichaud) - Map 5.2B

Originating from *Kuuruup Isua* ("*Kuuruk*'s end") and flowing into the Baie de Salluit, the *Kuuruk* (Rivière Guichaud) has many rapids and is virtually impossible to navigate by canoe. Nonetheless, Inuit of the region confirm that it is heavily travelled in winter for hunting, trapping and, especially, fishing. The north arm of the river is characterized by sandy deltas and, notably, by eskers, a place favourable to the discovery of archaeological sites. These features provide a natural travel route that skirts wetlands. In total, 10 Inuit sites were identified in the *Kuuruk* sector, including five observed by helicopter.

Located on an ancient delta of coarse sand and pebbles covered in peaty deposits, **Site 12** is a small Inuit camp on the south shore of the *Kuuruk*, containing two traditional tent structures. Also situated on the south side of the *Kuuruk*, ***Kuuruup Tupirvilinga*** **(Site 13)**, meaning "the tents of *Kuuruk*," is a hunting camp established on an elevated sand and gravel terrace. It contains a cache, three hunting blinds, an outside hearth, and two traditional tent structures, one

Tent structure, KbFm-9
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

of which housed an indoor hearth. During the fieldwork, a timid black bear was observed between the two sites, an unusual but increasingly frequent occurrence in this area, according to local residents.

A flyover identified five further sites on the same riverbank. **Site 14**, located on the same terrace as Site 13, includes at least one hunting blind and one traditional tent structure.

Sites 15 and 16 were identified at the confluence of the *Kuuruk* and the *Kuurqusaap Kuunga* ("river in the valley"). **Site 15**, located on the delta north of Katinniq ("it met"), features two tent structures, while **Site 16**, located west of Katinniq on the north shore of *Kuurqusaap Kuunga*, has one tent structure on a small, sandy bench on a hillside. On the east bank of the northern arm of the *Kuuruk*, **Site 17** is a tent structure observed on another ancient delta covered in scattered peaty deposits. Three kilometres further north, **Site 18** is also a tent structure, located on an ancient sand delta.

***Ippiit* (Site 19)** ("esker") is a small camp on the esker located south of *Kuuruup Isua*, featuring two traditional tent structures on a small bench on the western slope of the esker. Two caches were identified on the same site, at the foot of the east side of the esker. Two kilometres from the *Ippiit* site, another tent structure was observed on a sand bench and identified as **Site 20**. The presence of rocks for supporting ropes confirms that the structure dates from the Recent Historic period; however, the structure is poorly delineated and highly disturbed by erosion. East of the *Kuuruk* esker, ***Kuuruup Nunaturlinga* (Site 21)**, meaning the "old *Kuuruk* site", was found on an elevated terrace of coarse sand and pebbles with sparse vegetation. Four traditional tent structures were identified at this location, two of which had a sleeping platform. Judging from the appearance of its structures, this Inuit site appears older than the surrounding sites inventoried, but its cultural period could not be confirmed by any artifact.

Tent structure with sleeping platform at *Kuuruup Nunaturlik* (KbFm-10) (view towards the south)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

Qikirtaaruliup Kangirsunga ("the bay that has a tiny island") - Map 5.2C

Located some 40 km directly west of Salluit, Qikirtaaruliup Kangirsunga is a bay formed by stepped beaches resulting from post-glacial marine regression. These elevated terraces provided the ideal topography and sedimentary environment for Palaeoeskimo camps. In view of their strong discovery potential and the fact that only two sites of Inuit occupation were identified in 2015, more in-depth fieldwork could be considered.

Perched beaches at Qikirtaaruliup Kangirsunga (view towards the southwest)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

The first site, **Qikirtaaruliup Tupirvituqaaluttalinga (Site 22)**, meaning "the old worn campsite in the bay that has a tiny island", is actually an old camp located on an elevated terrace near a rocky outcrop on the east bank of the bay. The site contains five caches, an outdoor hearth and a traditional tent structure. The second site, **Site 23**, is found near a stream east of the bay's main river. The mouth of the bay is known as Tinujjaumavik, meaning "place to wait for the tide to come in", which indicates potential for finding evidence of past use of the site. However, only one hunting blind was found, and it was poorly preserved due to the active erosion of the terrace on which it was built.

It was also in this part of the study area that Patrick Plumet's team identified three sites during the 1977 Tuvaaluk mission: KcFm-1, 2 and 3. Time constraints did not allow the archaeologists on the 2015 expedition to confirm the location of those sites. However, a helicopter flyover of the area challenged the location of KcFm-3 due to the presence of steep slopes. Sites KcFm-1 and 2 could be located on the slopes of the Vallée Qurlutualuk ("the big waterfall"). This location should be validated.

Qarliik ("pants") - Map 5.2D

Qarliik is a location known and prized by local people for beluga hunting and fishing. It consists of two bays shaped like a pair of pants, stretching in a north-south direction. Although very large, both bays lack in archaeological potential because they have few accessible beaches and

have very steep cliffs located directly on the water. Six sites were identified in the Qarliik sector in 2015, including one by helicopter.

Qarliik Ungasinnisaq ("farther Qarliik") and Qarliik Qaninnisaq ("nearer Qarliik")

Qarliik Ungasinnisaq, meaning "farther Qarliik", is the eastern bay in the Qarliik sector. With its small beach surrounded by cliffs, it offers few places to land or even to establish a makeshift camp, and therefore has little archaeological potential. Weather conditions did not allow the archaeologists to explore the area thoroughly.

The end of *Qarliik Qaninnisaq* bay ("nearer Qarliik"), i.e. the western bay in the Qarliik sector, is ensconced between some cliffs. It has a small bench covered with vegetation that offers sufficient room for habitation. A site entitled ***Qarliiuup Qaninnisanga Nunaturlik*** **(Site 24),** previously identified during a flyover, consists of a traditional tent structure and possibly a sleeping platform.

Qarliini ("in the Qarliik") and Qarliik Kuunga ("Rivière Qarliik")

The Qarliini ("in the Qarliik") sector, located south of Qarliik Nuvua ("Qarliik's point") and stretching to the mouth of Qarliik Kuunga ("Rivière Qarliik"), shows archaeological potential due to its two majestic, mainly open valleys, as well as its river, benches covered with vegetation, and sandy deposits. These features make it a promising area for archaeologists.

Qarliik Kuunga (view towards the southwest)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

Qarliini (Site 25), named after the valley in which it is situated, is a small pre-Dorset site measuring approximately 15 X 5 m. It is located on a rocky outcrop southwest of the valley, approximately 150 m from the shore. Consisting of three loci of lithic remnants lying on the surface, it has no apparent dwelling structures. The stone artifacts were

General view of the pre-Dorset site at Qarliini (KcFo-1), northwest of the bay *Qarliik Qaninnisaq* (view towards the northeast)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

General view of a locus at the Qarliini site, KcFo-1 (view towards the southwest)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

Burin at the Qarliini site, KcFo-1 (*in situ*)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

found in small sand and gravel pockets in the hollows of the rounded bedrock. Thirteen artifacts were observed, recorded and collected, consisting of six chisels (tools characteristic of the pre-Dorset era), a bifacial tool fragment, three pale grey chert shards, one of which had signs of usage, one Southampton chert shard, and two unidentified tools made of crystalline quartz.

This was a highly interesting discovery because very few pre-Dorset sites have been found on the continental side of Hudson Strait. These artifacts may be the lone remnants among many objects that have disappeared over the centuries after being subjected to the harsh weather conditions and disturbances.

Site 26, ***Qarliiuup Mippivinga*****,** meaning "hunting blind at Qarliik", is located in Qarliik's west bay, between Qarliini and Qarliik Kuunga, at the junction of the two valleys. An ancient Inuit camp was found on the west bank of Qarliik Kuunga, named ***Qarliiuup Kuungata Tupirvilinga*** **(site 27)** ("the tents of the Rivière Qarliik"). By the appearance of the structures observed, this site most likely dates from the pre-contact period, or even earlier. Two main areas were identified on this site. Area A, on a beach ridge, comprises two traditional tent structures, one of which has a sleeping platform. Area B is located on the southern boundary of the first raised beach closest to the shore, near the sea. Walrus and beluga bone fragments were found there, partially buried and scattered over a distance of about 30 m.

Fragments of marine mammal bones, partially buried, KcFo-3
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

Another ancient Inuit camp was found in the Qarliik Kuunga sector, but on the east bank of the cove at the mouth of the river, and named ***Qarliiuup Nunaturlinga*** **(Site 28)**, appropriately meaning "old camp at Qarliik". Located near a hill on a beach of fine sand surrounded by sub-rounded rock, the site consists of five traditional tent structures, two horizontal fox traps and one cache. Most of the structures are partially filled with fine sediment due to wind in the area.

A final site was found on the elevated plateau at the junction of the Qarliini and Qarliik Kuunga valleys. ***Qarliiuup Tirigannianiutinga*** **(Site 29)**, meaning "fox trap at Qarliik", features a traditional horizontal fox trap that was particularly well constructed and preserved. The narrow opening through which the foxes entered to find the bait, and then be trapped, is still well defined.

Horizontal fox trap (*Tirigannianiuti*), KcFo-5
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

Kangirsukallak ("fat bay"- Cap Wolstenholme) - Map 5.2E

According to the archaeologists, this area has promising archaeological potential. Four Inuit sites and one Euro-Canadian/Inuit site were identified around *Kangirsukallak*.

Kuuk Ivujiviliariaq ("the river leading to Ivujivik") and Salluliariaq ("leading to Salluit")

During a helicopter flyover of *Kangirsukallak*, archaeologists observed two Inuit sites on the west bank, at the end of the bay. **Site 30**, which has an Historic appearance, consists of three Inuit tent structures on a gravel beach, while ***Kuuk Ivujiviliariaq Nunaturlinga*** **(Site 31)** is located in a boulder field near the small Rivière Kuuk Ivujiviliariaq ("the river leading to Ivujivik"), which flows into the bay. This site has at least nine heavily stoned structures and two traditional Inuit tent structures.

Two sites were found south of *Kangirsukallak*, at Salluliariaq ("leading to Salluit"), on the east bank of the Rivière Kuuk Ivujiviliariaq. **Site 32**, an Inuit site found in a boulder field, features a heavily stoned tent structure and a hunting blind.

Site 33 is a cache in a boulder field a little further off, near Nuvualuk ("big point").

Kampanirtaliviniq ("it had the Company (the HBC)")

The *Kangirsukallak* sector is historically important to the area. It is in this bay, also known as Erik Cove, that the Hudson's Bay Company (the HBC) established a trading post in the early 20th century. Known as the Cap Wolstenholme trading post, it was officially inaugurated on August 13, 1909, by W. R. Parsons, and remained active until 1947 (for further information on the history of the *Kangirsukallak* sector, refer to the History section, Chapter 5: Human Occupation). The site has since been abandoned: the buildings were dismantled so the materials could be reused, and most of the objects have been collected. Currently, all that remains onsite are the foundations of some of the buildings, the cemetery, a partially subterranean structure and a memorial cairn.

Cap Wolstenholme trading post in 1933
Credit: Max Sauer (Hudson's Bay Company Archives, Archives of Manitoba, HBCA 1987/363-W-31/23)

Cap Wolstenholme trading post
Credit: Flaherty, 2004

Group of Inuit women and children walking towards the store at the Cap Wolstenholme trading post, 1933
Credit: Associated Screen News Limited (Hudson's Bay Company Archives, Archives of Manitoba, HBCA 1987/363-W-31/7)

Called **Kampanirtaliviniq (Site 34)** ("it had the Company"), it was inventoried, documented and divided into three separate sectors: Area A, comprising the original location of the buildings; Area B, the cemetery; and Area C, the structure dug in the ground, called the warehouse (Figure 5.3). Area A is located on the sandy beach, very close to the water. The buildings were laid out side by side, facing the beach. Rocks painted white at the time marked a footpath connecting the buildings in front. Two extensions of the footpath connected the beach to the main path and suggest access ramps for unloading boats and transporting products to the buildings. Today only the vestiges of three buildings remain, but it is clear from archival photographs that at least six buildings were erected there in the 1930s. In fact, the trading post journals mention the construction of two new buildings in 1912, consisting of a shed and a residence, due to an influx of employees and because the post provided storage for the Cape Dorset post. Based on the testimonies of elders from Ivujivik and some archives, one of the buildings is known to have housed an Anglican mission whose purpose was to convert Inuit to Christianity.

Footpath at the Cap Wolstenholme trading post, Kampanirtaliviniq (KdFq-3, Area A) (view towards the west)
Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

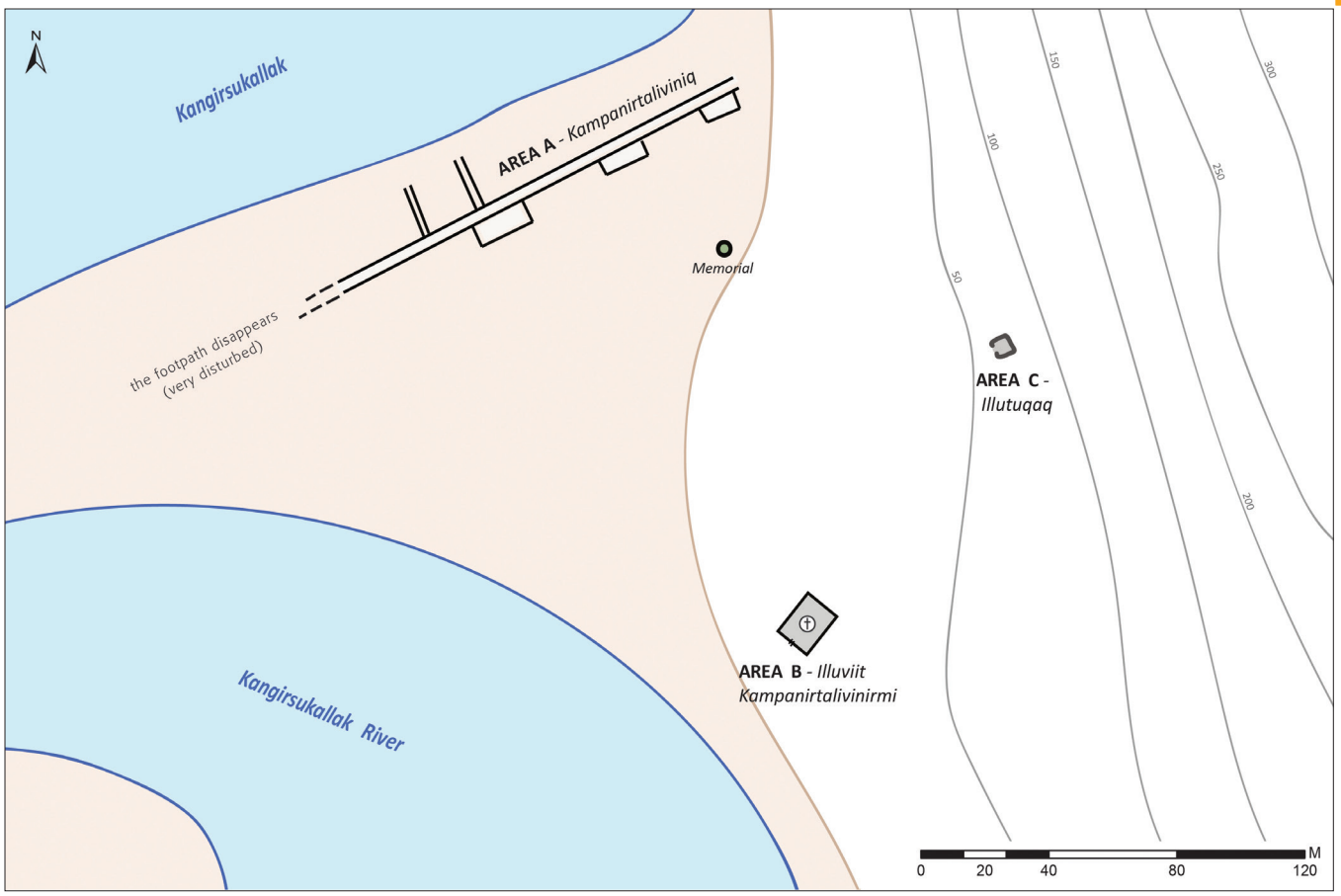


Figure 5.3 Schematic layout of the Kampanirtaliviniq site (KdFq-3), locating the three areas

Source: modified from Avataq Cultural Institute (2015)

Metal hook (*in situ*) probably used for mooring. Kampanirtaliviniq (KdFq-3, Area A) (view towards the north)

Credit: Elsa Cencig (Avataq Cultural Institute, 2015)

The archaeologists' visit provided the opportunity to observe some surface artifacts such as fragments of white earthenware, glass fragments, a barrel fragment, a sink, an engine part, a barrel lid, a walrus skull, pieces of a wood-burning stove, a large metal hook, a fragment of cement decoration, and many metal pieces that could not be identified. The metal hook, found in the ground near the river and measuring 20 cm, was most likely used to dock the boats arriving at the trading post. Another hook was noted from a distance on the other side of the river, which bears the Inuit place name Kuuk Umiakkuvik, meaning "river for boats". Archaeologists also observed that the hooks were placed with their open side facing away from the water, which would allow a boat to be tied with a rope without detaching as a result of wave action or the wind.

Area B of site 34 (*Illuviit Kampanirtalivinirmi*, "the graves where there was a company post") is the trading post cemetery. A total of 15 graves were counted, surrounded by a fence in an advanced state of collapse. The small entrance gate is still in place and functional. Each of the 15 graves features a small stone circle outlining the space where the

Commemorative cairn marking the Cap Wolstenholme trading post
Credit: Marianne Ricard

body was placed. Only two of the graves do not have a gravestone or a cross, suggesting the burial of newborns (for further information on the *Kangirsukallak* cemetery, see the photos in Appendix 12). An imposing burial structure erected to the memory of C. C. T. Shepherd and W. R. Ford, two HBC employees, and Sarah-Jane Shepherd, the spouse of C. C. T. Shepherd, is today in fragments. This marble memorial was once topped with a column and a cross. According to archives, Mrs. Shepherd succumbed to laryngitis in July of 1913 and the two men drowned in the sea the following month.

Area C, named *Illutuqaq* ("old house"), is on the hillside, east of the trading post. It consists of a rectangular structure dug into the soft sediment, much like the root cellars of yesteryear. Possibly used to store perishable goods, it had a foundation made of interlocking rocks, which can still be seen. Based on the few pieces found on site, it probably had a wooden roof covered with asphalt shingles.

Lastly, between Areas A, B and C, a cairn commemorates the trading post [note] A plaque shows the following inscription: *Hudson's Bay Company Incorporated, 2nd May, 1670. Wolstenholme Post, established on this site, August 13th 1909 by W. R. Parsons, Cairn erected 1935".*

Sectors of interest

In conclusion, the study area as a whole has some archaeological potential, with some sectors showing more promise due to their location, topography or the history of the region. ***Anngiit*** clearly has strong archaeological potential and appears to have been occupied regularly by Inuit. ***Kuuruk*** was, and continues to be, highly frequented—formerly by dogsled, currently by snowmobile, and, in summer, by *qajaq*. ***Kuuruk*** is a natural travel route as well as a sector rich in fishing and hunting resources. Although the topography of the **Qikirtaaruliup Kangirsunga** sector, consisting of well-defined and stratified elevated beaches, suggested strong potential, it proved poorer than expected. However, future studies in this sector could lead to new discoveries. It would also be appropriate to confirm and visit the three sites identified by Plumet's team in 1977. **Qarliik** is a sector that yielded more information than anticipated. The discovery of the **Qarliini** Pre-Dorset site (site 25) is highly unusual for the region. Further study of this sector may lead to more unexpected archaeological observations. The ***Kangirsukallak*** sector was very busy while the trading post was active, so it is no surprise that traces of occupation were found. A larger-scale study would certainly permit even more information to be identified.

Lastly, as shown by the work carried out in 2015, bays with beaches and valleys are the coastal locations with the strongest archaeological potential. Inland, the vast river system is more conducive to archaeological discoveries.

HISTORIC PERIOD

Believing they had discovered the New World, Europeans arrived in northern Québec, in the region now known as Nunavik – a land that for thousands of years had been home to groups of semi-nomadic hunter-gatherers who moved according to the seasons and the availability of natural resources.

Before describing the Inuit way of life at the time they first made contact with Europeans, it is important to understand that most of the information about this period comes from two distinct sources: documents written by Europeans and Inuit oral histories. It goes without saying that neither of these sources is comprehensive. The majority of the

European accounts are in the form of unpublished journals, reports, letters and notes made by traders, explorers and missionaries. The observations they contain are important, but must be interpreted with discernment because they derive from a time when the authors tended to perceive indigenous cultures with condescension and indifference, a perspective that prevailed in Europe in the early 19th century. Unfortunately, almost no Inuit oral histories that might have added nuance and depth to the European accounts were recorded or compiled until the early 1960s (MacDonald, 2010). The information on the history of the study area for the Parc national Iluiliq Project collected by the Avataq Cultural Institute (Lofthouse, 2017) comes primarily from archival documents, historic photographs, oral histories and recent interviews.

PRE-CONTACT WITH EUROPEANS

Inuit culture is not fixed in time or space, but varies from region to region, community to community and even from one Inuk to another. One of the Inuit traits explaining this cultural dynamism, a trait that has served them well through times of enormous change, is their strong adaptability. Before the first contacts with Europeans, Inuit led an essentially semi-nomadic life built around hunting, fishing and gathering. Their movements followed the seasons and the availability of resources. The Inuit Way, A Guide to Inuit Culture (Pauktuutit Inuit Women of Canada, 2006) provides a glimpse of this way of life. Inuit used to live in small family groups, travelling with the seasons to find food. In fact, their survival depended entirely on their environment, and so they developed an array of unique and impressive technologies that included the igloo, the qajaq, the ulu, the qulliq, clothing made of furs and harpoons with detachable heads.

Before Europeans arrived, there was no formal authority in Inuit communities; every community member was responsible for helping maintain balance and peace. They followed customary law, which was informal and flexible, but based on a complex set of values, beliefs and taboos. For minor offences, a person who behaved inappropriately was often ignored or mocked, and became a source of communal gossip or shame. In these tiny communities, where people were interdependent, such reactions were often the most effective: they could result in fewer invitations to join a hunt, less generous sharing of resources and other forms of social control (Pauktuutit Inuit Women of Canada, 2006). If a problem persisted and the first methods for dealing with an errant individual failed or in the case of a serious infraction, Inuit might resort to ostracism. The most extreme version of this involved banishing the offender, or even the entire community moving and leaving the offender behind (Pauktuutit Inuit Women of Canada, 2006). Vézinet (1980) cited the example of Piluqtuutialuq, an *Inuk* originally from Ungava Bay, towards the end of the 18th century. After a violent conflict, he was banished from his group and all his possessions were seized by the other members of the group. He went with his wife and young children to live in the area near Lac Faribault until the group had forgotten his offence. When he returned to the coast, he was an old man and his sons were nearly men (Vézinet, 1980). Through oral tradition, every member of the community knew that certain behaviours would not be tolerated: especially behaviours that threatened the stability, security and peace of the group (Pauktuutit Inuit Women of Canada, 2006).

The study area for the Parc national Iluiliq Project stretches along the coast of Hudson Strait, from *Kangirsukallak* (Erik Cove) to west of *Salluit Itivia* (Fjord de Salluit) (Figure 5.4). With access to the sea punctuated by sweeping cliffs, the region has seen most of its history unfold in areas like *Kangirsukallak* and *Salluit Itivia*, which are located in protected coves where it is easier to land. To move about the territory during that period, Inuit would travel by *umiaq* and *qajaq* in summer and dogsled in winter.

Life for Inuit in this region was nonetheless extremely difficult, and individual survival depended on extensive knowledge of the territory, including a sense of direction and the ability to find resources (Vézinet, 1980; Pauktuutit

Inuit mother's *amauti* (1890-1897)
Credit: McCord Museum M5837

Inuit Women of Canada, 2006). Over the long run, the Inuit were largely dependent on the availability of caribou and seals, which provided not only food but also materials for clothing, shelter and fuel (Dunbar, 1952; Pauktuutit Inuit Women of Canada, 2006). For example, it is estimated that to meet the caribou skin clothing needs of a family of five, about 30 skins were required. Not only was it a major challenge to obtain this many skins in a northern environment, but once the skins were in-hand, the women would devote 300 hours to prepare them and another 200 to sew the family's wardrobe (Vézinet, 1980).

The following section outlines the main historical events in the study area for the Parc national Iluiliq Project, and is based on a report prepared by Susan Lofthouse of the Avataq Cultural Institute (Lofthouse, 2017). Table 5.3 provides a summary of the main historical events of this section.

FIRST CONTACTS WITH EUROPEANS

The very first contacts between Inuit and European explorers occurred in the northwest sector of Nunavik. During this period, wealthy European merchants financed expeditions to search for the Northwest Passage; a route which, if discovered, would considerably reduce the time and cost of movements between Asia and Europe.

This was the objective of Henry Hudson's expedition in **1610**, when he visited the vast inland sea that would eventually be named in his honour: Hudson Bay. During this voyage, he passed through Hudson Strait and followed the east coast of Hudson Bay south to James Bay. Arriving at the northwest extremity of Nunavik, he named it Cap Wolstenholme (Anaulirvik) in honour of one of his patrons, Sir John Wolstenholme. His ship *Discovery* subsequently stopped at *Saarqajaaq* or *Qikirtasiit* (Digges Islands),[21] which Hudson named Cape Digges in honour of another wealthy patron, Sir Dudley Digges. At this stage of the expedition, crew members searching for meat and fresh water encountered caribou and stumbled upon an oval-shaped cache of birds (probably thick-billed murres). Henry Hudson became the victim of a mutiny by his famished crew when *Discovery* spent the winter in southern James Bay. The captain, possibly his son, and part of the crew were set adrift in a small craft while the rest of the crew headed north. On the return trip, *Discovery* returned to Digges Islands to search for food. This time the crew met a group of 50 or 60 Inuit aboard *qajaqs* and *umiaqs*. This surprising meeting unfolded peacefully at first. An *Inuk* even showed the crew how to capture murres using a pole with a noose on the tip, while the crew demonstrated how to use a musket to hunt birds. It appears that the two parties exchanged goods, most notably trading glass buttons and knives for skins and walrus tusks. However, the following day, for unknown reasons, the meeting between these Inuit and Europeans (*Qallunaat*) ended with a violent conflict resulting in deaths on both sides. After stocking up on fresh water and salted murres, the nine crew members of *Discovery* continued on their return voyage to London. Given the belief that they had found the Northwest Passage (Hudson thought Hudson Strait had led them to the Pacific Ocean and that Asia was on the west coast of Hudson Bay), the crew members were welcomed as heroes and mutiny charges against them were dropped.

Henry Hudson
Credit: Library and Archives Canada/C-17727. Retrieved from http://www.encyclopediecanadienne.ca/en/article/henry-hudson/

The enticement of the Northwest Passage motivated many expeditions in subsequent years, including the **1612-1613** voyage of Sir Thomas Button, whose crew included one of the survivors of the Hudson expedition. Just as Hudson had done, the expedition stopped at Digges Islands for provisions. A conflict ensued between *Qallunaat* and Inuit, this time in response to Button's actions, leading to casualties for both parties. Two *umiaqs* were taken from a camp that had been left unsupervised, representing a significant loss for that group. A few years later, in **1615**, Robert Bylot and William Baffin arrived at Digges Islands but decided not to venture on shore. They spent a month near *Tujjaat* (Nottingham Island) measuring the tides. In **1631-1632,** Thomas James travelled to James Bay and wintered there. He concluded that he had not reached Asia and that the Northwest Passage had not been discovered.

A shipping route had emerged from the information on tides and currents recorded by the numerous prior expeditions. Upon their arrival in Hudson Strait, ships would typically

[21] The place name Digges Islands sometimes makes it difficult to know which island is referred to. In Inuktitut, Saarqajaaq is the western-most island and Qikirtasiit, the eastern-most island.

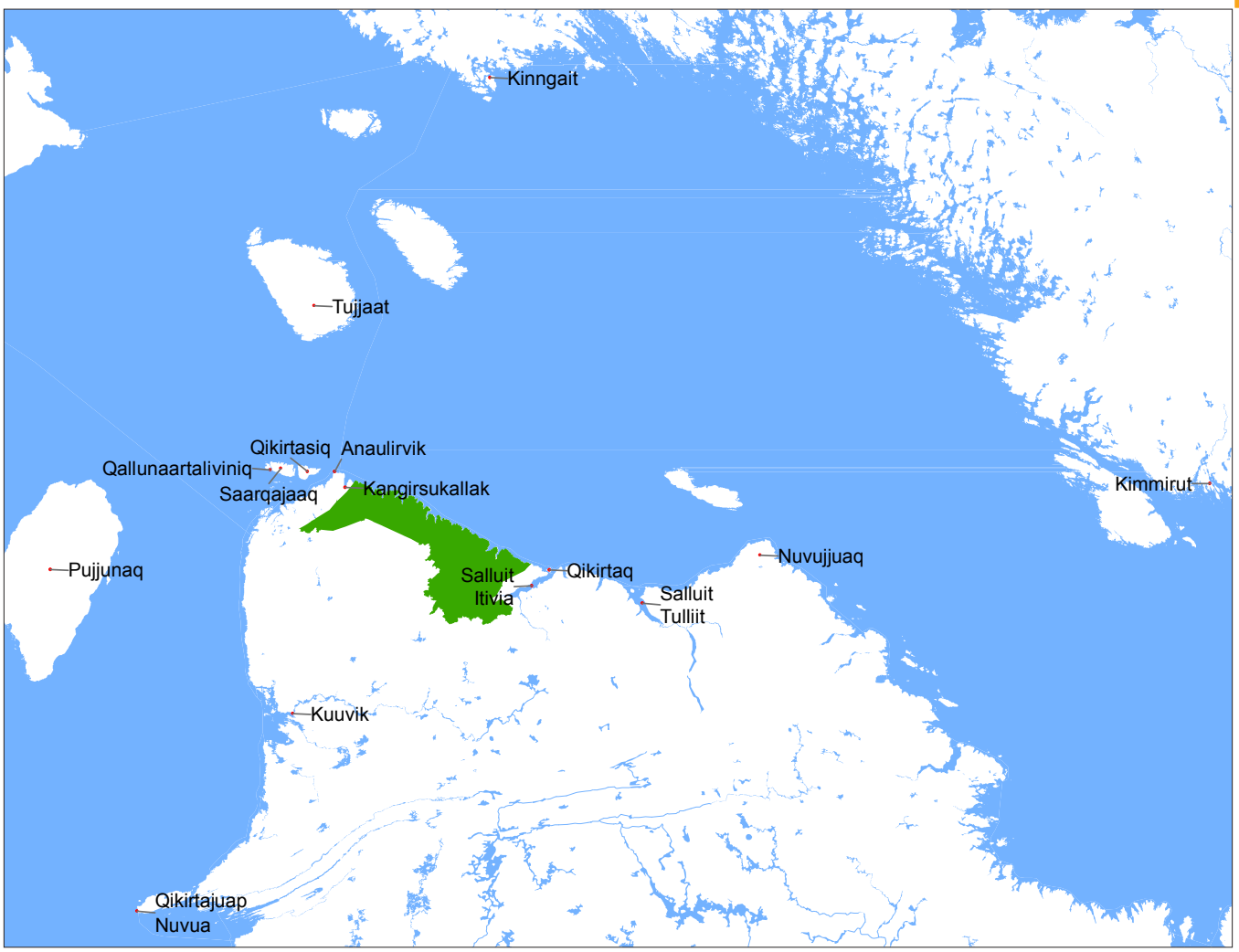
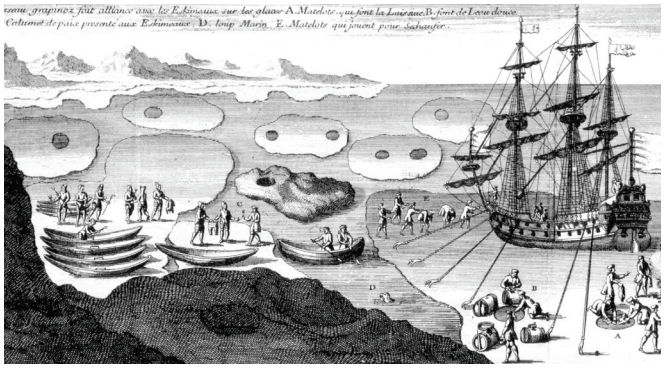


Figure 5.4 Principal Place Name in the Region of the Study Area

Source: Adapted from Lofthouse (2017)

follow the northern coast because they were assisted by the currents and dominant winds. For their return trips, they would follow the southern coast of the strait. During these expeditions, European merchants routinely met with Inuit and forged relationships for the fur trade. This was the case with the French ship *Pélican*, commanded by Pierre LeMoyne, who in **1697** recorded the first peaceful trades between Inuit and *Qallunaat*. Prints of these events were produced by Bacquevielle de La Potherie, a member of the expedition (Figure 5.4). They show Inuit and *Qallunaat* trading on coastal pack ice and sharing a peace pipe, a custom that the French mariners had most likely adopted from their meetings with the Cree of James Bay. De la Potherie also made an engraving of an *Inuk* in fur clothing, holding a spear and a throwing board, a flat piece of wood used to propel the lance and the harpoon (Figure 5.5). He also reported that "The Inuit traded their clothing for knives, scissors, needles, bells, pennies, and old pieces of sheet music, and that, in general, they considered everything we gave them as being of great value to them" (Avataq Cultural Institute, 1990).



Engraving by Bacquevielle de La Potherie depicting a trade scene between Inuit and *Qallunaat* on the pack ice at Cap Wolstenholme, dated 1697.

Credit: Tyrrell, (1931)

Table 5.3 Main Historical Events in the Study Area and Hudson Strait Region

YEAR	EVENT
1610-1611	Henry Hudson's expedition to find the Northwest Passage stops at *Qikirtasiit* (Digges Islands) to find meat and freshwater. The voyage continues to James Bay, where a mutiny occurs. The mutineers end up stopping again at *Qikirtasiit* on their return trip. They meet Inuit and have peaceful trade with them at first. However, violent altercations ensue, resulting in deaths on both sides. *Qikirtasiit* eventually becomes a well-known stop in the search for the Northwest Passage.
1612-1613	Thomas Button's expedition stops at *Qikirtasiit* to find meat and freshwater. After the expedition crew steal an *umiaq* from an unsupervised camp, a violent confrontation follows, causing the death of one Inuk and five sailors.
1615	Robert Bylot and William Baffin's expedition stops at *Qikirtasiit* to find meat and freshwater. They see Inuit on the shore but do not sail close enough for contact.
1697	Pierre LeMoyne leads a French naval expedition during the battle between the English and the French for control of trading in James Bay. The expedition stops at either *Qikirtasiit* or *Kangirsukallak* (Eric Cove) and records the first peaceful trading with Inuit.
1813	The HBC opens a trading post at Kuujjuarapik (Grande rivière à la baleine).
1830	The HBC opens a trading post at Kuujjuaq (Fort Chimo).
1853	The Qilalugarsiuvik (Petite rivière à la baleine) post opens, and Anglican missionaries settle there shortly after. Inuit from the Hudson Strait travel there by dogsled to trade in winter.
1860s	American and Scottish whaling ships begin hunting in Hudson Bay and Hudson Strait. Scottish whalers open a mica mine at Kimmirut (southern Baffin Island). Some families from *Kangirsukallak* are transported by whaling ship to work at the mine.
1876	Reverend Peck settles permanently at Qilalugarsiuvik, where he learns Inuktitut, translates religious texts into syllabics and teaches Inuit how to read.
1884-1887	The Canadian government sends an expedition to Hudson Bay and establishes four weather stations along Hudson Strait, at Killiniq (Port Burwell), Stupart Bay (near Kangiqsujuaq), *Tujjaat* (Nottingham Island) and *Qikirtasiit* (Digges Islands). The purpose of the weather stations is to observe ice conditions and the length of the shipping season between Europe and Hudson Bay via Hudson Strait.
1909	The HBC establishes the Cap Wolstenholme trading post (Eric Cove/*Kangirsukallak*), the first trading post operated specifically for trading in arctic fox pelts with Inuit. No Inuit come to the post during the first two years.
1910	Revillon Frères establishes a trading post at Kangiqsujuaq to compete with the HBC.
1919	Reverend Peck tours the Hudson Strait and stops at *Kangirsukallak*, where he performs a number of baptisms and marriages.
1920	Lamson and Hubbard (Lamson & Hubbard Trading Company) try to establish a trading post at *Kangirsukallak*.
1922	East Arctic patrols start visiting Nunavik each year. The HBC establishes a trading post at Akulivik (Cape Smith), which begins its operations as a satellite post for Cap Wolstenholme.
1924	Herbert Hall (Isumaataluk) and Solomon Ford (Salamonie) establish an independent trading post at *Salluit Itivia* (Fjord de Salluit).
1925	The HBC opens the Sugluk East trading post.
1927-29	An expedition is sent to Hudson Strait and six airbases are established to monitor ice conditions along Hudson Strait (Killiniq, Kangiqsujuaq and *Tujjaat*, and three on Baffin Island). These are the first airplanes to fly over Nunavik.
1930	The HBC opens the Sugluk West trading post. The Great Depression begins, triggering a steep decline in fox fur prices.
1930	A Catholic Mission is established at Salluit.
1938	A Catholic Mission is established at Ivujivik.
1940	The British movie *49th Parallel* is filmed.
1967	The Ivujivik cooperative opens.
1975	The JBNQA is signed, but the communities of Ivujivik, Salluit and Puvirnituq decline to sign. Instead, they establish *Inuit Tungavinga Nunamini*.

Source: Lofthouse (2017)

Engraving by Bacquevielle de La Potherie showing Inuit dress in the 17th century; a man is shown on the left and a woman on the right
Credit: **Left** Tyrell (1931) Tyrrell, J. B. 1931. *Documents relating to the early History of Hudson Bay*. The Champlain Society, Toronto. p. 204. First published in de la Potherie, C. C. L. R. 1722. *Histoire de l'Amérique septentrionale, volume I*. **Right**: Photo courtesy of Miriam and Ira D. 1976. Wallach Division. Art and Architecture Collection, New York Public Library. https://digitalcollections.nypl.org/items/510d47e4-81bd-a3d9-e040-e00a18064a99

In **1668**, Zachariah Gillam, accompanied by French fur trader Médard Chouart des Groseilliers, arrived at James Bay aboard *Nonsuch*. They erected a trading post at the mouth of the Rivière Rupert and ran a lucrative trade with local communities all winter. The success of this business led to the establishment of the Hudson's Bay Company (the HBC) in **1670** (Cooke and Holland, 1978).

Inuit of Hudson Strait: Tarramiut

While staying in Fort Chimo, a village once located across from present-day Kuujjuaq, Lucien Turner, a meteorological observer for the U.S. Army, recorded a great deal of information in the late 1800s about the way of life of the Inuit in Nunavik (Turner, 2001). Turner made an expedition to the Ungava region from **1882** to **1884**, during which he noted the presence of three groups of Inuit. The *Su hi' ni myut* or *Siqinirmiut*, meaning the people of the sunny side, occupied the territory between the Labrador coast of Ungava Bay and the western part of the bay to the Rivière aux Feuilles. The second group was the *It'vimiut* or *Itivimiut*, meaning the people of the other side, referring to the inhabitants of the east coast of Hudson Bay. The territory between the Rivière aux Feuilles and Hudson Strait was occupied by the *Ta'hag myut* or *Tarramiut*, meaning the people in the shade (Saladin d'Anglure, 1984). Subsequent writings by HBC employees nonetheless identified *Tarramiut* as the people of the north (*Northerners*), a term more generally denoting the inhabitants of southern Hudson Strait. According to Turner, the *Tarramiut* were little influenced by *Qallunaat* (Turner, 2001). They were culturally distinct from their southern neighbours and spoke a different dialect. Turner described clothing edged with pear-shaped ivory ornaments that rattled as the wearer walked, and special *kamiks* designed to provide traction on ice. The soles included multiple loops made from strips of sealskin. Turner also reported that igloos were used longer in that region than in the rest of Nunavik, a logical observation given the area's distance from the tree line, which restricted access to building materials.

Bernard Saladin d'Anglure, a Canadian anthropologist and ethnologist who devoted most of his career to studying the Inuit of the Canadian Arctic, used the place name Salluit to denote the coast between Cap de la Nouvelle-France (*Nuvujjuaq*) and Cap Wolstenholme (*Anaulirvik*). He used the term *Sallumiut* to refer to the inhabitants of the Fjord de Salluit (*Salluit Itivia*) and Baie Déception (*Salluit Tulliit*), and *Saniraq* to refer to the region between Cap Wolstenholme and Baie Kovik.

Saladin d'Anglure also highlighted that a Moravian manuscript from **1773** used the term *Nuvunnug* to refer to the Inuit of the Cap Wolstenholme region. This was echoed by E. W. Hawkes, who travelled along the coasts of Labrador, Ungava and Baffin Island in **1914** for the Geological Survey of Canada. Hawkes reported that the term *Nuvugmiuit*, meaning people at the point, was used to refer to inhabitants of the Cap Wolstenholme region. Tommy Weetaluktuk, an archaeologist with the Avataq Cultural Institute, has explained that the term *Nuvumiut* was still used during the latter half of the 20th century to refer to the inhabitants of Salluit and Ivujivik (pers. comm., 2016). Hawkes' account of his travel to Baffin Island also stated that the inhabitants of northern and southern Hudson Strait once lived together on southern Baffin Island. A conflict appears to have led some residents to cross the strait via the *Tujjaat* islands (Nottingham and Salisbury). Those who went as far as Ungava were known as *Iglumiut*, meaning those who live in igloos, while those who of southern Baffin Island were called *Sikosuilariut*. Nottingham and Salisbury islands have attracted walrus hunters from both coasts of the strait since historic times, and most likely since prehistoric times. In Hawkes' day, more people lived between Cape Smith and Cap Wolstenholme (known today as Akulivik-Ivujivik) than between Cape Hopes Advance and Cap Wolstenholme (today Quaqtaq-Ivujivik).

Development of Trade between *Tarramiut* and *Qallunaat*

From the start of the **1700**s, HBC supply ships were commonly seen near southern Baffin Island. There was a degree of interest for goods that could be obtained only by trading with the Inuit in that region, such as baleen. In **1738**, ship captains were instructed to offer mainly fishing hooks and sewing needles as trading goods. Increased trading with Inuit created a market for fur, ivory, and oil from marine mammals. Most of the trading at this time took place along the northern coast of Hudson Strait, even though the strait

was frequently being crossed. Peter Pitseolak, an Inuit historian from Cape Dorset who was born on Nottingham Island, reports that the crossing required a great deal of determination, and that the trip was made via the *Tujjaat* islands.

Toward the end of the 19th century, the advent of steamers and whaling boats led to increased traffic and longer travel in the region. Whalers travelled frequently between Davis Strait and northwest Hudson Bay to hunt for bowhead whales during their summer migration. The whaling industry developed mainly on the north coast of Hudson Strait with the opening of a U.S. whaling station near Kimmirut in **1880**. In **1900**, a Scottish mica mine opened in this region. At that time, mica was commonly used for window insulation and heating units (example, boilers). Miners were mainly from Baffin Island, but some also came from the Hudson Strait region of Nunavik.

Expeditions to Hudson Bay and Sovereignty of Canadian Arctic Waters

In **1884**, the Canadian government sponsored an expedition to collect as much information as possible on navigation in Hudson Strait. Six weather stations were installed along the strait, including four on the south coast, at Killiniq (Port Burwell), Stupart Bay (near Kangiqsujuaq), *Tujjaat* (Nottingham Island) and *Saarqajaaq* (Digges Islands). The steamer *Neptune* was leased to Newfoundland to lead the expedition. The objective was to assess the feasibility of transporting grain, a major economic resource at the time, first by train from the prairies to southwestern Hudson Bay, and then by ship to Europe. In **1885**, Robert Bell, a geologist with the expedition, travelled from the station at *Saarqajaaq* (Digges Islands) to the Ivujivik area. There he met Inuit in a camp that showed traces of ancient occupation. Bell also noted a vein of milky quartz, a material widely used by the Dorset peoples for making tools. These observations were made at several archeological sites in the region, suggesting that the area had been occupied for a long time.

Since most of the ships navigating in Hudson Strait were British or American, Canada started to be concerned about the sovereignty of Canadian Arctic waters. In **1897** during an expedition, Captain William Wakeham made several passages between Hudson Strait and Baffin Island, gathering considerable data on weather and ice conditions.

Subsequent expeditions included the *Neptune* in **1903-1904**, which wintered in western Hudson Bay. Led by A. P. Low of the Geological Survey of Canada, the expedition halted at *Kangirsukallak* and then *Salluit Itivia* (Fjord de Salluit) for fresh water. Low estimated that there were about 75 people living between *Nuvujjuaq*

Port Laperrière station on Digges Islands in 1884 with the *S.S. Neptune* anchored in the background
Credit: Robert Bell. Library and Archives Canada, C-086359

(Cap de Nouvelle-France) and *Kangirsukallak*, based on his observations of summer camps before the opening of fur trading posts in the region.

Introduction and Transmission of Syllabics

The establishment of a fur trading post at Petite rivière de la Baleine (Qilalugarsiuvik) in **1851** attracted Inuit to the region, especially in winter when dog sleds and *qamutiit* facilitated travel. The influx of visitors captured the attention of the Anglican mission in Mailasi (Chisasibi, Fort George), which began sending missionaries to the area in winter. In **1876**, the young reverend (R. P.) Edmund Peck moved permanently to Qilalugarsiuvik. Peck, who came to be nicknamed *Uqammaq* ("one who speaks well"), continued the translation work begun by his predecessor the Reverend John Harden after he had learned Inuktitut. This project used syllabics, created by the Reverend James Evans some years before. Using religious texts, Peck taught several Inuit to read during the winters they spent in Qilalugarsiuvik. Peck remained in Qilalugarsiuvik until **1890**, when the trading post was shut down and the Anglican mission decided to move its activities to Kuujjuarapik. Peck remained there until **1892**, but his influence spread far beyond the frontiers of this community. In fact, A. P. Low in **1903** recorded that a group of Inuit who had never had contact with missionaries were given religious books and immediately began to pray and sing hymns. A visitor to the Cap Wolstenholme trading post who arrived on board an HBC ship similarly observed in **1911** an *Inuk* reading religious literature in syllabics. To the observer's knowledge, the reader had had no prior contact with missionaries, suggesting a remarkable transmission of learning between Inuit despite the vastness of the territory. In **1919**, Reverend Peck made a farewell voyage along Hudson Strait on board the HBC supply ship *Nascopie.* During his visit to the Cap Wolstenholme trading post, he performed many baptisms and marriages. Peck noted that

the dialect of southern Hudson Strait was very similar to the dialect of northern Hudson Strait, indicating a long history of constant contact. His observations during this voyage suggest that there were 313 people living between Ivujivik and Kangirsuk.

Reverend Peck at the Cap Wolstenholme trading post in 1919
Credit: The General Synod Archives, Anglican Church of Canada, Edmund J. Peck Fonds, P7502-55i

1909: Opening of the Cap Wolstenholme Trading Post, First Post Established Exclusively for Trading with Inuit

During the HBC's first 240 years, supply ships navigated in Inuit territory and trade was carried on with Inuit on the northern coast of Hudson Strait without a single trading post being established on the tundra. All trading posts operating during this period were located close to the tree line, and trading was carried on with Inuit and Cree or Inuit and Naskapi respectively at the following locations: Qilalugarsiuvik (Petite rivière de la Baleine; 1750-1759), Grande rivière de la Baleine (Kuujjuarapik, beginning in 1813) and Fort Chimo (Kuujjuaq; open periodically beginning in 1830).

The early 20th century saw a dramatic jump in the value of arctic fox due to its popularity in Europe and North America. This increase, along with the onset of competition with the French company Revillon Frères, led the HBC to establish posts further north. Revillon Frères had already started spreading northward, where they could intercept hunters and their *qamutiit* on route to trading posts in the south. At the beginning of the 20th century, the two companies were thus actively competing on Nunavik's coasts.

The HBC opened its Cap Wolstenholme trading post at *Kangirsukallak* in **1909** (at the exact location now called *Kampanirtaliviniq*, meaning "it had the Company"). Cap Wolstenholme was Nunavik's first trading post dedicated exclusively to trade with Inuit, particularly in arctic fox furs. Unfortunately, two years elapsed before the manager, Ralph Parsons, finally met with Inuit. During his first winter, Parsons noted in his journal that "the only means of travelling here in winter is by a dog team overland", but he had none. He also noted that the hills in the region were "as slippery as glass and useless to attempt climbing them". The following summer, Parsons and a group of employees from the post travelled up to Cap de Nouvelle-France (*Nuvujjuaq*) aboard a repaired boat, without meeting a soul. During their absence, Captain Murray of the *Active*, a Scottish whaling ship, visited the Cap Wolstenholme post. He told its employees that he had brought several families from the region to northern Hudson Strait to find better hunting grounds. Shortly after this visit, Parsons observed a steamer in the area of Cap Wolstenholme (an ideal vantage point for observing naval traffic). Seeing that it was not an HBC vessel, he assumed it belonged to the French company, Revillon Frères. That same year, after the arrival of the HBC's supply ship, Parsons asked to be assigned to northern Hudson Strait, but his request was denied. The following year, the HBC sent more employees to the Cap Wolstenholme trading post along with a boat and dogs to facilitate overland travel.

The HBC trading post at Cap Wolstenholme, 1930-1940
Credit: Hudson's Bay Company Archives (ALBUM 8/74 (N5123), HBA8.73

1911: First Contact near Salluit

Despite two years without trading, the HBC persevered in keeping the Cap Wolstenholme trading post open due to the establishment of a Revillon Frères post at Kangiqsujuaq in **1910**, an event consistent with Parsons' observations of the previous year. Finally, in **1911**, an expedition organized by the Cap Wolstenholme trading post team provided contact with some families near Salluit. These families told Parsons

that 20 other families were en route and that they had traded at the Kangiqsujuaq trading post the previous winter. Juanasi Pamiup, father of Aijia Naulituk (born in 1906), witnessed the arrival of the first *Qallunaat* while at *Sajuvvialuk* (near *Salluit Itivia*, Fjord de Salluit). Aijia recounted that after receiving several gifts from the visitors, Juanasi quickly kayaked towards *Salluit Tulliit* (Baie Déception) with tobacco and tea to spread the news of the arrival of *Qallunaat* in the area. Later that summer, the Cap Wolstenholme trading post received its first Inuit clients. Aijia Naulituk, who was five years old at the time, remembered travelling on foot from Salluit to *Kangirsukallak*.

Two ships at *Kangirsukallak* in 1933: the S.S. MacLean (icebreaker) and the S.S. Nascopie (cargo and icebreaker)
Credit: Hudson's Bay Company Archives, Archives of Manitoba (Max Sauer Jr.), HBCA 112

Shortly after the first contacts with Inuit, the HBC supply ship *Pélican* arrived at the trading post with new employees, including William Ikey. The *Pélican* also brought the *Daryl*, a yawl with two 30-foot masts. The vessel was used by Parsons in subsequent years to establish new trading posts, mainly on the northern coast of Hudson Strait: at Lake Harbour (*Kimmirut*) in **1911**, Cape Dorset (*Kinngait*) in **1913** and Kangiqsujuaq in **1914**. The yawl proved useful for decades, especially for trips between the trading posts on the two coasts of Hudson Strait. Parsons played a key role in developing trade for the HBC in that area. He had a long career with the HBC, rising to the positions of regional manager and then district manager before retiring in 1940.

Visit by *Séduisante*

A significant event of this period at the trading post was a visit by the Scottish whaling ship *Séduisante* in **1911**, shortly before it sank. One evening, a crew member on the *Daryl* reported seeing flashes of light from a vessel near *Kangirsukallak* that looked like the traditional distress

View of the Cap Wolstenholme trading post facilities in 1933
Credit: Max Sauer. 1933. Hudson's Bay Company Archives (HBCA 1987/363-W-31/23)

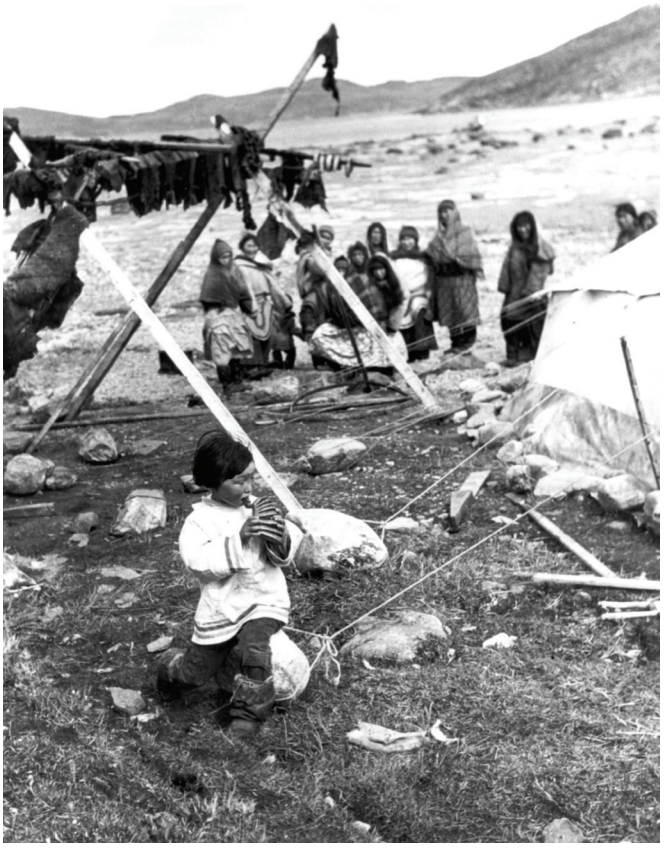
signal of matches being thrown overboard. The crew of the *Daryl* rowed to the ship and were welcomed by a Scottish voice that gave the ship's name as "*Sedy-Santy* [*Séduisante*] of Dundee". The following day, a whaleboat, which was a light and narrow canoe used for whale hunting, landed at the trading post carrying the captain, the owner, and the Inuit crew. The owner asked whether walruses had been spotted recently. Told that a group was near Salisbury Island, he replied that he would go in that direction. He explained that the previous night's distress signals had been launched because the crew had taken the *Daryl* for a Royal Canadian Mounted Police (RCMP) ship and the whaler did not have a Canadian permit for hunting walrus. Meanwhile, George Ford, an employee at Cap Wolstenholme trading post, who spoke fluent Inuktitut, conversed with the crew and learned that they had sacked an independent trading post during their trip through Hudson Strait and that the Cap Wolstenholme post would have suffered the same fate if the *Daryl* had not been mistaken for an RCMP vessel. In the fall of **1911**, Parsons noted in the trading post journal that several storms had hit during the season and that "[I] hope no harm come to any of the vessel around here". Little did he know that the *Séduisante* had sunk around that time in the shallow waters off *Tujjaat*. This shipwreck became famous in the area because the Inuit families working on board had survived but the *Qallunaat* crew had perished. Oral history relates that "four boats of survivors arrived [at Cape Dorset] from Toojat [*Tujjaat*], three whaleboats and one sealskin *umiaq* built during the winter. They carried 61 survivors."

Beginnings of Success in Southern Hudson Strait

Beginning in **1912**, families would come to the Cap Wolstenholme trading post area as soon as the waters were

navigable until the month of November. At that moment of the year, they could travel to their winter camps, located for the most part, near Ivujivik, *Saarqajaaq*/*Qikirtasiit* and Baie Kovik. In winter, they frequently travelled between their camps and the post by dog sled. Until the opening of the Salluit post in **1925**, families in that area would alternate between the Cap Wolstenholme and Kangiqsujuaq posts. According to the trading post journal, the Pamuck (Pamiuq)[22], Kaunnalut (Qaunnaluk) and Koomak (Qumaq) families had travelled there from Salluit. The Kanaksoak (Kanarjuaq) family travelled frequently from *Saarqajaaq*/*Qikirtasiit*, while the Nallueyak (Naluiyuk) family travelled to the trading post from various locations. Frank Melton, who headed the Wakeham post around **1916** and the Cap Wolstenholme post from **1925 to 1930,** reported that more women than men trapped fox, thereby ensuring that their families would have access to specific store merchandise like powder, munitions, tea and tobacco. Melton also mentioned that he urged the families to spread because they tended to congregate in winter. In this manner, they could cover a larger trapping area. However, this made the families more vulnerable to food shortages, especially when they were dispersed according to fox trapping needs rather than food resources.

Group of Inuit at *Kangirsukallak* during the summer of 1919
Credit: Bishop Fleming, Anglican Church of Canada. General Synod Archives, ANGP7516.278



Camp near Salluit, 1939
Credit: The Canadian Museum of History, NM#87004

Times of Starvation

Trading post journals often mention episodes of starvation, which occurred especially at the end of winter. Although Inuit traditionally located their camps in broad areas near more reliable food sources (such as igloo camps on pack ice near *agluit*, or seal breathing holes), fox trapping camps were smaller, more dispersed, and therefore more risky. For example, the Cape Smith trapping camp (near Akulivik) was regularly used in winter, after which it became a satellite trading post and finally a permanent trading post. Even so, Inuit sent there by the HBC for trapping frequently experienced starvation. An entry in the HBC journal mentions two hunters who returned with only 12 foxes in May **1913** after spending the fall and winter in the Cape Smith area, where they had endured starvation. An entry from April **1915** relates how Inuit had remained in their igloos in Salluit because they lacked the strength to go hunting. During that time, a letter sent to the Cap Wolstenholme trading post announced a decrease in supplies due to rationing in Europe during the First World War. During these times of famine, many people had no choice but to eat their dogs, which then made it even more difficult to get to their hunting grounds. A hunter's prosperity suffered significantly from a shortage of dogs or having dogs in poor health. The famines were no doubt linked to the cycle of the fox population, which reaches its apex every four years and then falls dramatically.

[22] Two versions of family names are given: the first uses the spelling from the original text, while the second, in parentheses, shows how they are written today.

Qumaq the Hunter

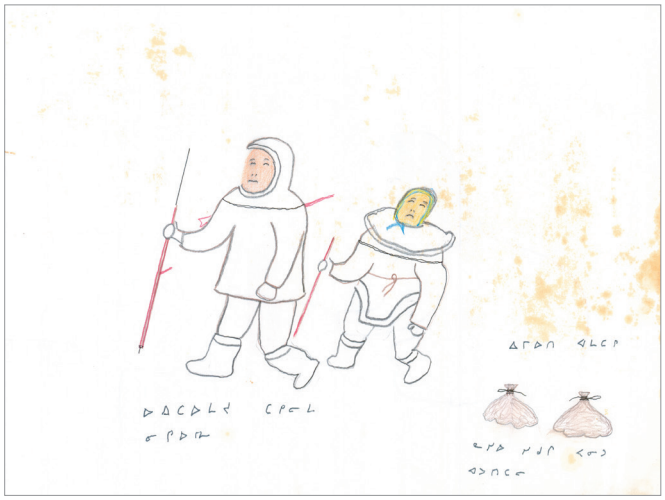
An entry in the Cap Wolstenholme trading post journal dated August 3, **1912,** relates the return of Qumaq, a prolific hunter who had visited many of the trading posts in the region. Qumaq became a legendary figure after he and his family spent several years on *Pujjunaq* (Mansel Island). In **1912**, the family, consisting of Qumaq, his wife, sons Peter Ussie and Ussie Sanak Nanook (Nanuq), his three daughters, and baby Tuumasi Mangioq, travelled over ice by *qamutiik* from Mansel Island to Digges Islands. They remained there two months to gather enough driftwood to build a vessel, which they covered with skins so they could travel to *Kangirsukallak*. At *Pujjunaq* (Mansel Island), they lived on what they could catch with a bow and arrow, and mainly wore clothing made from the skins of polar bears.

Qumaq's family travelled to the trading post several times over the years. Qumaq's son, Tuumasi Manioq (who later became a priest in Ivujivik), remembered camping at *Saarqajaaq* and travelling to the Cap Wolstenholme trading post at *Kangirsukallak*. One of the entries in the trading post journal dated April **1913** tells of the family drifting on ice from Digges Islands almost to Nottingham Island before the winds shifted and brought them back to their departure point. While at the Cap Wolstenholme trading post, the family met Robert Flaherty, a member of a geological expedition who became well known a few years later for his documentary *Nanook of the North*. The family, who had lived at *Pujjunaq* (Mansel Island) for years and travelled on pack ice and ice floes, made a strong impression on Flaherty, who frequently related their story after returning to the south. In February **1918**, Qumaq and his son arrived at the trading post, having travelled from *Pujjunaq* (Mansel Island) by dogsled. The ice conditions were so favourable that they arrived after spending only two nights on the ice.

It is unclear which violent event or events led the Qumaq family to leave the continent. Peter Pitseolak stated that Qumaq's younger brother had accidentally killed someone and that the Qumaq family was afraid of reprisals. Others mentioned an event that occurred at *Pujjunaq* (Mansel Island). The HBC journal alludes to a violent man who had killed several people at *Pujjunaq* (July **1911**). Other accounts relate events that happened between **1910** and **1915** in *Aqiggituurq,* an island in Baie Kovik. Tuumasi Kaitak, whose mother had escaped this wave of violence, recounted that after the events, people left the area for Salluit and Kangiqsujuaq, while other families left for *Pujjunaq*, including Qumaq's family. According to these histories, it appears that at least two incidents had occurred, one at Baie Kovik and the other at *Pujjunaq*. The Cap Wolstenholme journal reports the death of Qumaq in **1927**. After this event, his family broke its camp on Mansel Island and returned to live on the continent.

Deaths at the Cap Wolstenholme Trading Post

In addition to Qumaq's arrival, several deaths marked the year **1912**. First, Alexander Murray, captain of the whaler *Active*, died from the effect of alcoholism while overwintering at the Cap Wolstenholme trading post. Then in the summer, the new trading post head, Christopher Shepherd, his wife Sarah-Jane Shepherd, and his assistant William Ford, all met a tragic end. Sarah-Jane died from complications from laryngitis. Three weeks later, her husband and his assistant drowned while hunting. The clerk, A. Chalmers, who ran the trading post after their deaths, erected a monument to their memory in **1916**. The monument is still present in the Cap Wolstenholme cemetery.



Drawing by Tuumasi Kudluk depicting a man and a woman who walked for several weeks with their gear on floating ice in Ungava Bay
Credit: Avataq Cultural Institute, Tuumasi Kudluk Fonds Image A027

Tombstone and death monument for Christopher and Sarah-Jane Shepherd and William Ford at the Cap Wolstenholme trading post cemetery, 1919
Credit: Captain George E. Mack, McCord Museum. MP-0000.597.118

Tombstone at the Cap Wolstenholme trading post cemetery
Credit: Elsa Cencig, 2015

Lamson and Hubbard Trading Company

In **1920,** Lamson and Hubbard, a Boston-based fur trading company, tried to establish a foothold at *Kangirsukallak* near the Cap Wolstenholme trading post, but the price of skins fell shortly after. Lamson and Hubbard, who were former employees of the HBC, tried everything they could to attract clients, including offering fine trading goods like butter, milk and sugar, as well as high prices for skins. Business nonetheless floundered and they were forced to close in the fall of **1921**.

1927-1929: Establishment of Airbases along Hudson Strait

The first aircraft arrived in Hudson Strait in **1927** with a plan to establish six airbases in the region. Three were built on the south coast of Hudson Strait, at Killiniq, Kangiqsujuaq and *Tujjaat* (Nottingham Island). The Cap Wolstenholme trading post journal reports that the post's location was less than ideal and that the potential of Nottingham Island would be explored for the establishment of an airbase. The journal also reports an accident that occurred on August 29, **1928**, when a seaplane float broke on take-off, submerging the plane up to its wings. Three passengers narrowly escaped drowning.

Fokker aircraft used for the Hudson Strait expedition on the beach at *Kangirsukallak*, August 30, 1928
Credit: Canada Library and Archives, PA-123500

Independent Trading Post Established at *Salluit Itivia*

With the monopoly on trading in northwest Ungava held by the Cap Wolstenholme trading post, and Revillon Frères and HBC trading posts operating in the east at Kangiqsujuaq, *Salluit Itivia* (Fjord de Salluit) became the site for an independent trading post in **1924.** Managed by Herbert Hall, also called *Isumataaluk* ("the smart one"), and Solomon Ford, known as *Salamonie*, the business competed directly with the Cap Wolstenholme trading post since many of its clients travelled regularly between Salluit and *Kangirsukallak*. The HBC reacted quickly by opening a new establishment the following summer at *Salluit Tulliit* (Baie Déception), naming it Sugluk East. Chesley Russell, the first director of this post, was nicknamed *Aupartuapik,* meaning "red", in reference to his red nose. Still today, the word *Aupartuapik* is used to designate the trading post's location in memory of this employee. Hall and Ford were ferocious competitors of the HBC and offered high prices for fox fur.

Trader Herbert Hall at Sugluk in the summer of 1937.

Left: Isumaataluk and Salamonie at Igluligaarjuk (Chesterfield Inlet, Nunavut) in 1916
Credit: Copeland, D. 1985. *Coplalook: Chief Trader, Hudson's Bay Company, 1923-1939.* McGill-Queen's Press, Montréal and Kingston: Arctic Institute of North America. p. 24.
Right: Isumaataluk at *Salluit Itivia* in 1937.
Credit: Stevenson, A. 1975. *Arctic Fur Trade Rivalry*. August 1975. The Beaver. p. 49

In **1930**, the situation was such that the HBC decided to establish a second trading post closer to Hall and Ford at *Salluit Itivia*. Called Sugluk West, it was located on the west bank of the fjord. Sugluk East and West remained open for two years. When the former closed in **1942**, Sugluk West continued to operate however. In **1940**, after the deaths of Hall and Ford, Ford's brother tried to keep the post running but ultimately had to sell it to the HBC.

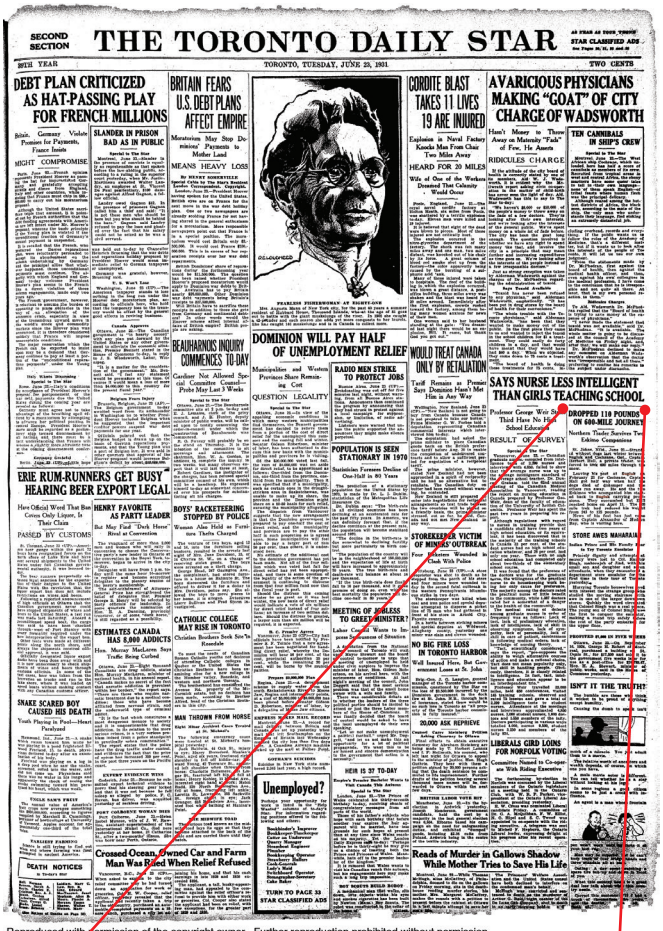
Herbert Hall was a legend in his own time. Extremely strong and very tall, he could reportedly carry a 45-gallon (170-litre) fuel tank. He was also known as the only *Qallunaaq* to have travelled from Hudson Strait to Ontario. Reporting on the expedition on June 23, 1931, the *Toronto Daily Star* related that Hall had lost all his dogs between Sugluk (Fjord de Salluit) and Ontario and had to walk over 950 kilometres. He was accompanied by two Inuit who died during the expedition. Hall lost more than 100 pounds, dropping from 245 to 135.

Epidemics

In July **1928**, *Kangirsukallak* was the scene of an epidemic, which a visiting physician diagnosed as smallpox. The naval base at *Tujjaat* (Nottingham Island) was contacted and vaccines were dispatched. No deaths were linked to the epidemic, but it was followed in September **1928** by a serious flu epidemic causing several deaths. Many tombstones in the *Kangirsukallak* cemetery still bear witness to the devastation (see section X at the end of this document). Amongst them, tombstones of respected hunter Alaku Mark (September 14, **1928**) and his wife Napatsi (September 13, **1928**) mention that they were survived by seven children ages 1 to 12. The epidemic was exacerbated by lack of food and difficult living conditions. Weather conditions were especially unfavourable that fall and most tents were completely soaked.

Inuit camp near the Cap Wolstenholme trading post at *Kangirsukallak* in 1933

Credit: Max Sauer, Jr., Hudson's Bay Company Archives (ALBUM 1/33)



SECOND SECTION

THE TORONTO DAILY STAR

TORONTO, TUESDAY, JUNE 23, 1931

TWO CENTS

DEBT PLAN CRITICIZED AS HAT-PASSING PLAY FOR FRENCH MILLIONS

BRITAIN FEARS U.S. DEBT PLANS AFFECT EMPIRE

CORDITE BLAST TAKES 11 LIVES 19 ARE INJURED

AVARICIOUS PHYSICIANS MAKING "GOAT" OF CITY CHARGE OF WADSWORTH

SLANDER IN PRISON BAD AS IN PUBLIC

TEN CANNIBALS IN SHIP'S CREW

RIDICULES CHARGE

DOMINION WILL PAY HALF OF UNEMPLOYMENT RELIEF

WOULD TREAT CANADA ONLY BY RETALIATION

SAYS NURSE LESS INTELLIGENT THAN GIRLS TEACHING SCHOOL

BEAUHARNOIS INQUIRY COMMENCES TO DAY

RADIO MEN STRIKE TO PROTECT JOBS

ERIE RUM-RUNNERS GET BUSY HEARING BEER EXPORT LEGAL

HENRY FAVORITE AS PARTY LEADER

BOYS' RACKETEERING STOPPED BY POLICE

DROPPED 110 POUNDS ON 600-MILE JOURNEY

POPULATION IS SEEN STATIONARY IN 1970

STOREKEEPER VICTIM OF MINERS' OUTBREAK

ESTIMATES CANADA HAS 8,000 ADDICTS

CATHOLIC COLLEGE MAY RISE IN TORONTO

MEETING OF JOBLESS TO GREET PREMIER?

NO BIG FIRE LOSS IN TORONTO HARBOR

SNAKE SCARED BOY CAUSED HIS DEATH

MAN THROWN FROM HORSE

Unemployed?

20,000 ASK REPRIEVE

LIBERALS GIRD LOINS FOR NORFOLK VOTING

ISN'T IT THE TRUTH?

Crossed Ocean, Owned Car and Farm Man Was Razed When Relief Refused

Reads of Murder in Gallows Shadow While Mother Tries to Save His Life

DEATH NOTICES

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DROPPED 110 POUNDS ON 600-MILE JOURNEY

Northern Trader Survives Two Eskimo Companions

St. Johns, Nfld., June 23.—Stranded without dogs last winter between Sugluk and Cochrane, Ont., Captain Herbert Hall, a private trader, was forced to trek 600 miles through the snow.

Leaving his post at Sugluk on February 23 for Cochrane, Captain Hall got half way when half his dogs died of distemper and the others ran away. He and the two Eskimos who acompanied him started back to Sugluk carrying provisions. They succumbed but Hall reached home on April 11. The 600 mile trek had reduced his weight from 245 to 135 pounds.

News of his feat has just come from Captain Alexander of Hudson Bay, who is visiting here.

Toronto Daily Star article on Herbert Hall's dog sled expedition, published on Tuesday, June 23, 1931: "Dropped 110 Pounds on 600-mile Journey"

Source: Toronto Daily Star Archives (June 23, 1931)

Winter 1932-1933: Incidents at *Pujjunaq*

The winter of **1932-1933** was marked by violent events at *Pujjunaq* (Mansel Island) when Usuarjuk went mad and started threatening the members of his group, including his own family. His wife at that time Mary Ningiurmaani recounted how he would enter their igloo brandishing his firearm. After spending most of the winter terrorized by Usuarjuk, the group decided to kill him for the sake of everyone's safety. An entry in the Cap Wolstenholme trading post journal reports the incident, describing how the camp had felt so terrified since the fall that trapping activities were disrupted. In February, Usuarjuk shot in the direction of some men, threatening to kill them the following night. In response, three Inuit volunteered to prevent him from causing further trouble. The week after the death, the RCMP sent an inspector to the area. In view of the circumstances, the incident was closed without any charges being brought against the three men.

49th Parallel Filmed at *Kangirsukallak*

In **1940**, the British film *49th Parallel* was filmed in part at *Kangirsukallak*. It related the tale of a fugitive Nazi and involved a 170-foot German submarine. The *Toronto Daily Star* entertainment section reported that a real-life submarine had been exploded at *Kangirsukallak* by the Canadian Royal Air Force, which had leased one of its aircraft fsor the event. Several Inuit took part in the project and found it memorable. Sarah Qalingo recalled that the women had to work very quickly to sew all the costumes, mittens and parkas needed for the film.

Poster from the British film *49th Parallel*
Image retrieved from [https://en.wikipedia.org/wiki/49th_Parallel_(film)#/media/File:Forty_ninth_parallel_(1941).jpg]

Beginning of Centralization

In the early **1950s,** the market for fox fur plummeted, and a dramatic fall in caribou populations especially affected Ungava Bay communities. However, Inuit along Hudson Strait had access to marine food resources to fall back on. The Cap Wolstenholme trading post continued to operate at *Kangirsukallak* although the main camp had moved to Ivujivik. Because of this change, Catholic Oblates established a mission at Ivujivik in **1938**. The Catholics had arrived eight years earlier at *Salluit Itivia* (Fjord de Salluit), where they had also established a mission. The centralization of communities in northwest Ungava was completed in the mid-**1950s** with the establishment of Anglican missions and federal schools. Families were compelled to remain in the communities close to the schools or risk losing their family allowances. Shortly after, as Québec assumed the administration of northern Québec, the RCMP set up detachments in the communities and was followed by the Sûreté du Québec in the **1960s**.

James Bay and Northern Québec Agreement and *Inuit Tungavingat Nunamini*

During the latter half of the 20th century, the cooperative movement in Nunavik gained traction with the opening of a cooperative in Ivujivik in **1967** and another in Salluit

Anglican church in Salluit, 1965
Credit: Claude Hamelin. Avataq Cultural Institute. Claude Hamelin Fonds, IND-HAM C-066

Right to left: Isiulak Parr, Keatainak Cameron and Paul Alaku near a school in Salluit, 1957
Credit: Margery Hinds. Avataq Cultural Institute. Margery Hinds Fonds, MH-14

Group in Salluit, between 1950 and 1960
Credit: Father Kees Verspeek, OMI. Avataq Cultural Institute. Father Kees Verspeek Fonds. IND-VER-119

Winter village in Ivujivik, 1950s
Credit: Father Lechat, OMI. Avataq Cultural Institute. Father Lechat Fonds, IND-PL-156

the following year. This movement was instrumental in mobilizing and politicizing Inuit communities. The stage was set for battles with the province over control of the territory and the hydroelectric potential of its vast bodies of water, in particular the major project at La Grande. The battle culminated in the signature of the JBNQA in **1975**. During the negotiation of the agreement, tension was rife between some communities. Believing that Inuit should form their own government, the communities of Puvirnituq and Ivujivik did not sign the JBNQA in 1975, and instead banded with some Salluit residents to found a movement called *Inuit Tungavinga Nunamini* (Mitchell, 2014; Makivik Corporation, 2015). In their view, Inuit should not have to divide their lands into categories and give up their rights at any price. More recently, several additional agreements have been signed, and Ivujivik officially entered into the JBNQA in **2015**.

PARC NATIONAL ILUILIQ PROJECT

Toponymy

Study area

Inuit toponym

Note : This map must be consulted with table 5.1

Source : Avataq Cultural Institute (2015)

Map Scale : 1:400 000

0 5 10 20 km

Ivujivik

Salluit

Kangiqsujuaq

Akulivik

Quaqtaq

Puvirnituq

Kangirsuk

Ungava Bay

Labrador Sea

Aupaluk

Inukjuak

Tasiujaq

Kangiqsualujjuaq

Hudson Bay

Kuujjuaq

Umiujaq

Kuujjuarapik

55e parallèle

Geodetic datum : NAD 83

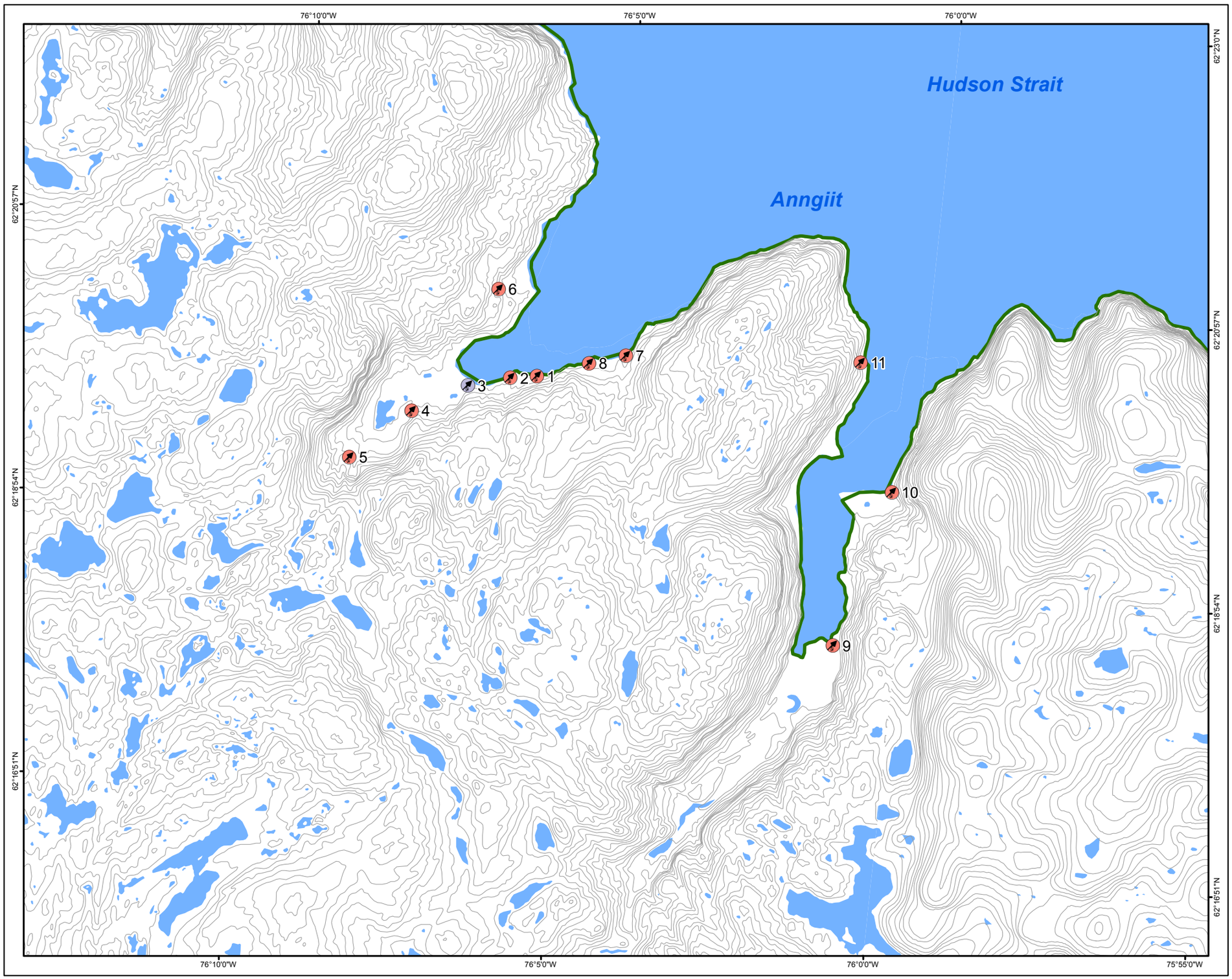
Coordinate system : Québec Lambert

August 2018

Map 5.1

Toponymy

Map 5.1



PARC NATIONAL
ILUILIQ PROJECT

Archeological Sites
Sector :
Anngiit

Study area

Archeological sites (culture and period)

- Historic
- Inuit
- Inuit-Recent Historic
- Pre-Dorset

Note : Must be consulted with table 5.2

Source : Avataq Cultural Institute (2015)

Map Scale : 1:50 000

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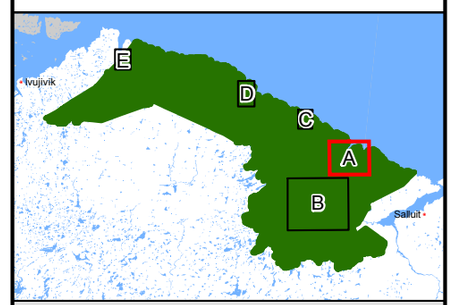


Geodetic datum : NAD 83
Coordinate system : Québec Lambert

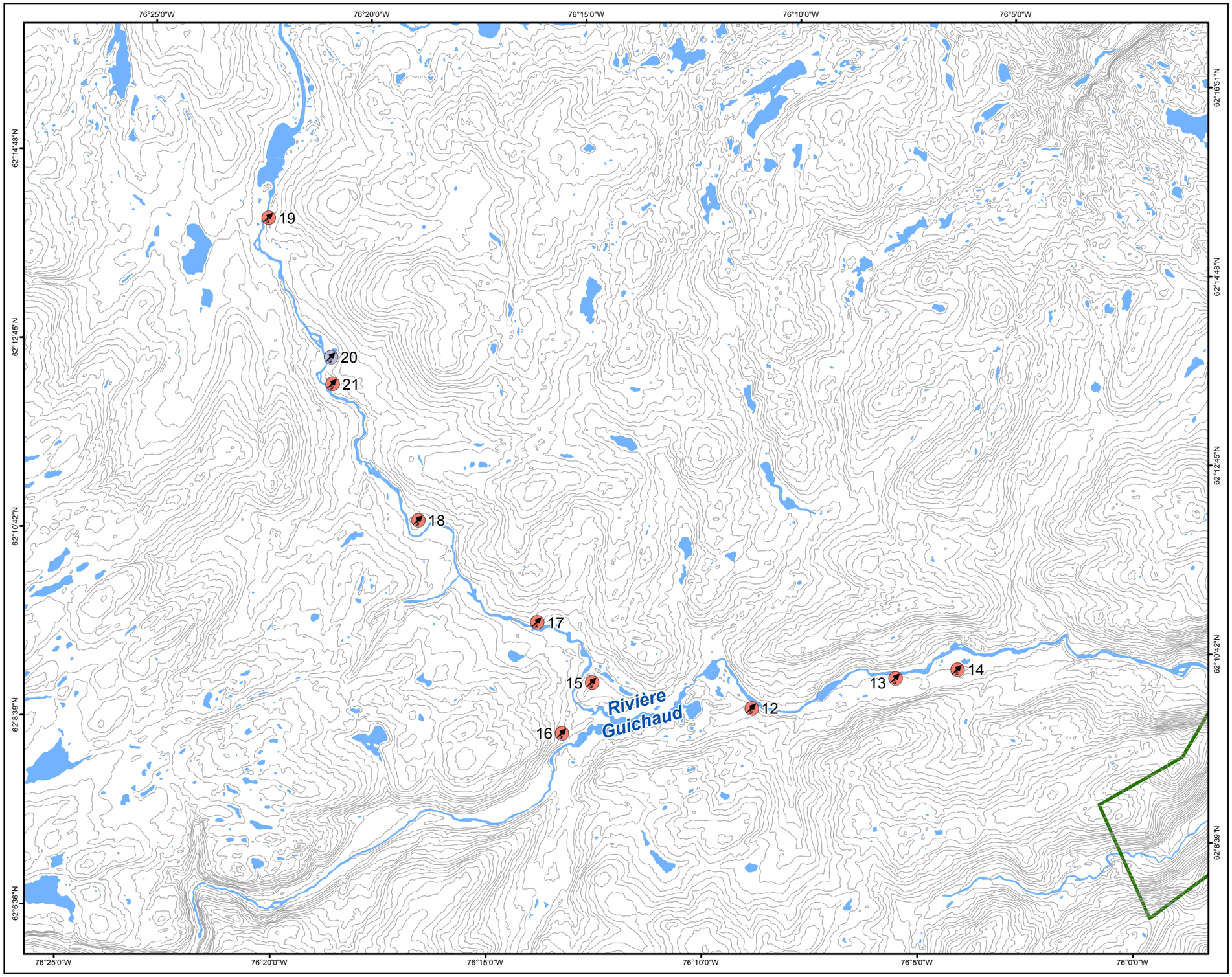
KATIVIK

August 2018

Map-5.2A

Archeological Sites
Sector: *Anngiit*

Map 5.2-A



PARC NATIONAL
ILUILIQ PROJECT

Archeological Sites
Sector :
Kuuruk

Study area

Archeological sites (culture and period)

- Historic
- Inuit
- Inuit-Recent Historic
- Pre-Dorset

Note : Must be consulted with table 5.2

Source : Avataq Cultural Institute (2015)

Map Scale : 1:75 000

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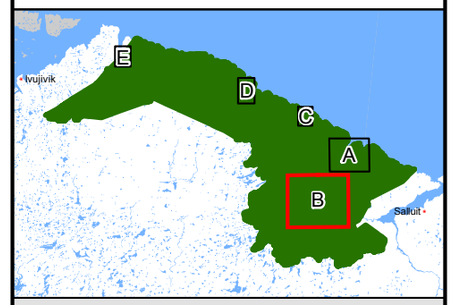


Geodetic datum : NAD 83
Coordinate system : Québec Lambert

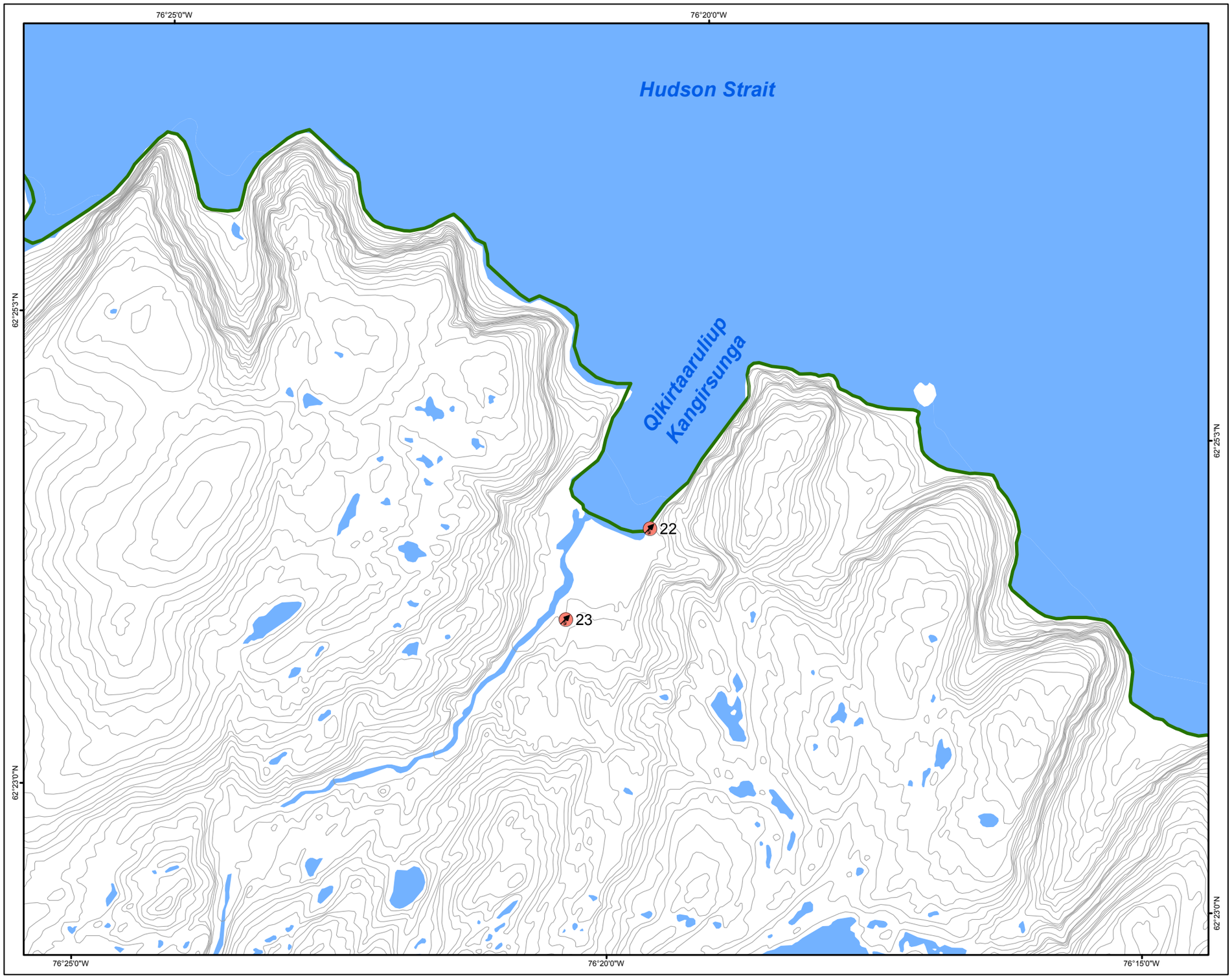
KATIVIK

August
2018

Map-5.2B

Archeological Sites
Sector: *Kuuruk*

Map 5.2-B



PARC NATIONAL
ILUILIQ PROJECT

Archeological Sites
Sector :
Qikirtaaruliup Kangirsunga

Study area

Archeological sites (culture and period)

- Historic
- Inuit
- Inuit-Recent Historic
- Pre-Dorset

Note : Must be consulted with table 5.2

Source : Avataq Cultural Institute (2015)

Map Scale : 1:30 000

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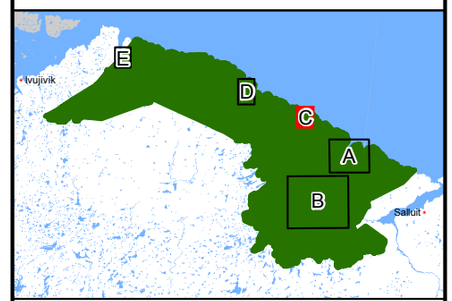


Geodetic datum : NAD 83
Coordinate system : Québec Lambert

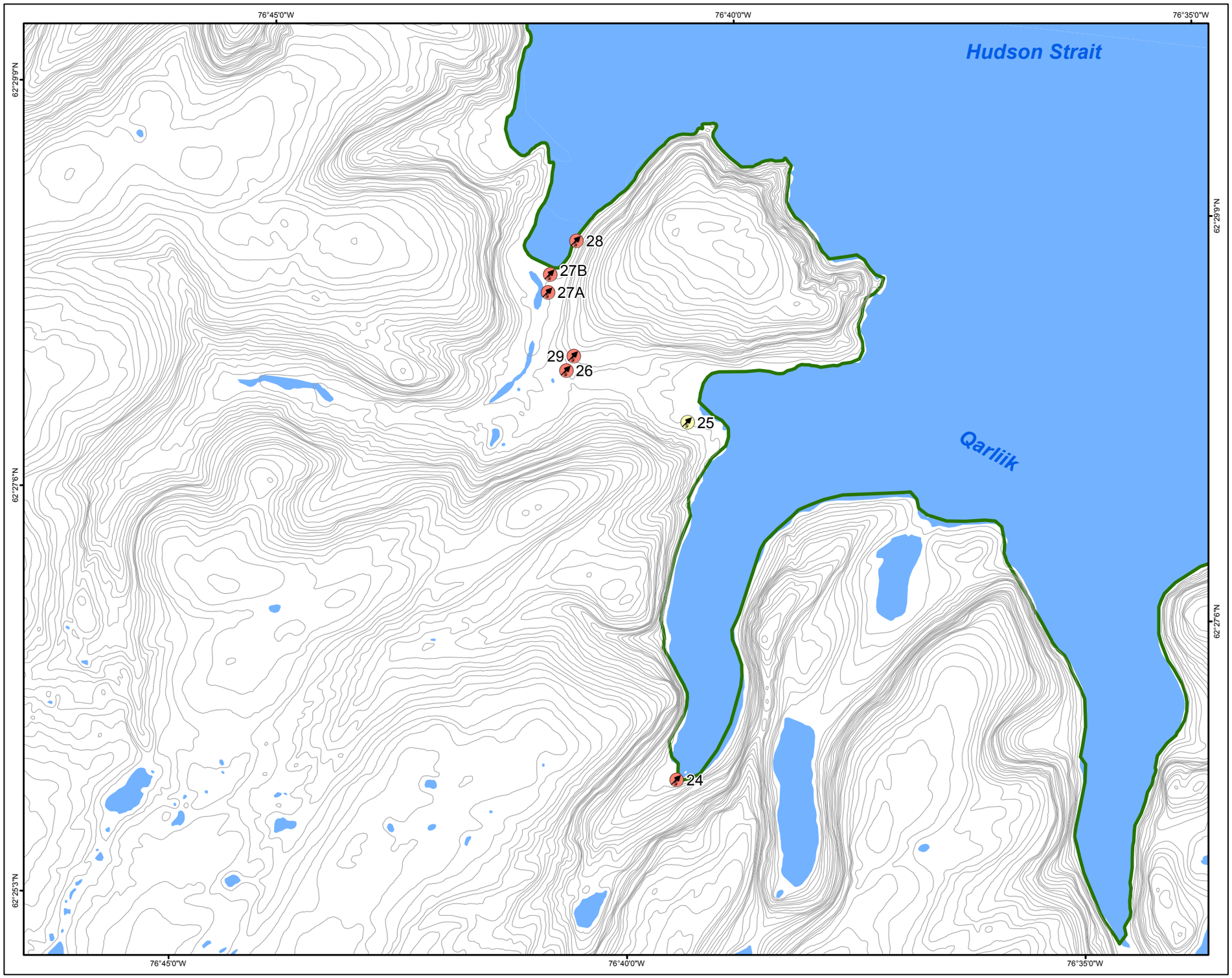
KATIVIK

August
2018

Map 5.2C

Archeological Sites
Sector: *Qikirtaaruliup Kangirsunga*

Map 5.2-C



PARC NATIONAL
ILUILIQ PROJECT

Archeological Sites
Sector :
Qarliik

Study area

Archeological sites (culture and period)

- Historic
- Inuit
- Inuit-Recent Historic
- Pre-Dorset

Note : Must be consulted with table 5.2

Source : Avataq Cultural Institute (2015)

Map Scale : 1:35 000

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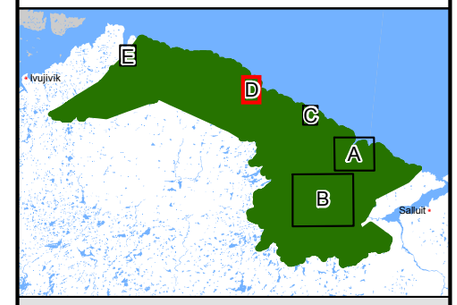


Geodetic datum : NAD 83
Coordinate system : Québec Lambert

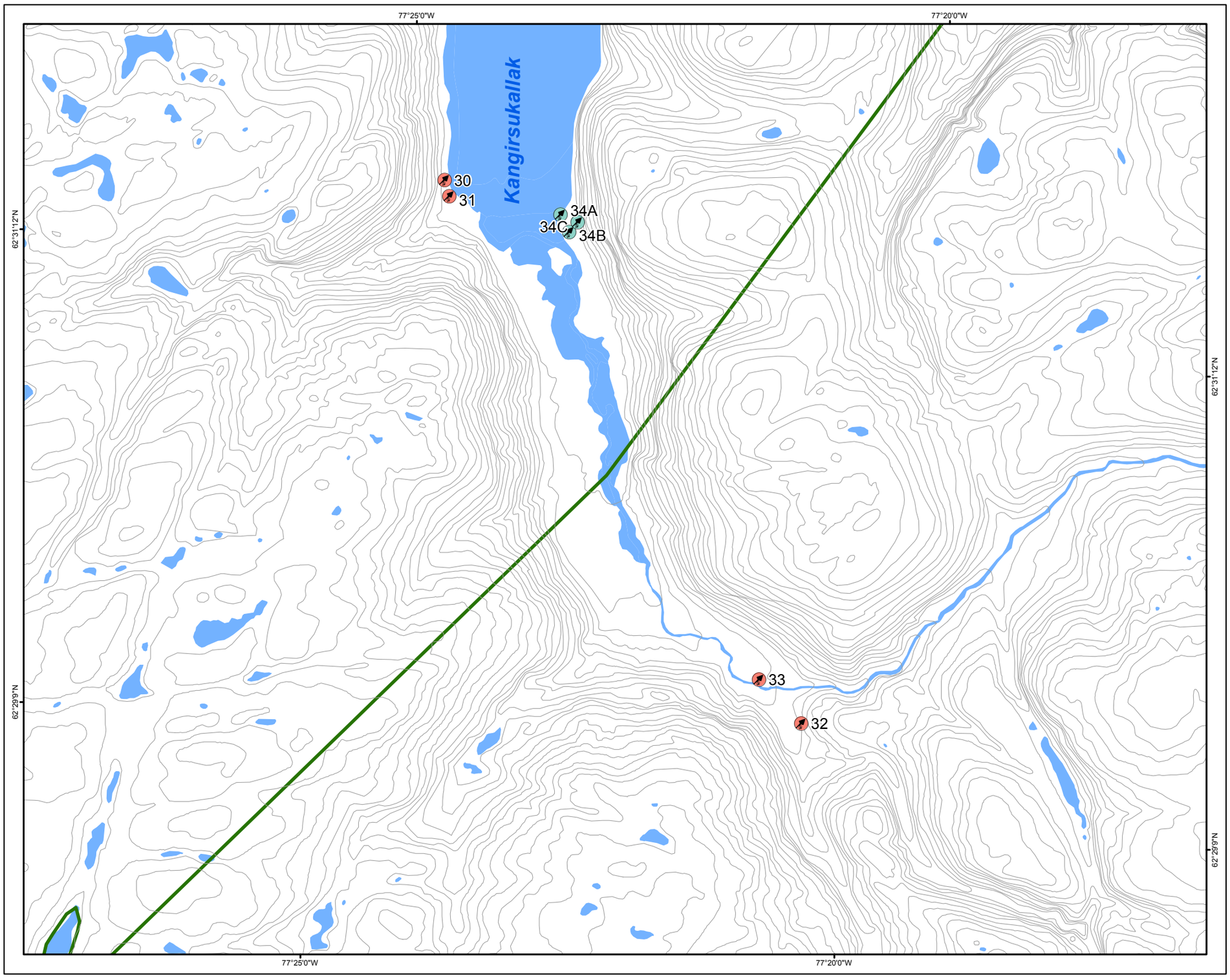
KATIVIK

August
2018

Map 5.2D

Archeological Sites
Sector: *Qarliik*

Map 5.2-D



PARC NATIONAL
ILUILIQ PROJECT

Archeological Sites
Sector :
Kangirsukallak

Study area

Archeological sites (culture and period)

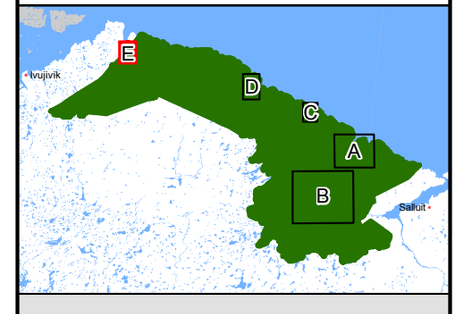
- Historic
- Inuit
- Inuit-Recent Historic
- Pre-Dorset

Note : Must be consulted with table 5.2

Source : Avataq Cultural Institute (2015)

Map Scale : 1:30 000

0 500 1 000 2 000 m



Geodetic datum : NAD 83
Coordinate system : Québec Lambert

KATIVIK

August
2018

Map 5.2E

Archeological Sites
Sector: *Kangirsukallak*

Map 5.2-E

6 CULTURAL AND NATURAL HERITAGE PROTECTION

Mature cirque east of *Kangirsukutaak*
Credit: Benoit Tremblay

The study area for the Parc national Iluiliq Project possesses some truly spectacular landscapes: sheer 400m high cliffs, a broad raised peneplain towering over Hudson Strait, and breathtaking coastal fjords. These diverse environments nurture a unique biodiversity and contain numerous remnants of a compelling history, both in terms of geology as well as historic and contemporary human occupancy. The characteristics of this territory that is representative of the Hudson Strait Fjord Coast natural region demonstrate the study area for this park project is an important region to protect.

The study area continues to display to this day signs of the last glaciation and marine transgression. Many geological and geomorphological phenomena combine with dynamic factors to shape the territory. These landscapes are in fact constantly evolving in the bitterly harsh arctic climate, which nonetheless is currently subject to a warming trend. The various ecosystems of the study area possess distinct wildlife and plants, including species that are rare, at risk or unique to the region, even iconic with reference to the thick-billed murres that nest in a large colony. Although outside the study area, Cap Wolstenholme (Anaulirvik) also possesses ecosystems of interest that have a definite influence on elements of the study area (refer to Section 4: Biological Environment under the heading Food Chain and Dynamics of the Cliffs at Anaulirvik for an explanation of the influence of the thick-billed murre colony on its surroundings). Finally, the particular importance of the Rivière Guichaud and the Rivière Narruniup Kuunga to the communities of Salluit and Ivujivik explains the inclusion in whole or in part of their drainage basins in the study area.

The following section provides an overview of sectors of particular interest in this vast territory.

SECTORS OF INTEREST IN THE STUDY AREA

In the study area, five sectors of interest have been identified according to outstanding elements of their physical, biological and human heritages. Map 6.1 shows these sectors, while their main elements of interest are listed in Table 6.1. The thematic maps and information concerning these sectors of interest contained in the preceding sections may be consulted for further details.

RIVIÈRE GUICHAUD (*KUURUK*) SECTOR

The u-shaped, roughly forty-kilometre valley of the Rivière Guichaud is the largest glacial valley with a fjord in the study area. The main branch of this river and its many tributaries have cut deeply into the plateau. With

Canyon in the Rivière Guichaud (*Kuuruk*) Sector
Credit: Alain Thibault

its upstream canyon, this river was a traditional route followed by Inuit travelling inland from the coast. Almost the entire drainage basin of the Rivière Guichaud (96.6%) is encompassed in the study area. This sector covers just over one third of the study area, i.e. 860 km^2. The portion of the drainage basin located outside the study area is part of Salluit Category I lands.

Marine transgression submerged the valley of the Rivière Guichaud to an elevation of 122 m and created many deltaic deposits. Thick deposits are in fact still visible along the protected slopes of the valley. Both deep and wide, the valley possesses milder climate conditions for vegetation, with a thermal regime that is more favourable for plants, contributing in part to their diversity in the study area. In addition, the lower Rivière Guichaud, with southerly exposed slopes and the gentlest climate in the study area, possesses communities of shrubs measuring a few metres high (Tremblay, 2016). This sector also nurtures diverse wildlife, in particular mammal species. In fact, several local place names make reference to wildlife. For example, *Amarurtuuliariaq* identifies a traditional travel route and means "where there are many wolves" and *Iqaluttuuq*, the name of a lake, means "there are always fish". Caribou may also be observed frequently: several individuals were sighted during fieldwork conducted in the study area.

The valley of the Rivière Guichaud is also culturally rich: 10 archaeological sites associated with Inuit culture (750 years BP to the historic period), from ancient to recent according to appearances, have been identified in the sector. For their part, glaciomarine deltas form natural travel routes, which fostered the sector's frequent use and occupation. The sector also possesses many place names referring to the use of the territory. Depending on the season, caribou hunting, fox trapping and fishing are frequently carried out in the sector. The Fjord de Salluit is popular for clam digging. The Rivière Guichaud is accessible from the Fjord de Salluit which, unlike the coast of the study area, is sheltered from the exposed marine conditions of Hudson Strait. Access is therefore less dependent on the weather, although it is difficult for large boats to reach the head of the Fjord de Salluit and rapids on the Rivière Guichaud make navigation challenging. The Rivière Guichaud is best accessed by freighter canoe at high tide. Notwithstanding, travel upstream on the Rivière Guichaud is possible for only a short distance. In winter, the river provides a route to the snowmobile trail linking the communities of Salluit and Ivujivik.

ANNGIIT SECTOR (EAST AND WEST INLETS)

The Anngiit sector, including its east and west inlets, is a sector of interest in the study area for the park project. Both inlets are of geomorphological interest: the first

View of Anngit Bay East
Credit: Benoit Tremblay

comprises a glacial valley with a fjord and upstream deltas. The second is a mature cirque that measures roughly 1.2 km wide at its mouth and possesses a magnificent cascade at its head. Dating performed on buried shells in the first inlet has established that the events that shaped the landscape occurred more than 7,050 years ago.

During fieldwork in this sector, botanists discovered a number of species of interest. In the eastern part of the sector, a vascular plant species likely to be designated threatened or vulnerable in Québec was identified: Potentilla valhiana. In the western part of the sector, two vascular taxa likely to be designated threatened or vulnerable in Québec were identified: Poa hartzii subsp. hartzii and Potentilla vahliana. It is also notable that surveying work carried out in 2015 added a species to the list of vascular plants in Québec: Draba arctica subsp. ostenfeldii. In addition, the west inlet at Anngiit possesses an outstanding ecosystem. The deep-sea glaciomarine deposits are rich in calcium carbonate, remnants of marine transgression. Mainly found along the slopes of the west inlet at Anngiit, they are in fact basophilous enclaves in a mostly acidic environment, contributing to the growth of unique plants. Such conditions are rare and isolated in the study area and even in Nunavik. As evidenced by the place names around these inlets, gulls are known to nest on the cliffs. Several caribou were observed during fieldwork, as well as harp seals and thick-billed murres.

The two inlets at Anngiit are today very popular with Salluimiut, especially for caribou, beluga and seal hunting. A cabin has been erected at this site and there is a pebble beach known as Qilalukkisiivik, meaning a "place to wait for whales". Both inlets also possess remnants of past human occupation. Three Inuit-culture archaeological sites have been identified in the east inlet, and eight in the west inlet.

The two inlets in this sector are easily accessible from Salluit: in winter, travel by snowmobile to the east inlet takes approximately one hour while, in summer, travel by boat takes a little more than one hour. The west inlet is about thirty minutes further on. Secure anchoring is possible, sheltered from the adverse conditions of Hudson Strait. Anngiit has good potential for the practice of recreational tourism activities. Terraces in each inlet are suitable for the construction of infrastructure needed for the future park. The sector may not however be accessible by airplane. A flyover of the sector confirmed the impossibility of developing an airstrip in the west inlet. As for the east inlet, evaluation will need to be carried out by a qualified pilot to validate the feasibility of an airstrip.

BAIE QIKIRTAARULIUP KANGIRSUNGA SECTOR

The valley upstream from Baie Qikirtaaruliup Kangirsunga possesses impressive raised beaches produced by the Tyrell Strait transgression and the isostatic uplift of the continent

Impressive raised beaches in the Qikirtaaruliup Kangirsunga Sector
Credit: Alain Thibault

following the retreat of these waters. A juvenile cirque is also considered a site of geomorphological interest in this sector. It has a typical bowl shape, very rocky stepped terraces, and it contains a lake. Cliff erosion in this sector reveals very visible dykes.

One taxa likely to be designated threatened or vulnerable in Québec, Potentilla vahliana, was identified in the sector during plant surveying conducted in 2015. The unusual occurrence of a hybrid with this species that is also likely to be designated threatened or vulnerable in Québec was inventoried: Potentilla vahliana X Potentilla arenosa subsp. chamissonis.

Two archaeological sites belonging to Inuit culture have been identified in this sector. In the valley, Inuit place names provide evidence of ancient use of the territory. For example, the place name Qikirtaaruliup Tupirvituqaaluttalinga refers to "an old, worn campsite" and the place name Tinujjaumavik at the mouth of the river in the valley means a "place to wait for the tide to come in".

The beauty of the landscapes at Baie Qikirtaaruliup Kangirsunga represents a special attraction in this sector: surrounded by clearly defined raised beaches, the turquoise waters are breathtaking on a sunny day. Approximately two hours from Salluit by boat, the bay is well protected from the sometimes adverse conditions of Hudson Strait and shore landings are possible. Access by airplane however has been ruled out, since an airstrip can not be built here. The bay offers good potential for the development of hiking trails and infrastructure for park activities. In addition, drinking water sources are present on both sides of the bay.

BAIE QARLIIK SECTOR

Considering its physical, biological and human components combined, Baie Qarliik is likely the sector that possesses the largest number of elements of interest in the study area. Qarliik, meaning a "pair of pants", refers to the leg shapes formed by the two inlets comprising this sector. Seven sites of geomorphological interest have been identified. Among these, two juvenile cirques are noteworthy: the first small cirque is situated in the glacial valley of the bay east of

View from the crest of Baie Qarliik
Credit: Alain Thibault

Cap Pachot and the second, which has a typical bowl shape, is part of the landscape adjoining *Qarliik Kuunga*. Three mature cirques are also included among the sector's sites of geomorphological interest. The first, which stretches about 1.3 km across at its mouth, is located east of Cap Pachot, and the stream cutting through the cirque wall is a unique feature. The second cirque is s-shaped and includes a large flooded zone in the western inlet of Baie Qarliik. Known as *Qarliik Qaninnisaq*, it is 18 times longer (7.2 km) than it is deep (400 m). The third cirque, located in the eastern inlet of Baie Qarliik and called *Qarliik Ungasinnisaq*, is very narrow and its upstream walls are severely eroded and notched. Between the two inlets of Baie Qarliik, a stepped cirque is also considered a site of geomorphological interest. It possesses three levels with lithological contact occurring between each. In addition, between the second and third levels, a waterfall flows over a nick point and connecting talus. Finally, the seventh site of geomorphological interest is a hanging u-shaped glacial valley, abutting a mature cirque. The flat floor of this valley is carpeted with deep-sea marine sediments. The valley's upstream walls have an irregular convex shape while downstream they are more regular. The valley cuts into the plateau over a distance of more than 300 m inland.

This sector of interest contains three outstanding ecosystems based on deep-sea glaciomarine deposits rich in calcium carbonate, remnants of marine transgression. As is the case with the western bay at Anngiit, these deposits are rare basophilous enclaves in the study area. More specifically, one enclave is located in the hanging valley east of the eastern inlet of Baie Qarliik. A second is located in the stepped cirque between the two inlets of the bay, while the third is located within the bay at *Qarliik Kuunga*. Regarding the plants in this sector, the identification of seven taxa likely to be designated threatened or vulnerable in Québec is especially notable: *Cerastium arcticum*, *Draba cayouetti*, *Draba corymbosa*, *Draba subcapitata*, *Epilobium arcticum*, *Poa hartzii* subsp. *hartzii* and *Potentilla vahliana*. It is also noteworthy that, in the study area, the only occurrence of *Draba cayouetti*, a plant endemic to the Ungava Trough, is in this sector. This species is also rare around the globe. Finally, it must be mentioned that *Draba subcapitata* is in the process of being legally designated a vulnerable species in Québec.

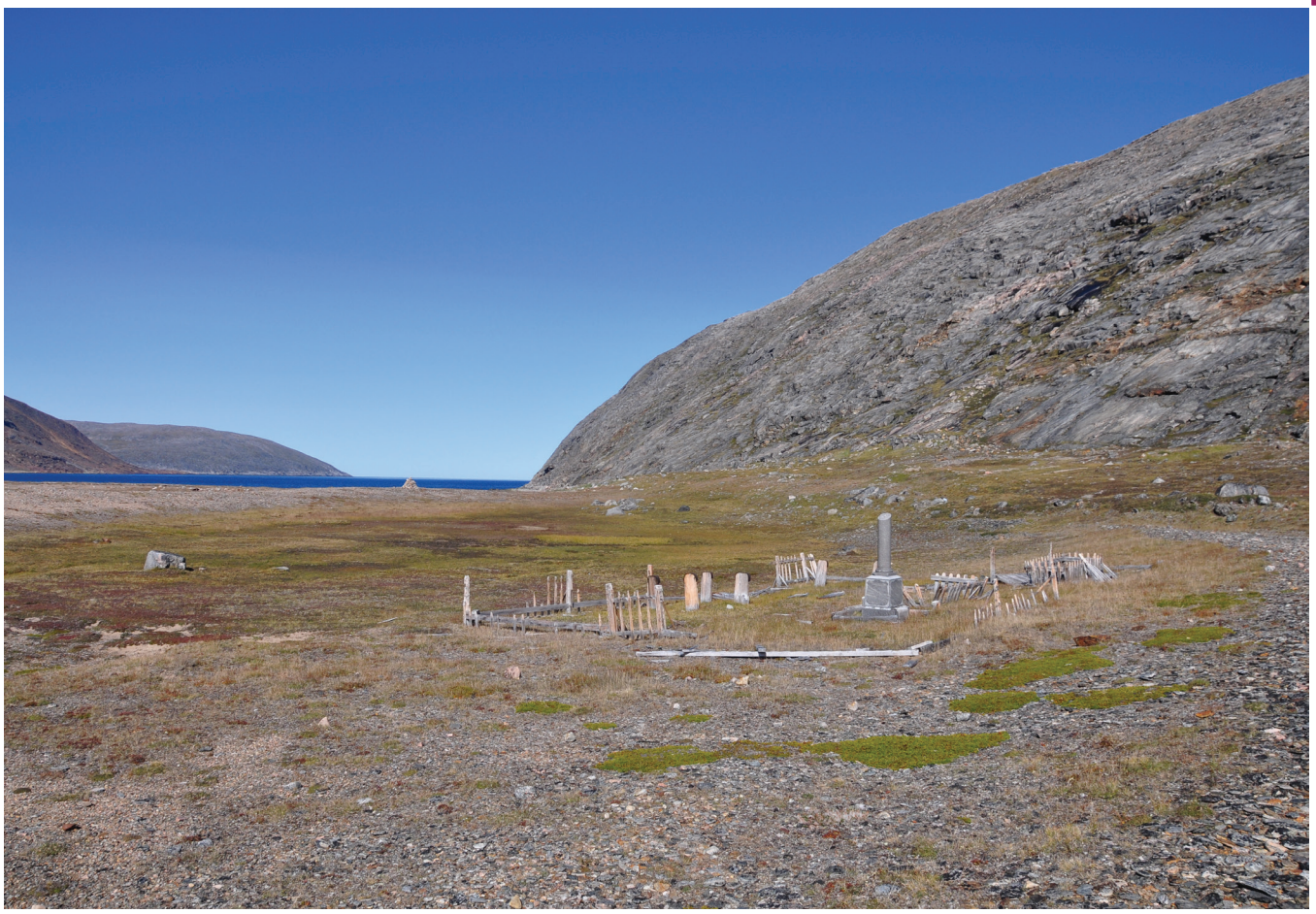
Culturally speaking, this sector is especially rich. Six archaeological sites dating from the historic period have been inventoried, including a pre-Dorset site from at least 2,500 years BP. This is the only site known in the study area belonging to this culture. It is located near Qarliini, in a bay next to the western inlet of Baie Qarliik. Several artifacts have been found at this site: chisels, scrapers, shards, etc. It should be pointed out that very few pre-Dorset sites have been identified along Hudson Strait. In this sector, the place name Qarliik Kisarvinga, meaning "Qarliik's anchorage" that designates a bay next to the western inlet of Baie Qarliik, provides evidence of the occupation of the territory. In addition, the sector is very popular with the residents of Salluit and Ivujivik for the practice of traditional activities, including seal hunting, since this animal is abundant in the sector.

Midway between Salluit and Ivujivik, the Baie Qarliik sector is accessible, frequented and used by the residents of both communities. It possesses majestic landscapes and is the hub of the study area. The recreational tourism potential of this sector clearly justifies its designation as an area of interest in the study area. This potential is in fact very strong: hiking, kayaking and infrastructure construction are all possible. During fieldwork carried out in 2017, the team validated a hiking trail along the ridge between the two inlets, next to the stepped cirque, offering a breathtaking view of the western inlet of Baie Qarliik. This roughly five-kilometre, 300-m vertical hike takes two hours and is accessible to a wide public. Regarding access to the sector by sea, it is important to consider that the bottoms of the two inlets of Baie Qarliik are littered with many rocks and the inlets are narrow with steep walls: anchoring is therefore not ideal. However, shore landing is possible at Qarliik Kisarvinga, adjoining the west arm of Baie Qarliik. The construction of infrastructure would also be possible in this sector. From Qarliik Kisarvinga, a hiking trail for various categories of hikers could be developed to reach *Qarliik Kuunga*, a rich valley possessing a juvenile cirque, plant habitats of interest and a few archaeological sites. A flyover of the sector nevertheless confirmed that the construction of an airstrip would be impossible.

BAIE KANGIRSUKALLAK SECTOR

The valley and fjord at Kangirsukallak are a site of geomorphological interest. The upstream section of the v-shaped valley connects three tributaries at a confluence zone known as Salluliariaq. Downstream, the valley expands to a u-shaped valley, 460 m wide. Upstream of the confluence zone are major deltas; the heavy erosion of the fluvial terraces is noteworthy. In this sector, the place name Aupartualuk refers to the red-tinted cliffs on the east shore of the bay. From this point to Cap Wolstenholme (Anaulirvik), a significant change in the depth of Hudson Strait produces challenging navigational conditions (waves, currents, eddies, whirlpools, etc.) for vessels.

The spectacular Cap Wolstenholme (Anaulirvik) is the nesting site of hundreds of thousands of thick-billed murres, a key species in this ecosystem. Murres carry a significant quantity of nutrients from the sea to the land. First, the large amounts of guano produced by these birds represent a considerable contribution of nitrogen and phosphate, two



View of the cemetery at *Kangirsukallak*
Credit: Alain Thibault

natural fertilizers that influence local plant growth. The impacts may be observed up to roughly 275 m inland from the cliffs. Nutrients are also introduced into the terrestrial environment via food extracted by thick-billed murres from the sea to feed themselves or their nestlings and that may be dropped or abandoned. As well, murres (their eggs, nestlings and even adults) may themselves become the prey of terrestrial predators. In addition to the huge colony of thick-billed murres, peregrine falcons, gulls, caribou and belugas may also be observed in this sector. Residents of the community of Ivujivik also use this sector, particularly at Kangirsukallaup Nuvua for beluga hunting. It is also interesting to note that Kangirsukallak is known for the size of its blueberries. It is therefore a popular picking site for the residents of Ivujivik.

The human occupation of this sector is based on a gripping narrative. Several place names refer to the use of the territory: Kuuk Umiakkuvik means the "river for boats", which is to say a place to land on shore; Qilalukkisiivik, the name of a camp, means a "place to wait for whales"; Umiarjuap Imirtavinga meaning "Umiarjuaq's water tending place" refers to a freshwater source; Umiarjuaq means a "huge boat; ship"; and Salluliariaq refers to a river "leading to Salluit". As well, Kampanirtaliviniq, meaning "it had the Company", refers to the site of the former trading post at Cap Wolstenholme that was in operation from 1909 to 1947. The buildings at this site however were dismantled to permit reuse of the materials and, today, only a few remnants bear witness to this past period: ceramic dishware, metal engine parts, a walrus skull, etc. Two large metal hooks well anchored in the ground, about 20 m apart, also remain. They would have been used to moor large vessels during the trading-post period. An onsite cemetery with a still functional gate contains 15 graves and an old monument topped with a cross. A dugout structure not far from the cemetery probably served as a storage place for various goods and food. Finally, a commemorative cairn was erected in 1935 to mark the site of the former trading post. Four Inuit culture archaeological sites have been identified in the sector. The place name Inuit Nunaviningat, meaning

"Inuit's old land", refers to an area which may have some archaeological potential. Unfortunately, it could not be explored during 2015 fieldwork.

This sector is bursting with recreational tourism potential. Although the largest portion of this sector is outside the study area, future visitors to the park will consider the entire sector a must-see. Considering the historic importance of the former trading post at Cap Wosltenholme as well as the distinct ecological element represented by the colony of thick-billed murres, this sector must be taken into account as a special attraction of the national park project. The cliff landscapes are spectacular and the potential for hiking in this sector is strong, in particular to reach and observe the nesting cliffs of the thick-billed murre. This sector is moreover easily accessible from Ivujivik: less than two hours by boat. However, marine conditions of Hudson Strait can present unforeseeable constraints to navigation.

NEXT STEPS TOWARDS THE CREATION OF THE PARK

Following the publication of this status report and based on the wealth of knowledge it contains, a provisional master plan for the Parc national Iluiliq Project will be produced by the Ministère des Forêts, de la Faune et des Parcs (forests, wildlife and parks, MFFP) (Figure 1.2). One purpose of this document will be to inform the general public about the park project development proposal. The provisional master plan will provide a summary description of the main development opportunities and constraints in the study area for the park project, as well as propose boundaries for the future Parc national Iluiliq. It will also present the management orientations for the protection and development of the park, a zoning plan and a development scenario. The provisional master plan will support the general public to provide feedback at public

View of the northern point of Québec *Anaulirvik*
Credit: Alain Thibault

View of Puijisiurvik an intermediate cirque in the study area for the Parc national Iluiliq
Credit: Alain Thibault

hearings and will be prepared in collaboration with the park project working group.

In parallel, the Kativik Regional Government (KRG) has a mandate to prepare an environmental and social impact study and an economic impact study that will be subject to the environmental assessment procedure established under the *James Bay and Northern Québec Agreement* (JBNQA). Accordingly, the documents will be submitted to the JBNQA administrator who will transmit them to the Kativik Environmental Quality Commission (KEQC). Public hearings organized by the MFFP (pursuant to the *Parks Act*) and by the KEQC (pursuant to the JBNQA) will be organized in the concerned communities to afford the general public an opportunity to express their opinions on this park project (Figure 1.2). Subsequently, Parc national Iluiliq could become the fifth national park established in Nunavik, along with Parc national des Pingualuit created in 2004, Parc national Kuururjuaq created in 2009, Parc national Tursujuq created in 2013 and Parc national Ulittaniujalik created in 2016.

Table 6.1 Specific Elements of the Sectors of Interest in the Study Area

SECTOR OF INTEREST	PHYSICAL ENVIRONMENT	BIOLOGICAL ENVIRONMENT
1- Rivière Guichaud (*Kuuruk*)	– Site of geomorphological interest: the largest glacial valley with a fjord in the study area: roughly 40 km long to the fjord. – The u-shaped valley cuts deeply into the plateau of the study area: the main watercourse and many tributaries produce a dendritic pattern. – A canyon is etched into the river's upstream section. – Marine transgression submerged the valley of the Rivière Guichaud to an elevation of 122 m, forming many deltaic deposits. – The drainage basin of the Rivière Guichaud covers 39% of the study area, i.e. 860 km^2 (96.6% of the river's total drainage basin is encompassed in the study area).	– The valley of the Rivière Guichaud is wide and deep; its predominantly east–west axis gives certain slopes a southerly exposure. The valley possesses milder climate conditions for vegetation, with a thermal regime that is more favourable for plants. – Thick deposits along the protected slopes of the valley. – An outstanding ecosystem, the valley of the Rivière Guichaud adds considerably to plant diversity in the study area. **Vascular plants:** – Shrub formations restricted to the valley of the Rivière Guichaud. **Nonvascular plants:** – Bryophyte added to the list of species in Québec: *Schistidium platyphyllum.* – A rare liverwort in Québec: *Jungermannia polaris.* – A new lichen in Québec: *Catillaria contristans.* **Wildlife:** – A black bear (*Ursus americanus*) was spotted in 2015. – Caribou (*Rangifer tarandus*) use this sector. – Many place names in this sector refer to wildlife species: *Amarurtuuliariaq* (a traditional route) — "where there are many wolves"; *Iqaluttuuq* (lake) — "there are always fish". – Various seal species are present. – Net fishing in the fjord: Arctic char and cod.

*LDTV: Likely to be designated threatened or vulnerable.

HUMAN OCCUPATION

- all 10 archaeological sites identified in this sector all belonging to Inuit culture and dating from ancient to contemporary periods of occupation.
- Glaciomarine deltas in this sector form natural travel routes, i.e. potential archaeological sites.
- Sector often used in the winter and spring for caribou hunting, fox trapping and mainly fishing.
- Sector with many place names referring to use: *Iqiattavik* (ice fishing site) — "jigging place"; *Nuluarniavik* (fishing site) — "place to net"; *Upirngasarsiutik* (traditional route) — "it is for spring"; *Ullugumitarvik* (shoreline) — "place to have supper".
- Clam picking in the Fjord de Salluit.

RECREATIONAL TOURISM POTENTIAL

- Sector accessible from Salluit; close to the village. The Fjord de Salluit is protected from the marine conditions of Hudson Strait; access to this sector is therefore less subject to weather conditions.
- Shoals in the Fjord de Salluit limit access by large boats. Many rapids on the Rivière Gichaud make navigation by freighter canoe difficult and the river is only accessible at high tide .
- The Rivière Gichaud is a traditional travel route. In addition, the snowmobile trail between the communities of Salluit and Ivujivik follows a section of the river.

Table 6.1 Specific Elements of the Sectors of Interest in the Study Area

SECTOR OF INTEREST	PHYSICAL ENVIRONMENT	BIOLOGICAL ENVIRONMENT
2-Anngiit Sector (East and West Inlets)	**Anngiit – East Inlet** – Glacial valley with a fjord, and a site of geomorphological interest. – Upstream deltas in the valley, near a break in the slope (widening of the valley). – Shells (*Hiatella arctica*) discovered in the valley have been dated to around 7,050 years BP (±150 years).	**Anngiit – East Inlet** **Vascular plants:** – 1 taxa LDTV*: *Potentilla vahliana.* **Nonvascular plants:** – A rare lichen in Québec: *Agonimia gelatinosa.* – A new lichen in Québec: *Sporodictyon terrestre*. **Wildlife:** – Gulls nest along a cliff at the mouth of the inlet: phenomenon confirmed by the place names for the cliff at the east inlet and a sector between the two inlets.
	Anngiit – West Inlet (*Anngiit Kuunga*) – Mature cirque of geomorphological interest measuring roughly 1.2 km wide at its mouth. – The eastern edge of the cirque (west-facing wall) corresponds to a lithological contact boundary. – A cascade is present at the head of the cirque.	**Anngiit – West Inlet (*Anngiit Kuunga*)** – Outstanding ecosystem: deep-sea glaciomarine deposits rich in calcium carbonate, remnants of marine transgression.. **Vascular plants:** – 1 new vascular plant in Québec: *Draba arctica* subsp. *ostenfeldii*. – 2 taxa LDTV* in Québec: *Poa hartzii* subsp. *Hartzii* and *Potentilla vahliana*. **Nonvascular plants:** – A rare lichen in Québec: *Myriolecis torrida*. – New lichens in Québec: *Arthonia lapidicola*, *Aspicilia cingulate* and *Caloplaca approcimata*. – A new lichen in Canada: *Polyblastia gothica*. **Wildlife:** – Observations in 2017: a harp seal (*Pagophilus groenlandicus*), a caribou and thick-billed murres (*Uria lomvia*). – Various species of gulls (*Larus* spp.) nest on the cliffs.

*LDTV: Likely to be designated threatened or vulnerable.

HUMAN OCCUPATION

Anngiit – East Inlet

- 3 Inuit archaeological sites identified in this inlet.
- Often used by the residents of Salluit for caribou, seal (various species) and beluga (*Delphinapterus leucas*) hunting.
- Cabin located on the western shore of the inlet.

Anngiit – West Inlet (*Anngiit Kuunga*)

- 8 archaeological sites identified in this inlet: all belonging to Inuit culture, although certain date from the period of early contacts with Europeans.
- Place name: *Qilalukkisiivik* — "place to wait for whales", designates the pebble beach on the west shore at the mouth of the inlet.
- Site used by the residents of Salluit for beluga and seal hunting.

RECREATIONAL TOURISM POTENTIAL

Anngiit – East Inlet

- Inlet located near Salluit (about 1 hour and 15 minutes away by boat).
- Safe site for anchoring, sheltered from the marine conditions of Hudson Strait.
- Level terraces at the head of the inlet adequate for the installation of park infrastructure and, possibly, the construction of an airstrip.
- Accessible in winter by snowmobile from Salluit (roughly a 1-hour journey).

Anngiit – West Inlet (*Anngiit Kuunga*)

- Approximately 15 to 20 minutes by boat from the east inlet at Anngiit.
- Sheltered from the marine conditions of Hudson Strait, although it is more difficult to anchor a large boat in this inlet.
- The head of the inlet is wide and pleasant for walking; there is adequate space for the installation of infrastructure.

Table 6.1 Specific Elements of the Sectors of Interest in the Study Area

SECTOR OF INTEREST	PHYSICAL ENVIRONMENT	BIOLOGICAL ENVIRONMENT
3- Baie Qirkirtaaruliup Kangirsunga	– Valley with a river flowing in its centre. – Spectacular raised beaches in the valley produced by the Tyrrell Strait transgression and isostatic uplifting that followed the retreat of these waters. – The juvenile cirque in the sector is a site of geomorphological interest: typical bowl shape, very rocky stepped terraces, and it contains a lake. – *Dyke formations on the cliffs*.	**Vascular plants:** – 1 taxa LDTV* in Québec: *Potentilla vahliana.* – 1 hybrid of taxa LDTV* in Québec: *Potentilla vahliana* X *Potentilla arenosa* subsp. *chamissonis.* – The only occurrence of *Potentilla vahliana* X *Potentilla arenosa* subsp. *chamissonis* in the study area is in this sector. **Nonvascular plants:** – A new lichen in Québec: *Catillaria contristans.* – Rare mosses in Québec: *Plagiomnium curvatulum* and *Tortella inclinata.* **Wildlife:** – Caribou (*Rangifer tarandus*) is be present in this sector.

*LDTV: Likely to be designated threatened or vulnerable.

HUMAN OCCUPATION

- 2 archaeological sites identified in this sector belonging to Inuit culture.
- In the valley, one place name refers to an “an old, worn campsite”; at the mouth of the river, another place name means a “place to wait for the tide to come in”. These place names provide evidence of extended human occupation in this sector.

RECREATIONAL TOURISM POTENTIAL

- The valley possesses breathtaking landscapes with raised beaches and turquoise-coloured waters on sunny days.
- Shore landings are possible, sheltered from the marine conditions of Hudson Strait; located about 2 hours by boat from Salluit.
- Drinking water is accessible at Baie Qirkirtaaruliup Kangirsunga, which has good potential for the development of hiking trails, park infrastructure and an airstrip.

Table 6.1 Specific Elements of the Sectors of Interest in the Study Area

SECTOR OF INTEREST	PHYSICAL ENVIRONMENT	BIOLOGICAL ENVIRONMENT
4- Baie Qarliik	– 7 sites of geomorphological interest are present in this sector: – 2 juvenile cirques: • the first small cirque is situated in a bay east of Cap Pachot in a glacial valley; • the second small cirque adjoins Baie *Qarliik Kuunga*; it possesses a typical bowl shape and a downstream break in the slope. – 3 mature cirques: • the first is situated east of Cap Pachot. A stream cuts through the cirque wall. The cirque is approximately 1.3 km wide at its mouth; • the second is the western inlet at Baie Qarliik, known as *Qarliik Qaninnisaq*. It is 18 times longer (7.2 km) than it is deep (400 m), has an s-shape and includes a large flooded zone; • the third is the eastern inlet at Baie Qarliik, known as *Qarliik Ungasinnisaq*. It is very narrow and its upstream walls are severely eroded and notched. It possesses a lake. – 1 stepped cirque is situated between the two inlets of Baie Qarliik. It possesses three levels with lithological contact occurring between each level. Thick till deposits are located near the first lake; between the second and third lakes, there is a waterfall (nick point and connecting talus). The slopes are characterized by talus slopes. – 1 u-shaped hanging glacial valley adjoining a mature cirque (eastern inlet at Baie Qarliik). The flat floor is carpeted with deep-sea marine sediments (silt and sandy clay). The valley's upstream walls have an irregular convex shape while, downstream, they are more regular. The valley cuts more than 300 m inland.	– 3 outstanding ecosystems comprising deep-sea glaciomarine deposits, rich in calcium carbonate and remnants of marine transgression. They are basophilous enclaves in a mostly acidic environment. One enclave is located in the hanging valley east of the eastern inlet of Baie Qarliik; a second is located in the stepped cirque between the two inlets of the bay; and a third within the cove at *Qarliik Kuunga*. **Vascular plants:** – 7 taxa LDTV*: *Cerastium arcticum, Draba cayouetti, Draba corymbosa, Draba subcapitata, Epilobium arcticum, Poa hartzii* subsp. *Hartzii* and *Potentilla vahliana*. – *Draba subcapitata* is in the process of beging legally designated a vulnerable species in Québec. – The only occurrence of *Draba cayouettei* in the study area is found in this sector: the plant is endemic to the Ungava Trough and rare around the globe. – The only two occurrences of *Epilobium arcticum* are in this sector. **Nonvascular plants:** – New lichens in Québec: *Acarospora moenium*, *Acarospora rugulosa*, *Aspicilia cingulata*, *Caloplaca approximata*, *Hymenelia epulotica*, *Hymenelia heteromorpha*, *Lecidea ecrustacea*, *Polysporina urceolata*, *Rhizocarpon intermediellum* and *Staurothele arctica*. – New lichens in Canada: *Cecidonia umbonella*, *Lecanora formosa*, *Lecidea swartzioidea* and *Rinodina notabilis*. – A rare lichen in Québec: *Myriolecis torrida*. – Rare mosses in Québec: *Andreaea nivalis*, *Cinclidium latifolium, Oligotrichum falcatum* and *Schistidium venetum*. – A rare liverwort in Québec: *Scapania kaurinii*. **Wildlife:** – Various species of seals. – Caribou. – Various species of seabirds.

*LDTV: Likely to be designated threatened or vulnerable.

HUMAN OCCUPATION

- 6 archaeological sites dating from the historic period identified in this sector.
- Among these, a pre-Dorset site (from at least 2,500 years BP). The only pre-Dorset site in the study area belonging to this culture, it was discovered near Qarliini, a cove adjoining the western inlet at Baie Qarliik. Several artifacts have been found at this site: chisels, scrapers, shards, etc. Very few pre-Dorset sites have been identified along Hudson Strait.
- The place name Qarliik Kisarvinga, meaning “Qarliik’s anchorage”, designates a cove adjoining the western inlet of Baie Qarliik and identifies the use of this site.
- A very popular sector for the residents of Salluit and Ivujivik for the practice of traditional activities.

RECREATIONAL TOURISM POTENTIAL

- Sector situated in the middle of the study area; accessible and used by the residents of Salluit and Ivujivik.
- Sector with a very high potential for recreational tourism activities: hiking, *qajaq* excursions and airstrip construction.
- Hiking opportunity along the ridge between the two inlets, following the stepped cirque and offering a breathtaking view of the western inlet of Baie Qarliik. In 2017, the field team tested the roughly five-kilometre, 300-m vertical hike: the excursion took a total of 2 hours and 15 minutes.
- The heads of the inlets at Baie Qarliik are littered with rocks and the slopes are steep; anchoring and the installation of infrastructure are not ideal. For its part, *Qarliik Kisarvinga*, which adjoins the western inlet of Baie Qarliik, has a beach where anchoring is possible, and infrastructure could also be installed.
- From *Qarliik Kisarvinga*, it is an easy hike to *Qarliik Kuunga,* a valley possessing a juvenile cirque, plant habitats of interest and archaeological sites.

Table 6.1 Specific Elements of the Sectors of Interest in the Study Area

SECTOR OF INTEREST	PHYSICAL ENVIRONMENT	BIOLOGICAL ENVIRONMENT
5- Baie Kangirsukallak	– The valley and fjord at Baie Kangirsukallak are a site of geomorphological interest. – The valley begins as three v-shaped three tributaries connecting at the confluence zone called *Salluliariaq*. Downstream, the valley expands to a u-shaped valley, 460 m wide. – Major deltas upstream of the confluence zone. Heavy erosion of fluvial terraces. – *The* fjord is 6.6 km long and 2.6 km wide. – The place name *Aupartualuk* refers to the red-tinted cliffs on the east shore of the bay (outside the study area). – Hudson Strait is a moderate depth between Cap Wolstenholme and *Kangirsukallak* (roughly 128 m) approximately 800 m from shore. Then, the depth increases abruptly to 450 m. This can sometimes create difficult marine conditions for small watercraft (waves, currents, eddies, whirlpools, etc.).	– Cap Wolstenholme (*Anaulirvik*) is a unique habitat. The abundance of guano produced by hundreds of thousands or thick-billed murres represents a considerable contribution of nitrogen and phosphate, natural fertilizers that foster the growth of nitrophilous species. This phenomenon may be observed up to about 275 m inland from the cliffs near *Anaulirvik* (outside the study area) and has an influence on the study area. **Vascular plants:** – Growth of *Poa arctica* and *Alopecurus borealis*. **Nonvascular plants:** – A new lichen for science: *Porpidia* sp. nov. Fryda. – *New lichens in Québec*: *Catillaria contristans* and *Tetramelas insignis*. – *Rare moss in* Québec: *Oligotrichum falcatum*. – *Rare liverworts in Québec*: *Clevea hyalina* and *Mannia gracilis*. **Wildlife:** – Beluga hunting site for the residents of Ivujivik. – Caribou may be observed in the valley and high on the cliffs. – Largest colony of thick-billed murres in Québec: over 300,000 individuals. – Peregrine falcons (*Falco peregrinus*) and gulls (herring, Iceland, glaucous, great black-backed).

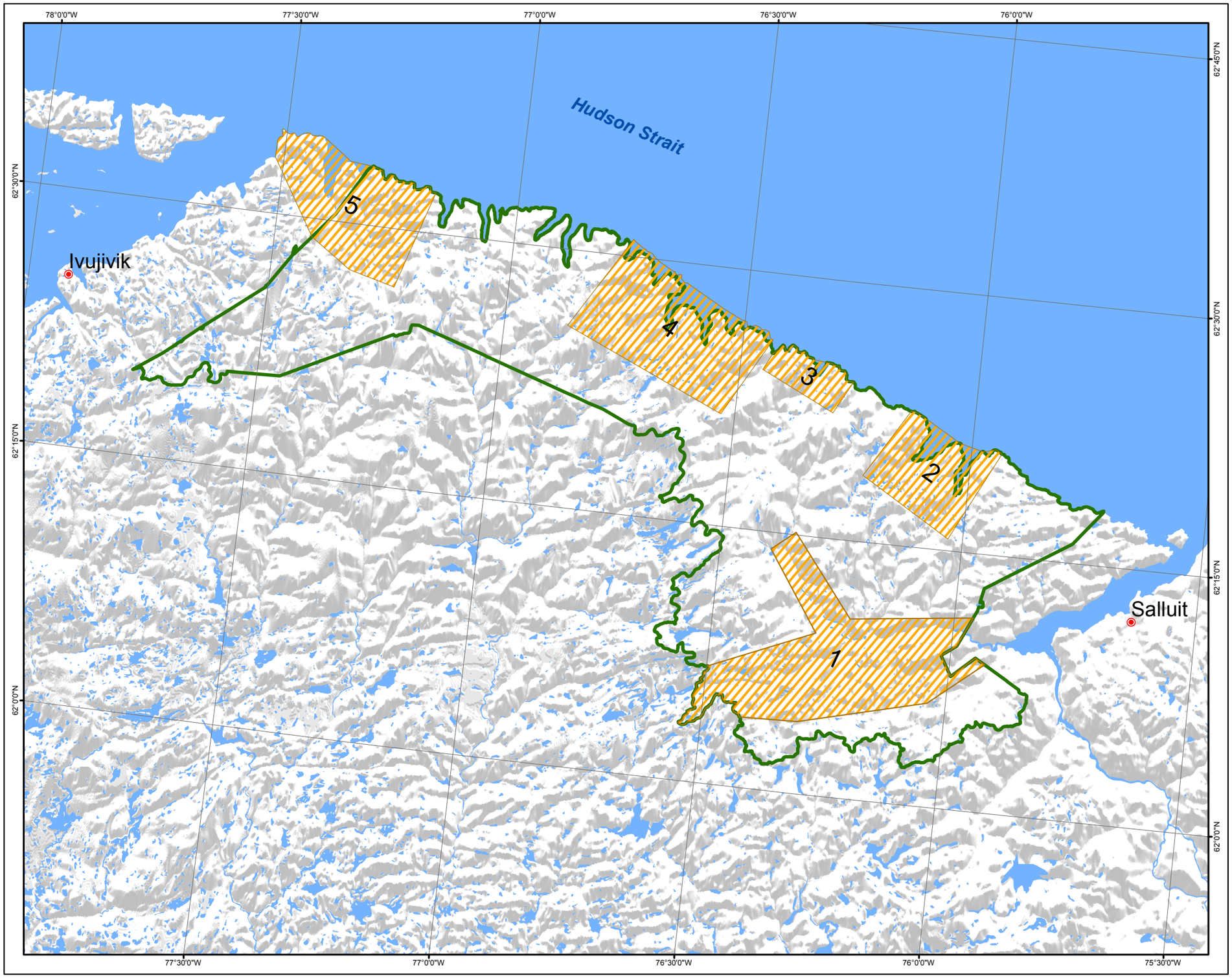
*LDTV: Likely to be designated threatened or vulnerable.

HUMAN OCCUPATION

- 4 archaeological sites all belonging to Inuit culture have been identified in this sector.
- One place name refers to an area with archaeological potential. It was not possible to explore this area during fieldwork in 2015: *Inuit Nunaviningat* — "Inuit's old land".
- A Euro-Canadian site was also identified, i.e. the trading post at Cap Wolstenholme (CBH) that was in operation from 1909 to 1947:
  - buildings were dismantled to permit the reuse of materials; only artifacts remain today (ceramic dishware, metal engine parts, a walrus skull, etc.). Two large metal hooks, situated 20 m apart that would have served to moor large vessels, are also present at the site;
  - the cemetery contains 15 graves and a monument. The cemetery gate is still functional;
  - a cellar-type site, which was probably used for storage, is still visible;
  - a cairn commemorating the trading post was erected in 1935 at the site.
- The place name for the site of the trading post is *Kampanirtaliviniq* — "it had the Company".
- Several place names refer to the use of this sector: *Kuuk Umiakkuvik* (site for shore landings) — "river for boats"; *Qilalukkisiivik* (camp) — "place to wait for whales"; *Umiarjuap Imirtavinga* (freshwater source) — "Umiarjuaq's water tending place"; *Umiarjuaq* — "huge boat; ship"; and *Salluliariaq* — "leading to Salluit".

RECREATIONAL TOURISM POTENTIAL

- Sector located close to the community of Ivujivik, i.e. less than 2 hours by boat.
- Sector often used by the community of Ivujivik for beluga hunting, in particular *Kangirsukallaup Nuvua*.
- *Kangirsukallak* is known for the size of the blueberries that grow there; it is therefore a popular picking site for the residents of Ivujivik.
- A must-see sector for visitors:
  - significant historical site: trading post;
  - colony of thick-billed murres.
- Spectacular landscapes offering numerous hiking opportunities, in particular to the cliffs where the thick-billed murre nest.
- Adequate for the installation of park infrastructure.
- Construction of an airstrip in the valley may be possible.



PARC NATIONAL
ILUILIQ PROJECT

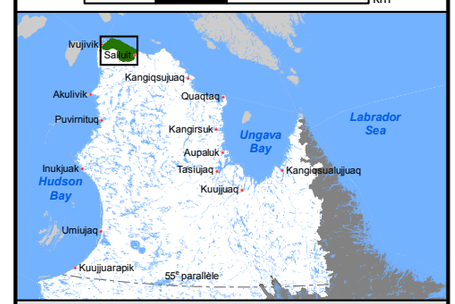
Sector of Interest

- Study area
- 1 Rivière Guichaud (Kuuruk)
- 2 Baie Anngiit Est/Ouest
- 3 Qikirtaaruliup Kangirsunga
- 4 Qarliik
- 5 *Kangirsukallak*

Note : This map must be consulted with table 6.1

Map Scale : 1:400 000

0 5 10 20 km



Geodetic datum : NAD 83
Coordinate system: Québec Lambert

August
2018

Map 6.1

Sector of Interest

Map 6.1

GLOSSARY

Abbreviation: adj.: adjective
n.: noun
ph.: phrase

Active layer: n. Layer of ground above the permafrost that freezes in winter and thaws in summer.

Adze: n. Axe with a curved edge.

Albedo: n. The fraction of light reflected by a non-luminous surface.

Amphibolite: n. Rock produced by regional metamorphism, with dark-green colouring, consisting essentially of amphibole and white calcic plagioclase (feldspar).

Anadromous: adj. Describes fish that migrate up rivers from the sea to spawn in freshwater.

Angiosperms: pl.n. Flowering plants with ovules enclosed in a cavity or ovary.

Archaic: n. and adj. Precolumbian prehistoric period (8,000–3,000 years BP). It represents the continent's second occupation period following the Palaeoindian.

Archean: n. and adj. The earliest geological period, prior to 2,600 million years ago.

Artifact: n. An object that has undergone a transformation, however small, by human action, and that can be distinguished from another object shaped by a natural phenomenon.

Axial layout: n. A layout comprising two parallel rows of stones subdividing the interior of a dwelling into two equal parts; the two rows are situated about half a metre apart in continuity with the dwelling entrance (this separation subdivides home life: one side is used for daily activities and the other for sleeping); a hearth is most often situated two thirds of the way into the dwelling. This type of layout appears very early in the history of human occupation of the eastern Artic; it was used by Pre-Dorset and Dorset peoples (Maxwell, 1985).

Biotite: n. Monoclinic mica with hexagonal lamina and black colouring.

Bryophyte: n. Land or semi-aquatic plant that does not have vessels or roots. Bryophytes include liverworts, mosses, and hornworts. The latter are not found in Nunavik.

Calco-silicate rock: n. Rock mainly composed of calco-silicates, resulting from the metamorphism of limestone or dolomite.

Carex: n. Genus of plant of the family *Cyperaceae* (sedge) very common in temperate and cold regions.

Carrion eater: n. Pertaining to an organism that feeds on carcasses and rotting meat.

Chert: n. Siliceous sedimentary rock composed of small silexite sponges sometimes contained in dolomite.

Chrysotile: n. A type of asbestos of the serpentine group, having a fibrous texture.

Cirque: n. A deep, semi-circular hollow with vertical or very steep walls, formed by glacial erosion and generally situated at the head of glacial valleys.

Coastal erosion: n. Erosion produced by the action of ocean waters on the land.

Cortex: n. Rather coriaceous external layer of the thallus, consisting of hypha more or less closely associated as a false tissue.

Craton: n. A vast, ancient and stable portion of a continental domain that undergoes only epirogenic movement, i.e. lifting and sinking of continental landmasses.

Cratonization: n. Series of phenomena connected with the formation of cratons.

Crustaceous: adj. Growing on rock, adhering to rock.

Cryosphere: n. The total mass of ice and snow on the earth's surface.

Cryoturbation: n. The churning and stirring of soil as a result of repeated cycles of freezing and thawing.

Debris cone: n. A conical mass of alluvia washed down a steep slope by a stream and deposited on a less-pronounced slope.

Delta: n. Area at the mouth of a steam or river where alluvia are deposited in a roughly triangular pattern. A delta is composed of bedded sediment, characterized by specific sedimentary structures.

- **Glaciomarine delta**: ph. Delta composed of glacial sediment transported to the sea.
- **Perched delta:** ph. Elevated above the surface level of existing bodies of water, are evidence of ancient lake or sea levels.

Deltaic terrace: n. Terrace formed from delta materials as the level of the associated glacial lake drops.

Diapause: n. Period during which the metabolic activity or development of an insect is suspended, at any stage in its life cycle (egg, larva, pupa or adult), due to internal or external factors.

Differential erosion: n. Irregular wearing away that forms depressions in softer rock, while harder rock remains to form ridges.

Diorite: n. Coarse-grained plutonic igneous rock consisting essentially of plagioclase (feldspar), amphibole and a little biotite, but poor in quartz.

Dioritic: adj. Containing diorite.

Dolomite: n. Sedimentary rock composed of a natural calcium and magnesium carbonate.

Drainage basin: n. Area within a watershed divide collecting the water that feeds in part or in whole a watercourse.

Dyke: n. A vein of magmatic rock measuring a few dozen or hundred metres thick, exposed by erosion.

Ecosystem: n. System formed by the interaction between living organisms (biocenosis) and their interaction with their non-living environment (biotope).

Ecosystemic: adj. In relation to an ecosystem.

Ecotone: n. Transition area between two or more adjacent but different ecological environments.

Ecotype: n. Local population of a species that exhibits distinct characteristics as a result of natural selection and adaptation to particular environmental conditions.

Erratic: adj. Pertaining to rock fragments (blocks, pebbles, granules, silt and clay) carried by glaciers and deposited on bedrock with a different lithology.

Esker: n. Narrow elongated ridge, often sinuous, composed of rounded granular materials. Eskers are formed in subglacial tunnels by the drainage of glacial meltwater.

Essential subsistence harvesting area: ph. Area essential for the communities and for the pursuit of subsistence activities. They consist of habitats of high biological productivity and are indispensable for the survival of wildlife.

Facies: n. Features characterizing a sediment that explain its origin.

Fault: n. Fracturing of geological stratum according to a more or less vertical fracture zone, with displacement of the fractured compartments.

- **Thrust fault**: ph. Related to tectonic motions that cause one stratum to overlap another due to an abnormal, slightly inclined geological contact.

Feldspar: n. A natural aluminosilicate, consisting of an alkaline or alkaline-earth metal, which forms the greatest part of igneous and metamorphic rock.

Ferromagnesian: adj. Containing iron and magnesium.

Foraminifer: n. A pelagic or benthic protozoan encased in a calcareous structure (skeleton) with holes through which extend pseudopods used for locomotion and grappling. Analysis of the isotopic composition of carbon and oxygen in the skeletons of these organisms (found in oceanic sedimentary layers) makes it possible to establishe sea-surface temperatures (pelagic species) and the age of deep-sea waters (benthic species) during the period these species were alive.

Gabbro: n. Rock mainly composed of plagioclase and pyroxene produced through slow cooling and fractional crystallization in the magma chamber.

Gelifluction: n. The downslope movement of a formation that has been made plastic or liquid by thawing.

Gelifraction: n. The fragmentation of bedrock or unconsolidated deposits (blocks, pebbles, fine gravel, etc.) by water as it freezes and thaws in rock stratification planes or fractures.

Geological province: n. Geographical area with a similar history and geological characteristics.

Glacial erosion: n. Erosion produced by the movement of ice downstream, cutting deeply into the preglacial topography over which it moves.

Glacial lake: ph. Lake created next to or near a glacier and fed by glacier meltwaters.

Glacial valley: n. A trench-shaped, drained depression formed by a glacier or with a morphology resulting from glacial erosion. It is generally u-shaped.

Glacio-eustasy: n. Variations in sea level caused by the continental glaciations.

Glacio-isostasy: n. Vertical movements of the earth's crust in response to the weight of continental ice sheets and their melting.

Glaciolacustrine: adj. Pertaining to lakes fed by melting glaciers.

Gneiss: n. Very common metamorphic rock produced deep under the earth's surface and characterized by alternating dark clear layers. Paragneiss derives from sedimentary rock, while orthogneiss derives from igneous rock.

Gneissic: adj. Pertaining to a rock having the texture of gneiss.

Granodiorite: n. A coarse-grained plutonic igneous rock, resembling granite, mainly composed of quartz and feldspar in which plagioclases are more abundant than orthoclases. Secondary minerals are biotite, amphibole and pyroxene.

Granulite: n. Metamorphic rock consisting essentially of quartz and feldspar, which may also contain garnets.

Growing degree-days: ph. The sum of degree-days above 5°C over the course of the growing season. For a given day, the degree-days are the number of degrees Celsius of the daily average above 5°C.

Guano: n. Fertilizing substance that forms from the excrement of seabirds, or by extension animal debris.

Gymnosperms: pl.n. Vascular plants that have seeds which are naked or unprotected. Most gymnosperms are evergreens.

Hornworts: n. Hornworts (*Anthocerotophyta* or *Anthocerotae*) are a division of ancient land plants (embryophytes).

Hydrographic region: n. Region defined according to hydrographic networks and comprising several drainage basins.

Hydrographic network: ph. All the streams that collect water in a same watershed.

Ice-contact deposit: n. Sediments comprising debris carried or deposited by the ice of a glacier. The term ice-contact qualifies the sediments as having been deposited while in contact with the glacier or on its margin.

Ice dam lake: n. Lake produced by a glacier forming a dam and preventing the drainage of water according to the natural gradient of the land.

Ice divide: n. Topographic ridge on an ice mass which induces a divergence of flow lines from a linear axis.

Ice sheet: ph. Vast field of continental ice that may be a few kilometres thick at its centre and the edges of which form arms or ice barriers.

Ichthyofauna: n. The fish native to a given region.

Important subsistence harvesting area: ph. Area important for the communities and for the pursuit of subsistence activities, although there is less biodiversity than in essential subsistence harvesting areas.

Intrusive rock: ph. Magmatic rock that has penetrated existing rock formations (ex.: granite).

Iron-bearing: adj. Containing iron or one of its compounds.

Isohyet: n. A curve connecting points having equal amounts of rainfall.

Isostatic lifting: n. Upward movement of a continent, following deglaciation, due to a decrease in the weight of the ice.

Isotherm: n. A curve connecting points having equal temperatures at a given moment or period.

Ivujimmiut: n. Residents of the Northern Village of Ivujivik.

Joint: n. A fissure in bedrock permitting the infiltration of water.

Kemp: n. Thick, brittle fibre present in the fur or fleece of animals.

Lichen: n. Extremely resistant organism without vascular tissue growing on the substrate, formed through a symbiotic association of filamentous fungus and microscopic algae.

Lignin: n. Organic substance responsible for lignification, a process by which the walls of certain plant cells become impervious, hard and wood-like.

Limestone: n. Sedimentary rock consisting essentially of calcium carbonate.

Limnology: n. The scientific study of biological, chemical, hydrological and physical phenomena occurring in relation to or in lakes.

Lithology: n. Nature of the rock comprising a geological formation.

Lithosphere: n. The earth's external rock crust.

Lithostratigraphic: adj. In geology, pertaining to lithostratigraphy, the branch of stratigraphy dealing with the organization of strata according to lithologic criteria.

Liverwort: n. Nonvascular bryophytic plant with a thallus or leaves often divided in two and liver-shaped.

Management unit: n. Also referred to as stock, a taxonomic subspecies usually defined according to ecological or genetic characteristics to facilitate management and monitoring; core concept of the conservation and management of natural populations.

Marble: n. Metamorphic rock derived from limestone or dolomite, as a result of regional metamorphism or contact.

Mesic: adj. Of organic material at an intermediate stage of decomposition between fibric and humic materials; still used with reference to average drainage conditions.

Metamorphic rock: ph. Large family of rocks whose mineralogy, texture and composition were transformed by high pressure and high temperatures.

Metamorphism: n. Transformation of rock due to high temperature or extreme pressure.

Metamorphosed rock: n. Rock transformed underground by high pressure and high temperature, and which no longer possesses its original textures and mineralogy.

Metasedimentary rock: ph. Describes sedimentary rock that has been subject to metamorphism.

Micromammal: n. Group of small mammals, including shrews, moles, voles, lemmings and mice.

Migmatitic: adj. Pertaining to migmatite, i.e. metamorphic rock formed of layers of gneiss separated by layers of granite.

Monocotyledon: n. Flowering plant whose seeds have only one cotyledon.

Monzogranite (biotite granite): n. Feldspar-rich plutonic igneous rock characterized by the presence of biotite (mica).

Monzonite: n. Igneous rock of intermediate composition between syenites and diorites.

Moraine: n. Accumulation of heterometric glacial materials, of varying sizes, whose shape depends on the process by which it was constructed. Moraines are landforms, rather than deposits.

- **Ablation moraine**: n. Ground moraine derived from a glacier down-melting process.
- **Dead-ice moraine**: ph. Moraine deposited by stagnant ice without a precise orientation. Very hilly and consisting of different materials.
- **Frontal moraine**: n. Accumulation of glacial material at the front of a glacier; identifies exactly the position of glacial margins that remained stationary for certain periods.

Morph: n. Refers to a distinct form of a species or organism, such as a colour variant.

Moss: n. Spore-producing plant with a radial leafy-stemmed growth form that does not have vessels or roots.

Mylonite: n. A very fine-grained rock produced by intense tectonic grinding.

Necton: n. Macroscopic animal organisms in the pelagic environment, capable of swimming long distances.

Neve: n. Area where snow accumulates and, through packing, transforms into ice that can feed a glacier.

Nonvascular: adj. Describes a cryptogamic plant that does not have vascular tissue, including algae, liverworts, lichen, moss and sphagnum moss.

Nunavimmiut: pl.n. Residents of Nunavik.

Ophiolitic: adj. Pertaining to ophiolite, i.e. a successive rock assemblage composed from bottom to top of peridotites and gabbros, volcanic rock, and a thin covering of deep-sea marine sediments, and corresponding to a section of the oceanic crust.

Ordovician: n. and adj. The second period of the Paleozoic, roughly between 485 and 445 million years before the present.

Orogen: n. A mountain system formed on an unstable portion of the continental crust from folding and deformation.

Orogeny: n. Process by which mountain ranges and other raised features are formed from the earth's crust.

Ostiole: n. Bare substrate that pot marks vegetation cover and produced by repeated freezing and thawing action. Unsorted and circular in shape, they generally consist of fine-grained sediment.

Paleodelta: n. Delta formed when sea levels were higher, and today found on the continental plateau.

Paleoproterozoic: n. and adj. Earliest period of the Proterozoic, roughly between 2.5 and 1.6 billion years before the present.

Pan-cryospheric: adj. Pertaining to all ice-related phenomena and processes observed on the surface of the earth.

Paragneiss: n. A gneiss derived from sedimentary rock.

Peatland: n. Somewhat acidic environment consisting of peat and characteristic of wetlands. Peatlands are typically colonized by low-growing plants.

Pedologic: adj. Pertaining to pedology, i.e. the scientific study of the reciprocal relations between soil and horizons (i.e. the soil mantle), as well as their physical, chronic, hydric and organic characteristics in connection with their position in the landscape.

Pericratonic: adj. Located around the edges of a craton.

Periglacial: n. and adj. Describes and refers to phenomena, morphogenic systems and regions where the action of cold and alternating freezing and thawing play a determining role.

Permafrost: n. Permanently frozen layer of soil or rock, at variable depths under the earth's surface, where the temperature is continually below 0°C for at least a few years and summer warming does not reach the base of the frozen layer.

Phenology: n. Study of effects of time and climate on animal and plant life stages (flowering, reproduction, etc.).

Phytogeographic: adj. Pertaining to the geographical distribution of plants.

Phytoplankton: n. Single- or multi-celled plant organisms living in suspension in salt and fresh water.

Plankton: n. Single- or multi-celled animal (zooplankton) and plant (phytoplankton) organisms living in suspension in salt and fresh water.

Planktonic: adj. Pertaining to plankton.

Platinum group elements (PGE): n. Term designating platinum plus five additional elements of group VIII of the periodic table (iridium, osmium, palladium, rhodium and ruthenium) that share many similar properties with platinum and are often found in association with each other.

Pluton: n. An igneous rock body deep in the earth, with a large oval or lenticular shape.

Plutonic rock: n. Describes intrusive rock composed of coarse ovoid masses (plutons) formed by the slow crystallization of magma at a certain depth in the earth.

Plutonism: n. Theory that attributes the formation of certain rocks to heat and fusion phenomena. Formation of magma deep inside the earth.

Polynya: n. f. Open water surrounded by sea ice.

Porphyritic: adj. Resembling porphyry, i.e. a very hard igneous rock, with large feldspar crystals.

Precambrian: n. and adj. The oldest and longest geological eon, that lasted approximately 4 billion years and was marked by the formation of continents and the appearance of ocean life; followed by the Cambrian period.

Proglacial lake: n. Lake formed by glacier meltwater, located at the front of the glacier.

Proterozoic: n. and adj. The most recent part of the Precambrian (roughly 2,500 to 544 million years ago).

Qallunaat: pl.n. Non-Inuit individuals.

Qamutiik / Qamutiit: n. *Qamutiik* is the Inuktitut term for one or two sleds; *Qamutiit* is the Inuktitut term two or more sleds.

Quartziferous: adj. Quartz-bearing.

Quartzite: n. Essentially siliceous compact rock, comprising cemented quartz grains. It may derive from sedimentation (cementation of sandstone) or metamorphism.

Quartzitic: adj. Possessing characteristics of quartzite.

Quaternary: n. The most recent and current geological period (1.6 million years ago to present). It includes two epochs: the Pleistocene, characterized by a succession of great glaciations (the Wisconsinan was the latest) and the Holocene, the current warmer epoch that began 10,000 years ago.

Rhizoid: n. Root-like structure with similar appearance and function.

Rift: n. A deep cleft in a mid-oceanic ridge, characterized by raised edges and a greater or lesser degree of volcanic activity.

Sallumiut: n. Residents of the Northern Village of Salluit.

Saxicolous: adj. Living on rock and on stony terrain.

Scientific paradigm: n. The principles and methods shared by the scientific community; may alter over time.

Sedimentary rock: ph. Large family of rocks that includes all those produced by the decomposition of igneous and metamorphic rock, as well as the diagenesis of their sediments.

Semipelite: n. Fine-grained sedimentary rock that has acquired a crystalline texture through metamorphism.

Silurian: n. and adj. The third period of the Paleozoic, roughly between 444 and 420 million years before the present.

Snow bank: n. Heap of snow piled by the wind in the lee of an obstacle or irregular land form.

Spawning: n. Period during which female fish release their eggs and the male fertilizes them.

Sphagnum moss: n. Group of several moss species found in acid wetlands – especially bogs, where they form thick carpets.

Standard deviation: n. A mathematical concept used in statistics to measure dispersion of a random variable. It is a measure of the dispersion of data: low standard deviation indicates that the data is fairly concentrated near the average, while high standard deviation indicates that the data is widely dispersed.

Subduction: n. The sinking of a portion of oceanic crust under an overriding continental or oceanic plate.

Taxon: n. (pl. taxa) A systematic plant or animal unit, such as family, genus, species, subspecies or variety. The basic taxonomic unit is the species and the other units are groups or subdivisions of the species.

Tectonics: n. Study of the structural deformation of the earth's crust due to internal forces and of the structure of the resulting rock.

Tectonostratigraphic: adj. Describes a mix of lithostratigraphic units, i.e. piled sediments considered from a geometric, lithologic and petrographic point of view, resulting from tectonic deformation.

Terricolous: adj. Describes lichens that grow on mineral or organic soils.

Thalweg: n. Line connecting the lowest points of a valley.

Thermohaline: adj. Pertaining to both temperature and salinity.

Till: n. Mixture of rock debris of all sizes (from clays to large boulders), unsorted and without any apparent structure, deposited directly by a glacier without much meltwater involvement.

Tonalite: n. Coarse-grained plutonic igneous rock related to diorite, but quartziferous. Diorite contains less than 5% quartz and tonalite more than 20%.

Tonalitic: adj. Pertaining to tonalite.

Trophic network: ph. System of interconnected food chains through which energy and biomass travel in an ecosystem.

Tundra: n. Plant formation in subarctic regions and sometimes in alpine environments in temperate zones that is generally treeless and composed of shrubs, herbaceous plants and mosses.

Vascular: adj. Describes plants that possess vessels (xylem and phloem) through which sap flows.

Volcanic rock: n. Endogenous rock deposited during volcanic eruptions.

Volcanic and sedimentary rock: ph. Describes rock formed by the accumulation of lava debris (projections), mixed with sediment deposited on the sea floor, and subsequently subjected to light metamorphism.

Watershed divide: n. Boundary separating adjacent drainage basins.

Wisconsinan: n. and adj. In North America, the fourth and final glacial stage of the Pleistocene, following the Sangamonian Interglacial Stage and preceding the Holocene. The latest part of this stage has been determined to be 10 thousand years ago.

Xeric: adj. Describes an extremely dry environment.

Zooplankton: n. Single- or multi-celled animal organisms present in plankton.

Sources: Mainly extracted or inspired by: Bellavance, (2014); Faubert (2013a); Payette (2013); Poly-Géo, (2013); Genest (2000); Parent (1990); as well as various websites.

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LEGISLATION

Compilation of Québec Laws and Regulation (CQLR):
Act respecting Conservation and Development of Wildlife CQLR, c. C-61.1.
Act respecting Hunting and Fishing Rights in the James Bay and New Québec Territories, CQLR, c. D 13.1, section 2.
Act respecting Northern Villages and the Kativik Regional Government CQLR, c. V-6.1.
Act respecting the Land Regime in the James Bay and New Québec Territories CQLR, c. R-13.1.
Act respecting the Makivik Corporation CQLR, c. S-18.1.
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AGREEMENTS

Agreement concerning Block Funding for the Kativik Regional Government (Sivunirmut Agreement)
James Bay and Northern Québec Agreement (JBNQA), CQLR c. C-67.
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STRATEGIC PLANS

Master Plan for Land Use in the Kativik Region, KRG, 1998.
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ABBREVIATIONS AND ACRONYMS

ATV: All-Terrain Vehicle
BP: Before present (indication of time calculated conventionally from 1950)
CAFF: Conservation of Arctic Flora and Fauna
CEN: Centre d'études nordiques
CERQ: Cadre écologique de référence du Québec
CLSC: Local community service center
COMPADRE: Comité ministériel permanent de l'aménagement, du développement régional et de l'environnement
COSEWIC: Committee on the Status of Endangered Wildlife in Canada
CPE: Centre de la petite enfance
CRCM: Canadian Regional Climate Model
DEB: Direction de l'expertise en biodiversité
DFO: Department of Fisheries and Ocean
EHB: Eastern Hudson Bay
FAPAQ: Société de la faune et des parcs du Québec
Ga: Billion years (gigaannum)
GDP: Gross Domestic Product
HBC: Hudson Bay Company
HBCA: Hudson Bay Company Archives
HFTCC: Hunting, Fishing and Trapping Coordinating Committee
ITN : Inuit Tungavinga Nunamini
IUCN: International Union for Conservation of Nature
JBNQA: James Bay and Northern Quebec Agreement
KEQC: Kativik Environmental Quality Commission
KMHB: Kativik Municipal Housing Bureau
KRG: Kativik Regional Government
LDTV: Likely to be designated threatened or vulnerable in Québec
LRH: Leaf River herd
Ma: Million years (Mega-annum)
MCP: Minimum convex polygon
MEF: Ministère de l'Environnement et de la Faune
MDDELCC: Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques
MDDEP: Ministère du Développement durable, de l'Environnement et des Parcs
MDDEFP: Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs
MER: Ministère de l'Énergie et des Ressources
MERN: Ministère de l'Énergie et des Ressources naturelles
MFFP: Ministère des Forêts, de la Faune et des Parcs
MLCP: Ministère du Loisir, de la Chasse et de la Pêche
MRNFP: Ministère des Ressources naturelles, de la Faune et des Parcs
NEQA: Northeastern Québec Agreement
NILCA: Nunavik Inuit Land Claims Agreement
NMRWB: Nunavik Marine Region Wildlife
NTA: Nunatik Tourism Association
Pers. comm: Personal communication
PGE: Platinum Group Element
RCMP: Royal Canadian Mounted Police
TAT: Total Allowable Take
TEK: Traditional Ecological Knowledge
THO: Trans-Hudson Orogeny
UB: Ungava Bay
WHB: Western Hudson Bay
ZAA: Zero Annual Amplitude

APPENDICES

Looking north from the northern point of Québec, *Anaulirvik*
Credit: Alain Thibault

Appendix 1 Nonvascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

Lichens and lichenicolous fungus

LATIN	FRENCH	ENGLISH
Acarospora moenium (Vainio) Räsänen	acarospore	cobblestone lichen
Acarospora rugulosa Körber	acarospore	cobblestone lichen
Acarospora sinopica (Wahlenb.) Körber	acarospore terre cuite	terra cota cobblestone lichen
***Agonimia gelatinosa* (Ach.) M. Brand & Diederich**	agonimie gélatineuse	gelatinous trifle lichen
Alectoria ochroleuca (Hoffm.) A. Massal.	alectoire blanc jaunâtre	green witch's hair
Allantoparmelia alpicola (Th. Fr.) Essl.	allantoparmélie alpine	alpine rock grubs
Amandinea punctata (Hoffm.) Coppins & Scheid.	amandinée ponctuée	tiny button lichen
Arctocetraria andrejevii (Oxner) Kärnefelt & A. Thell	arctocétraire d'André	Andrejev's Iceland lichen
Arthonia lapidicola (Taylor) Branth & Rostrup	arthonie des roches	rock comma lichen
Aspicilia cingulata (Zahlbr.) Oxner	aspicilie	sunken disk lichen
Aspilidea myrinii (Fr.) Hafellner	aspilidée de Myrin	Myrin's sunken disk lichen
Athallia holocarpa (Hoffm.) Arup, Frödén & Søchting (aggr.)	caloplaque orangée	orange firedot lichen
Bellemerea alpina (Sommerf.) Clauzade & Cl. Roux	bellemère alpine	alpine sunken disk lichen
Bellemerea subsorediza (Lynge) R. Sant.	bellemère	sunken disk lichen
Biatora cuprea (Sommerf.) Fr.	biatore	dot lichen
Biatora subduplex (Nyl.) Printzen	biatore	dot lichen
Blastenia ammiospila (Wahlenb.) Arup, Søchting & Frödén	caloplaque cannelle	cinnamon firedot lichen
Bryocaulon divergens (Ach.) Kärnefelt	bryocaule divergent	northern foxhair
Bryonora curvescens (Mudd) Poelt	bryonore	rim lichen
Bryoplaca sinapisperma (Lam. & DC.) Søchting, Frödén & Arup	caloplaque à spores jaunes	yellow-spored firedot lichen
Bryoria fuscescens (Gyelnik) Brodo & D. Hawksw.	bryorie fauve	pale-footed horsehair lichen
Bryoria nitidula (Th. Fr.) Brodo & D. Hawksw.	bryorie brillante	tundra horsehair lichen
Buellia spuria (Schaerer) Anzi	buellie bâtarde	sunken button lichen
Caloplaca approximata (Lynge) H. Magn.	caloplaque	firedot lichen
Caloplaca cerina (Ehrh. ex Hedwig) Th. Fr. (aggr.)	caloplaque cireuse	grey-rimmed firedot lichen
Caloplaca stillicidiorum (Vahl) Lynge	caloplaque	firedot lichen
Caloplaca tornoensis H. Magn.	caloplaque de Torno	Torno firedot lichen
Calvitimela aglaea (Sommerf.) Hafellner	calvitimèle splendide	splendid disk lichen
Calvitimela armeniaca (DC.) Hafellner	calvitimèle d'Arménie	Armenian disk lichen
Calvitimela melaleuca (Sommerf.) R. Sant.	calvitimèle	disk lichen
Candelariella aurella (Hoffm.) Zahlbr.	candélarielle cachée	hidden goldspeck lichen

LATIN	FRENCH	ENGLISH
Candelariella citrina B. de Lesd.	candélarielle de la toundra	tundra goldspeck lichen
Candelariella vitellina (Hoffm.) Müll. Arg.	candélarielle jaune d'oeuf	common goldspeck lichen
Carbonea vorticosa (Flörke) Hertel	carbonée tourbillonnante	vortex disk lichen
Catapyrenium cinereum (Pers.) Körber	catapyrène cendré	ashen stipplescale lichen
Catillaria contristans (Nyl.) Zahlbr.	catillaire	dot lichen
Cecidonia umbonella (Nyl.) Triebel & Rambold	cécidonie	disk lichen
Cetraria aculeata (Schreber) Fr.	cétraire épineuse	spiny heath lichen
Cetraria islandica (L.) Ach. subsp. *crispiformis* (Räsänen) Kärnefelt	cétraire crispée	true Iceland lichen
Cetraria nigricans Nyl.	cétraire noirâtre	blackened Iceland lichen
Cladonia amaurocreae (Flörke) Schaerer	cladonie pennée	quill lichen
Cladonia arbuscula (Wallr.) Flotow subsp. *mitis* (Sandst.) Ruoss	cladonie douce	green reindeer lichen
Cladonia borealis S. Stenroos	cladonie boréale	boreal pixie-cup
Cladonia chlorophaea (Flörke ex Sommerf.) Sprengel	cladonie vert-foncé	mealy pixie-cup
Cladonia crispata Ach.) Flotow	cladonie crispée	organ-pipe lichen
Cladonia ecmocyna Leighton subsp. *ecmocyna*	cladonie saupoudrée	frosted cladonia
Cladonia gracilis (L.) Willd. subsp. *elongata*	cladonie allongée	smooth cladonia
Cladonia gracilis (L.) Willd. subsp. *gracilis*	cladonie turbinée	smooth cladonia
Cladonia phyllophora Hoffm.	cladonie feutrée	felt cladonia
Cladonia pocillum (Ach.) O. J. Rich.	cladonie en rosette	carpet pixie-cup
Cladonia stricta (Nyl.) Nyl.	cladonie dressée	lesser felt-soldiers cladonia
Cladonia stygia (Fr.) Ruoss	cladonie du Styx	black-footed reindeer lichen
Cladonia turgida Ehrh. ex Hoffm.	cladonie enflée	crazy-scale lichen
Cladonia uncialis (L.) F. H. Wigg.	cladonie à calices	thorn cladonia
Clauzadeana macula (Taylor) Coppins & Rambold	clauzadeana	clauzadeana
Dimeleana oreina (Ach.) Norman	dimelène des montagnes	golden moonglow lichen
Diplotomma hedinii (H. Magn.) P. Clerc & Cl. Roux	diplotomme	button lichen
Diplotomma nivalis (Bagl. & Carestia) Hafellner	diplotomme	button lichen
Enchylium tenax (Sw.) Gray	collème tenace	common soil-jelly
Euopsis granatina (Sommerf.) Nyl.	euopse grenue	grainy water-crust lichen
Farnoldia jurana (Schaerer) Hertel	farnoldie du Jura	Jura disk lichen
Flavocetraria cucullata (Bellardi) Kärnefelt & A. Thell	flavocétraire cucullée	curled snow lichen

Appendix 1 (cont'd) Nonvascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

LATIN	FRENCH	ENGLISH
Flavocetraria nivalis (L.) Kärnefelt & A. Thel	flavocétraire nivéale	crinkled snow lichen
Frutidella caesioatra (Schaerer) Kalb	frutidelle bleu foncé	darkish blue disk lichen
Fulgensia bracteata (Hoffm.) Räsänen	fulgensie bractée	tundra sulphur lichen
Fuscopannaria praetermissa (Nyl.) P. M. Jørg	fuscopannaire omise	moss shingle lichen
Gowardia nigricans (Ach.) P. Halonen, L. Myllys, S. Velmala, & H. Hyvärinen	alectoire grise	gray witch's hair
Hymenelia epulotica (Ach.) Lutzoni	hyménélie à cicatrices	scarred watercolor lichen
Hymenelia heteromorpha (Kremp.) Lutzoni	hyménélie	watercolor lichen
Icmadophila ericetorum (L.) Zahlbr.	icmadophile en filets	candy lichen
Immersaria athroocarpa (Ach.) Rambold & Pietschm.	immersaria	immersaria lichen
Ionaspis lacustris (With.) Lutzoni	ionaspe lacustre	rusty brook lichen
Japewia tornoënsis (Nyl.) Tønsberg	japéwie de Torno	hidden dot lichen
Lambiella gyrizans (Nyl.) M. Westb. & Resl	rimulaire	disk lichen
Lambiella impavida (Th. Fr.) M. Westb. & Resl.	rimulaire	disk lichen
Lathagrium auriforme (With.) Otálora, P. M. Jørg. & Wedin	collème en forme d'oreille	ear-like jelly lichen
Lathagrium undulatum (Flotow) Otálora, P. M. Jørg. & Wedin	collème ondulé	protean jelly flakes lichen
Lecanora epibryon (Ach.) Ach.	lécanore sur mousse	over-moss rim-lichen
Lecanora formosa (Bagl. & Carestia) Knoph & Leuckert	lécanore	rim-lichen
Lecanora marginata (Schaerer) Hertel & Rambold	lécanore	rim-lichen
Lecanora polytropa (Ehrh.) Rabenh. (+aggr.)	lécanore polytrope	granite-speck rim-lichen
Lecanora rupicola (L.) Zahlbr.	lécanore des rochers	white rim-lichen
Lecidea alpestris Sommerf.	lécidée alpestre	disk lichen
Lecidea auriculata Th. Fr.	lécidée auriculée	disk lichen
Lecidea diducens Nyl.	lécidée séparée	parted disk lichen
Lecidea ecrustacea (Anzi ex Arnold) Arnold	lécidée	disk lichen
Lecidea lactea Flörke ex Schaerer	lécidée	disk lichen
Lecidea lapicida (Ach.) Ach. var. *lapicida* (+ aggr.)	lécidée tailleur de pierres	gray-orange disk lichen
Lecidea paupercula Th. Fr.	lécidée pauvre	poor disk lichen
Lecidea plana (J. Lahm) Nyl.	lécidée plate	flat disk lichen
Lecidea ramulosa Th. Fr.	lécidée rameuse	many-branched disk lichen
Lecidea silacea Ach.	lécidée jaune orange	reddish brown disk lichen
Lecidea swartzioidea Nyl.	lécidée	disk lichen

LATIN	FRENCH	ENGLISH
Lecidea tessellata Flörke	lécidée mosaïque	disk lichen
Lecidella carpathica Körber	lécidelle des Carpates	Carpathian disk lichen
Lecidella euphorea (Flörke) Hertel	lécidelle euphorique	euphoric disk lichen
Lecidella patavina (A. Massal.) Knoph & Leuckert	lécidelle	disk lichen
Lecidella stigmatea (Ach.) Hertel & Leuckert	lécidelle stigmatisée	limestone disk lichen
Lecidella wulfenii (Hepp) Körber	lécidelle de Wulfen	Wulfen's disk lichen
Lecidoma demissum (Rutstr.) Gotth. Schneider & Hertel	lécidome bas	brown earth-crust
Lepraria finkii (B. de Lesd.) R. C. Harris	lépraire	fluffy dust lichen
Lepraria neglecta (Nyl.) Erichsen (+ aggr.)	lépraire négligée	zoned dust lichen
Lichenomphalia hudsoniana (H. S. Jenn.) Redhead, Lutzoni, Moncalvo & Vilgalys	lichenomphalie d'Hudson	Hudson mushroom lichen
Lobaria linita (Ach.) Rabenh.	lobaire du lin	cabbage lungwort
Lopadium pezizoideum (Ach.) Körber	lopade faux-pézize	turban-like urn-disk lichen
Megaspora verrucosa (Ach.) Hafellner & V. Wirth	mégaspore verruqueuse	false sunken disk lichen
Melanelia hepatizon (Ach.) A. Thell	mélanie hépatique	rimmed camouflage lichen
Micarea incrassata Hedl.	micarée	dot lichen
Micarea inquinans (Tul.) Coppins	micarée	dot lichen
Miriquidica lulensis (Hellbom) Hertel & Rambold	miriquidice de Lule	Lule disk lichen
Miriquidica nigroleprosa (Vainio) Hertel & Rambold	miriquidice	disk lichen
Miriquidica pycnocarpa (Körber) Andreev	miriquidice	disk lichen
Miriquidica subplumbea (Anzi) Cl. Roux	miriquidice	disk lichen
Montanelia disjuncta (Erichsen) Divakar, A. Crespo, Wedin & Essl.	mélanélie disjointe	mealy camouflage lichen
Montanelia panniformis (Nyl.) Divakar, A. Crespo, Wedin & Essl.	mélanélie feutrée	shingled camouflage lichen
Montanelia sorediata (Ach.) Divakar, A. Crespo, Wedin & Essl.	mélanélie à sorédies	powdered camouflage lichen
Myriolecis dispersa (Pers.) Śliwa, Zhao Xin & Lumbsch (+aggr.)	lécanore du mortier	mortar rim-lichen
***Myriolecis torrida* (Vainio) Śliwa, Zhao Xin & Lumbsch**	**lécanore torride**	**torrid rim-lichen**
Myriolecis zosterae (Ach.) Śliwa, Zhao Xin & Lumbsch	lécanore de Zoster	flat-fruited rim-lichen
Nephroma arcticum (L.) Torss.	néphrome arctique	arctic kidney lichen
Nephroma expallidum (Nyl.) Nyl.	néphrome alpin	alpine kidney lichen
Nodobryoria subdivergens (E. Dahl) Common & Brodo	nodobryorie	redhair lichen
Ochrolechia androgyna (Hoffm.) Arnold (+aggr.)	ochroléchie androgyne	powdery saucer lichen
Ochrolechia frigida Sw.) Lynge	ochroléchie arctique	arctic saucer lichen

Appendix 1 (cont'd) Nonvascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

LATIN	FRENCH	ENGLISH
Ochrolechia upsaliensis (L.) A. Massal.	ochroléchie d'Upsala	tundra saucer-lichen
Ophioparma ventosa (L.) Norman	ophioparme venteuse	alpine bloodspot
Orphniospora moriopsis (A. Massal.) D. Hawksw.	orphniospore en morille	black-on-black lichen
Parmelia omphalodes (L.) Ach.	parmélie nombril	smoky crottle
Parmelia saxatilis (L.) Ach.	parmélie saxatile	salted shield lichen
Parmelia skultii Hale	parmélie	shield lichen
Parvoplaca tiroliensis (Zahlbr.) Arup, Søchting & Frödén	caloplaque du Tyrol	Tirolian firedot lichen
Peltigera aphthosa (L.) Willd.	peltigère aphtheuse	common freckle pelt
Peltigera canina (L.) Willd.	peltigère canine	dog-lichen
Peltigera didactyla (With.) J. R. Laundon	peltigère didactyle	alternating dog-lichen
Peltigera lepidophora (Nyl. Ex Vainio) Bitter	peltigère écailleuse	scaly pelt
Peltigera leucophlebia (Nyl.) Gyelnik	peltigère à nervures blanches	ruffled freckle pelt
Peltigera malacea (Ach.) Funck	peltigère douce	veinless pelt
Peltigera neckeri Hepp ex Müll. Arg.	peltigère	black saddle lichen
Peltigera polydactylon (Necker) Hoffm.	peltigère à plusieurs fruits	many-fruited pelt
Peltigera ponojensis Gyelnik	peltigère de Ponoj	pale-bellied dog-lichen
Peltigera rufescens (Weiss) Humb.	peltigère rougeâtre	field dog-lichen
Peltigera scabrosa Th. Fr.	peltigère scabreuse	scabby pelt
Pertusaria dactylina (Ach.) Nyl.	pertusaire dactylique	finger wart lichen
Pertusaria geminipara (Th. Fr.) C. Knight ex Brodo	pertusaire géminée	geminate wart lichen
Pertusaria oculata (Dickson) Th. Fr.	pertusaire oculaire	eyed wart lichen
Pertusaria panyrga (Ach.) A. Massal.	pertusaire arctique	arctic wart lichen
***Pertusaria subdactylina* Nyl.**	**pertusaire à doigts courts**	**short-fingered wart lichen**
Pertusaria subobducens Nyl.	pertusaire émoussée	roundish wart lichen
Phaeophyscia constipata (Norrlin & Nyl.) Moberg	phéophyscie ecombrée	pincushion shadow lichen
Physcia caesia (Hoffm.) Hampe ex Fürnr.	physcie gris bleuâtre	blue-gray rosette lichen
Physconia muscigena (Ach.) Poelt	physconie mousseuse	ground frost lichen
Placynthium tantaleum (Hepp) Hue	placynthie	ink lichen
Pleopsidium chlorophanum (Wahlenb.) Zopf	acarospore	gold cobblestone lichen
Polyblastia cupularis A. Massal.	polyblaste à cupule	cup-shaped black bump lichen
Polyblastia gothica Th. Fr.	polyblaste	black bump lichen
Polyblastia hyperborea Th. Fr.	polyblaste hyperboréenne	hyperborean black bump lichen

LATIN	FRENCH	ENGLISH
Polyblastia intermedia Th. Fr.	polyblaste	black bump lichen
Polychidium muscicola (Sw.) Gray	polychide des mousses	eyed moss-thorn lichen
Polysporina urceolata (Anzi) Brodo	polysporine	coal-dust lichen
Porpidia melinodes (Körber) Gowan & Ahti	porpidie miellée	honey-like boulder lichen
Porpidia tuberculosa (Sm.) Hertel & Knoph	porpidie tuberculeuse	tubercled boulder lichen
Porpidia sp. nov.	porpidie	boulder lichen
Protoblastenia rupestris (Scop.) J. Steiner	protoblasténie des rochers	orange dot lichen
Protopannaria pezizoides (Weber) P. M. Jørg. & S. Ekman	protopannaire fausse-pézize	brown-gray moss-shingle
Pseudephebe minuscula (Nyl. ex Arnold) Brodo & D. Hawksw.	pseudephèbe très petite	coarse rockwool
Pseudephebe pubescens (L.) M. Choisy	pseudephèbe pubescente	fine rockwool
Psora rubiformis (Ach.) Hooker	psore papillon	butterfly scale
Psoroma hypnonum (Vahl) Gray	psorome vert	green moss-shingle
Psoroma tenue Henssen	psorome	moss-shingle
Rhizocarpon badioatrum (Flörke ex Sprengel) Th. Fr. *s.l.*	rhizocape brun rougeâtre foncé	dark reddish brown map lichen
Rhizocarpon copelandii (Körber) Th. Fr.	rhizocape de Copeland	Copeland's map lichen
Rhizocarpon disporum (Nägeli ex Hepp) Müll. Arg.	rhizocape à deux spores	two-spored map lichen
Rhizocarpon distinctum Th. Fr.	rhizocarpe distinct	distinct map lichen
Rhizocarpon effiguratum (Anzi) Th. Fr.	rhizocape	map lichen
Rhizocarpon geminatum Körber	rhizocarpe géminé	dual map lichen
Rhizocarpon geminiparum Körber	rhizocape	map lichen
Rhizocarpon geographicum (L.) DC. (+ aggr.)	rhizocape géographique	yellow map lichen
Rhizocarpon inarense (Vainio) Vainio	rhizocape d'Inar	Inar map lichen
Rhizocarpon intermediellum Räsänen	rhizocape	map lichen
Rhizocarpon intersitum Arnold	rhizocape	map lichen
Rhizocarpon macrosporum Lynge	rhizocape citronné	lemon map lichen
Rhizocarpon polycarpum (Hepp) Th. Fr.	rhizocape à plusieurs fruits	many-fruited map lichen
Rhizocarpon pusillum Runemark	rhizocape	map lichen
Rhizocarpon simillimum (Anzi) Lettau	rhizocape	map lichen
Rhizocarpon superficiale (Schaerer) Vainio	rhizocape superficiel	superficial map lichen
Rhizocarpon sp. nov.	rhizocarpe	map lichen
Rinodina mniaraea (Ach.) Körber	rinodine de Mniara	Mniara pepper-spore lichen
Rinodina notabilis (Lynge) Sheard	rinodine	pepper-spore lichen

Appendix 1 (cont'd) Nonvascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

LATIN	FRENCH	ENGLISH
Rinodina olivaceobrunnea C. W. Dodge & Baker	rinodine	pepper-spore lichen
Rinodina roscida (Sommerf.) Arnold	rinodine	pepper-spore lichen
Rinodina turfacea (Wahlenb.) Körber	rinodine de la toundra	tundra pepper-spore lichen
Rostania ceranisca (Nyl.) Otálora, P. M. Jørg. & Wedin	collème cireux	cushion jelly lichen
Rusavskia elegans (Link) S. Y. Kondr. & Kärnefelt	xanthorie élégante	elegant sunburst lichen
Sarcogyne hypophaea (Nyl.) Arnold	sarcogyne belle-fille	grain-spored lichen
Schaereria endocyanea (Stirton) Hertel & Gotth. Schneider	schérère	false map lichen
Schaereria fuscocinerea (Nyl.) Clauzade & Cl. Roux	schérère gris-foncé	false map lichen
Scytinium imbricatum (P. M. Jørg.) Otálora, P. M. Jørg. & Wedin	leptogie	scaly jellyskin
Scytinium intermedium (Arnold) Otálora, P. M. Jørg. & Wedin	leptogie	jellyskin
Scytinium tenuissimum (Dickson) Otálora, P. M. Jørg. & Wedin	leptogie ténue	liliput jellyskin
Solorina crocea (L.) Ach.	solorine orangée	orange chocolate chip lichen
Sphaerophorus fragilis (L.) Pers.	sphérophore fragile	fragile coral lichen
Sphaerophorus globosus (Hudson) Vainio	sphérophore globulaire	clustered coral lichen
Sporastatia polyspora (Nyl.) Grummann	sporastatie à plusieurs spores	many-spored patch lichen
Sporastatia testudinae (Ach.) A. Massal.	sporastatie tortue	copper patch lichen
Sporodictyon terrestre (Th. Fr.) Savić & Tibell	sporodictyon terrestre	terrestrial sporodictyon
Staurothele arctica Lynge	staurothèle	rock pimple
Stereocaulon alpinum Laurer ex Funck	stéréocaule alpin	alpine foam lichen
Stereocaulon arenarium (Savicz) I. M. Lamb	stéréocaule des sables	sand foam lichen
Stereocaulon paschale (L.) Hoffm.	stéréocaule lapin	cottontail foam lichen
Stereocaulon rivulorum H. Magn.	stéréocaule des neiges	snow foam lichen
Stereocaulon symphycheilum I. M. Lamb	stéréocaule à deux teintes	two-toned foam lichen
Tephromela atra (Hudson) Hafellner	téphromèle noire	black-eyed lichen
Tetramelas insignis (Nägeli ex Hepp) Kalb	tétramèle	button lichen
Tetramelas papillatus (Sommerf.) Kalb	tétramèle papilleux	button lichen
Thamnolia subuliformis (Ehrh.) W. L. Culb.	thamnolie subulée	awn-shaped whiteworm lichen
Thamnolia vermicularis (Sw.) Ach. ex Schaerer	thamnolie vermiculaire	vermicular whiteworm lichen
Thelidium papulare (Fr.) Arnold	thélide papuleux	papulan speck lichen
Toninia squalescens (Nyl.) Th. Fr.	toninie	blister lichen
Tremolecia atrata (Ach.) Hertel	trémolécie noirâtre	rusty-rock lichen
Tuckermannopsis sepincola (Ehrh.) Hale	tuckermannopse châtain	chestnut wrinkle-lichen

LATIN	FRENCH	ENGLISH
Umbilicaria cylindrica (L.) Delise ex Duby	ombilicaire cylidrique	fringed rock tripe
Umbilicaria deusta (L.) Baumg.	ombilicaire brûlée	peppered rock tripe
Umbilicaria hyperborea (Ach.) Hoffm.	ombilicaire hyperboréenne	blistered rock tripe
Umbilicaria proboscidea (L.) Schrader	ombilicaire ridée	netted rock tripe
Umbilicaria torrefacta (Lightf.) Schrader	ombilicaire perforée	punctured rock tripe
Umbilicaria vellea (L.) Ach.	ombilicaire velouteuse	arctic frosted rock tripe
Umbilicaria virginis Schaerer	ombilicaire virginale	blushing rock tripe
Verrucaria arctica Lynge	verrucaire arctique	arctic speck lichen

Bryophytes - Mosses

LATIN	FRENCH	ENGLISH
Abietinella abietina (Hedw.) M. Fleisch.	thuidie petit-sapin	wiry fern moss
Amphidium mougeotii (Bruch & Schimp.) Schimp.	amphidie à feuilles linéaires	Mougeot's yoke moss
***Andreaea nivalis* Hook.**	**lanterne des neiges**	**snow rock moss**
Andreaea obovata Thed.	lanterne à feuilles obovées	obovate rock moss
Andreaea rupestris Hedw.	lanterne des rochers	black rock moss
Aplodon wormskioldii (Hornem.) R. Br.	aplodon arctique	carrion moss
Aulacomnium palustre (Hedw.) Schwägr.	aulacomnie des marais	ribbed bog moss
Aulacomnium turgidum (Wahlenb.) Schwägr.	aulacomnie gonflée	mountain harp moss
Bartramia ithyphylla Brid.	bartramie à feuilles étroites	strait-leaved harp moss
Blindia acuta (Hedw.) Bruch & Schimp.	blindie aiguë	sharp-leaved Blind's moss
Brachythecium albicans (Hedw.) Schimp.	buissonnette blanchâtre	whitish ragged moss
Brachythecium turgidum (Hartm.) Kindb.	buissonnette turgide	thick ragged moss
Bryum algovicum Sendtn. ex Müll. Hal.	bryum réticulé	drooping bryum
Bryum archangelicum Bruch & Schimp.	bryum archange	black-spored bryum
Bryum arcticum (R. Br.) Bruch & Schimp.	bryum arctique	arctic bryum
Bryum calophyllum R. Br.	bryum carpette	matted bryum
Bryum cryophilum Mårtensson	bryum rouge	pink-red compact bryum
Bryum pseudotriquetrum (Hedw.) G. Gaertn., B. Mey. & Scherb. (*s.l.*)	grand bryum	common green bryum
Bryum veronense De Not.	bryum vert	river bryum
Bryum weigelii Spreng.	bryum à feuilles décurrentes	Weigel's bryum

Appendix 1 (cont'd) Nonvascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

LATIN	FRENCH	ENGLISH
Calliergon cordifolium (Hedw.) Kindb.	calliergon commun	heart-leaved spear moss
Calliergon richardsonii (Mitt.) Kindb.	calliergon boreal	Richardson's spear moss
Campylium stellatum (Hedw.) C.E.O. Jensen	campylie étoilée	yellow starry fen moss
Ceratodon purpureus (Hedw.) Brid.	cératodon pourpre	fire moss
***Cinclidium latifolium* Lindb.**	**mnie à feuilles larges**	**wide-leaved cinclidium moss**
Cinclidium stygium Sw.	mnie apiculée	sooty cupula moss
Cinclidium subrotondum Lindb.	mnie à feuilles rondes	ovate harp moss
Conostemum tetragonum (Hedw.) Lindb.	quinte boréale	helmet moss
Cratoneuron filicinum (Hedw.) Spruce	cratoneuron crochet	fern-leaved hook moss
Dicranoweisia crispula (Hedw.) Milde	coussin des rochers	mountain thatch moss
Dicranum acutifolium (Lindb. & Arnell) C.E.O. Jensen	dicrane à feuilles aiguës	sharp-leaved broom moss
Dicranum elongatum Schleich. ex Schwägr.	dicrane élancé	long-forked broom moss
Dicranum leioneuron Kindb.	dicrane à feuilles variables	variable-leaved broom moss
Dicranum spadiceum J.E. Zetterst.	dicrane boréal	confusing broom moss
Didymodon acutus (Brid.) K. Saito	pixie à pointe aiguë	pointed beard moss
Didymodon asperifolius (Mitt.) H. A. Crum, Steere & L.E. Anderson	pixie à feuilles rugueuses	rough-leaved beard moss
Distichium capillaceum (Hedw.) Bruch & Schimp.	tresse à feuilles étroites	erect-fruited iris moss
Ditrichum flexicaule (Schwägr.) Hampe	ditric flexueux	flexible cow-hair moss
Drepanocladus aduncus (Hedw.) Warnst.	faucillette courbée	Knieff's hook moss
Encalypta brevicollis (Bruch & Schimp.) Ångström	éteignoir à col court	white-mouthed extinguisher moss
Encalypta rhaptocarpa Schwägr.	éteignoir strié	ribbed extinguisher moss
Grimmia donniana Sm.	grimmie à capsule jaune	Donn's grimmia
Hygrohypnum eugyrium (Schimp.) Loeske	riverine commune	inflated brook moss
Hygrohypnum ochraceum (Turner ex Wilson) Loeske	riverine à manchon	claw brook moss
Hylocomnium splendens (Hedw.) Schimp.	hylocomie brillante	stairstep moss
Hymenostylium recurvirostrum (Hedw.) Dixon	pixie à bec recourbé	curved-beaked beardless moss
Hypnum bambergeri Schimp.	hypne brune	Bamberger's golden plaite moss
Hypnum callichroum Brid.	hypne lustrée	downy plaite moss
Hypnum cupressiforme Hedw.	hypne cyprès	cypress-leaved plait moss
Hypnum plicatulum (Lindb.) A. Jaeger	hypne plissée	northern plait moss
Hypnum revolutum (Mitt.) Lindb.	hypne révolutée	revolute plait moss

LATIN	FRENCH	ENGLISH
Hypnum vaucheri Lesq.	hypne boréale	Vaucher's plait moss
Kiaeria blyttii (Bruch & Schimp.) Broth.	faux-dicrane flexueux	Blytt's fork moss
Kiaeria starkei (F. Weber & D. Mohr) I. Hagen	faux-dicrane alpin	Starke's fork moss
Leptodictyum riparium (Hedw.) Warnst.	amblystégie des rivages	riparian feather moss
Loeskypnum badium (Hartm.) H.K.G. Paul	guivre à feuilles arquées	sickle-leaved loeskypnum
Meesia triquetra (L. ex Jolycl.) Ångström	meesie dentée	three-angled thread moss
Mielichhoferia elongata (Hoppe & Hornsch.) Nees & Hornsch.	cuivrine élancée	elongate copper moss
Mnium lycopodioides Schwägr.	mnie faux-lycopode	club-moss leafy moss
Mnium thomsonii Schimp.	mnie des escarpements	Thomson's leafy moss
Myurella julacea (Schwägr.) Schimp.	myurelle ficelle	small mousetail moss
Myurella sibirica (Müll. Hal.) Reimers	myurelle dentée	Siberian mousetail moss
***Oligotrichum falcatum* Steere**	**polytric à feuilles falciformes**	**sickle-leaved hair moss**
Oligotrichum hercynicum (Hedw.) Lam. & DC.	polytric à feuilles droits	Hercynian hair moss
Oncophorus virens (Hedw.) Brid.	oncophore vert-noir	green spur moss
Oncophorus wahlenbergii Brid.	oncophore pomme-d'Adam	Wahlenberg's spur moss
Orthotrichum pylaisii Brid.	houppe nordique	Pylaie's bristle moss
Paludella squarrosa (Hedw.) Brid.	paludelle hérissée	tufted fen moss
Philonotis fontana (Hedw.) Brid. var. *fontana*	philonotis commun	fountain apple moss
Philonotis tomentella Molendo	philonotis nordique	woolly apple moss
***Plagiomnium curvatulum* (Lindb.) Schljakov**	**mnie recourbée**	**curved leafy moss**
Plagiomnium ellipticum (Brid.) T.J. Kop.	mnie à feuilles elliptiques	marsh leafy moss
Plagiothecium cavifolium (Brid.) Z. Iwats.	satinette à feuilles creuses	round silk moss
Platydictya jungermannioides (Brid.) H.A. Crum	filigrane fausse-jongermanne	false willow moss
Pleurozium schreberi (Willd. ex Brid.) Mitt.	pleurozie dorée	red-stemmed feather moss
Pogonatum dentatum (Menzies ex Brid.) Brid.	polytric denté	mountain hair moss
Pogonatum urnigenum (Hedw.) P. Beauv.	polytric verseau	urn hair moss
Pohlia cruda (Hedw.) Lindb.	pohlie opalescente	opal nodding moss
Pohlia crudoides (Sull. & Lesq.) Broth.	pohlie boréale	pipe nodding moss
Pohlia elongata Hedw.	pohlie à capsule longue	elongated nodding moss
Pohlia filum (Schimp.) Mårtensson	pohlie à bulbilles ovoïdes	slender nodding moss
Pohlia longicolla (Hedw.) Lindb.	pohlie à col allongé	long-necked nodding moss
Pohlia nutans (Hedw.) Lindb.	pohlie penchée	common nodding moss

Appendix 1 (cont'd) Nonvascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

LATIN	FRENCH	ENGLISH
Pohlia obtusifolia (Vill. ex Brid.) L.F. Koch	pohlie à feuilles obtuses	blunt nodding moss
Pohlia proligera (Kindb.) Lindb. ex Arnell	pohlie à bulbilles minces	cottony nodding moss
Pohlia wahlenbergii (F. Weber & D. Mohr) A.L. Andrews	pohlie blanchâtre	Wahlenberg's nodding moss
Polytrichastrum alpinum (Hedw.) G.L. Sm. *var. alpinum*	polytric alpin	alpine haircap moss
Polytrichastrum alpinum (Hedw.) G.L. Sm. *var. fragile* (Bryhn) D.G. Long	polytric fragile	fragile alpine haircap moss
Polytrichastrum alpinum (Hedw.) G.L. Sm. *var. septentrionale* (Brid.) G.L. Sm.	polytric septentrional	arctic-alpine haircap moss
Polytrichastrum sexangulare (Flörke ex Brid.) G.L. Sm.	polytric nivéal	northern haircap moss
Polytrichum hyperboreum R. Br.	polytric hyperboréen	hyperboreal haircap moss
Polytrichum jensenii I. Hagen	polytric arctique	Jensen's haircap moss
Polytrichum juniperinum Hedw.	polytric genévrier	juniper haircap moss
Polytrichum piliferum Hedw.	polytric porte-poil	bristly haircap moss
Polytrichum strictum Menzies ex Brid.	polytric dressé	bog haircap moss
Polytrichum swartzii Hartm.	polytric variable	Swartz's haircap moss
Pterigynandrum filiforme Hedw.	cordelette des rochers	capillary wing moss
Racomitrium affine (Schleich. ex F. Weber & D. Mohr) Lindb.	petite frangine	lesser rock moss
Racomitrium canescens (Hedw.) Brid.	frangine blanchâtre	grey rock moss
Racomitrium fasciculare (Hedw.) Brid.	frangine à branches courtes	clustered rock moss
Racomitrium lanuginosum (Hedw.) Brid.	frangine laineuse	hoary rock moss
Racomitrium microcarpon (Hedw.) Brid.	frangine des rochers	small-fruited rock moss
Racomitrium sudeticum (Funck) Bruch & Schimp.	frangine à feuilles étroites	narrow-leaved rock moss
Sanionia uncinata (Hedw.) Loeske	faucillette à feuilles plissées	sickle moss
Sarmentypnum exannulatum (Schimp.) Hedenäs	lamie commune	ringless spoon moss
Sarmentypnum sarmentosum (Wahlenb.) Tuom. & T.J. Kop.	lamie rouge	twiggy spoon moss
Schistidium agassizii Sull. & Lesq.	grimmie des ruisseaux	Agassiz's bloom moss
Schistidium apocarpum (Hedw.) Bruch & Schimp.	grimmie commune	radiate bloom moss
Schistidium boreale Poelt	grimmie boréale	boreal bloom moss
Schistidium canadense (Dupret) Ignatova & H.H. Blom	grimmie à feuilles mutiques	Canada bloom moss
Schistidium dupretii (Thér.) W.A. Weber	grimmie pionnière	Dupret's bloom moss
Schistidium platyphyllum (Mitt.) Perss.	grimmie à feuilles larges	broad-leaved bloom moss
Schistidium rivulare (Brid.) Podp.	grimmie des rivages	river bloom moss
Schistidium robustum (Nees & Hornsch.) H.H. Blom	grimmie robuste	robust bloom moss

LATIN	FRENCH	ENGLISH
***Schistidium venetum* H.H. Blom**	**grimmie azurée**	**bluish bloom moss**
Scorpidium cossonii (Schimp.) Hedenäs	scorpidie verdâtre	Cosson's hook moss
Scorpidium revolvens (Sw.) Rubers	scorpidie rouge violacé	rusty hook moss
Sphagnum arcticum Flatberg & Frisvoll	sphaigne arctique	arctic peat moss
Sphagnum balticum (Russow) C.E.O. Jensen	sphaigne de la Baltique	Baltic peat moss
Sphagnum capillifolium (Ehrh.) Hedw.	sphaigne grêle	small red peat moss
Sphagnum concinnum (Berggr.) Flatberg	sphaigne jolie	elegant peat moss
Sphagnum girgensohnii Russow	sphaigne de Girgensohn	Girgensohn's peat moss
Sphagnum lindbergii Schimp.	sphaigne de Lindberg	Lindberg's peat moss
Sphagnum russowii Warnst.	sphaigne de Russow	Russow's peat moss
Sphagnum squarrosum Crome	sphaigne hérissée	shaggy peat moss
Sphagnum subfulvum Sjörs	sphaigne fauve	fulvous peat moss
Sphagnum teres (Schimp.) Åmgström[1]	sphaigne arrondie	rigid peat moss
Sphagnum tundrae Flatberg	sphaigne de la toundra	tundra peat moss
Sphagnum warnstorfii Russow	sphaigne de Warnstorf	Warnstorf's peat moss
Splachnum sphaericum Hedw.	splanc sphérique	round-fruited dung moss
Splachnum vasculosum Hedw.	splanc pichet	rugged dung moss
Syntrichia norvegica F. Weber	tortule des rochers	Norway screw moss
Syntrichia ruralis (Hedw.) F. Weber & D. Mohr	tortule des champs	sidewalk screw moss
Tetraplodon mnioides (Hedw.) Bruch & Schimp.	tétraplodon fausse-mnie	entire-leaved nitrogen moss
Tomentypnum nitens (Hedw.) Loeske	tomenteuse à feuilles étroites	golden fuzzy fen moss
Tortella fragilis (Hook. & Wilson) Limpr.	tortelle fragile	fragile twisted moss
***Tortella inclinata* (R. Hedw.) Limpr.**	**tortelle inclinée**	**inclined twisted moss**
Tortella tortuosa (Hedw.) Limpr.	tortelle tortueuse	frizzled crisp moss
Tortula hoppeana (Schultz) Ochyra	tortule nordique	Hoppe's screw moss
Tortula mucronifolia Schwägr.	tortule à feuilles mucronées	mucronate screw moss

Bryophytes - Liverworts

LATIN	FRENCH	ENGLISH
Aneura pinguis (L.) Dumort.	aneura gras	common greasewort
Anthelia juratzkana (Limpr.) Trevis.	anthélie des neiges	Juratzka's silverwort
Arnellia fennica (Gottsche & Rabenh.) Lindb.	arnellie arctique	tundra liverwort

Appendix 1 (cont'd) Nonvascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

LATIN	FRENCH	ENGLISH
Barbilophozia hatcheri (A. Evans) Loeske	barbille bipolaire	Hatcher's pawwort
Barbilophozia lycopodioides (Wallr.) Loeske	grande barbille	greater pawwort
Barbilophozia sudetica (Nees ex Huebener) L. Söderstr., De Roo & Hedd.	barbille des collines	hill notchwort
Blepharostoma trichophyllum (L.) Dumort. var. *trichophyllum*	ciliaire doigts-de-fée	hairy threadwort
Cephalozia bicuspidata (L.) Dumort.	céphalozie cornue	two-horned pincewort
Cephaloziella divaricata (Sm.) Schiffn.	céphalozielle étalée	spreading threadwort
Cephaloziella grimsulana (J.B. Jack) Müll. Frib.	céphalozielle sombre	Lake Grimsel threadwort
Cephaloziella varians (Gottsche) Stephani	céphalozielle variable	arctic threadwort
***Clevea hyalina* (Sommerf.) Lindb.**	**morgane évanescente**	**hyaline liverwort**
Fuscocephaloziopsis albescens (Hook.) Váňa & L. Söderstr.	dame blanche	snow threadwort
Fuscocephaloziopsis pleniceps (Austin) Váňa & L. Söderstr.	céphalozie trompeuse	blunt pincerwort
Gymnocolea inflata (Huds.) Dumort.	gobelin noir	inflated notchwort
Gymnomitrion concinnatum (Lightf.) Corda	gymnomitrion élégant	braided frostwort
Gymnomitrion corallioides Nees	gymnomitrion corail	coral frostwort
Isopaches bicrenatus (Schmidel ex Hoffm.) H. Buch	lophozie à deux dents	lesser notchwort
***Jungermannia polaris* Lindb.**	**jongermanne polaire**	**arctic flapwort**
Lophozia ventricosa (Dicks.) Dumort. var. *ventricosa* (*+s.l.*)	lophozie ventrue	tumid notchwort
Lophozia wenzelii (Nees) Stephani	lophozie à feuilles rondes	Wenzel's notchwort
Lophoziopsis excisa (Dicks.) Konstant. & Vilnet	lophozie découpée	cut notchwort
Lophoziopsis polaris (R.M. Schust.) Konstant. & Vilnet	lophozie polaire	arctic notchwort
***Mannia gracilis* (F. Weber) D.B. Schill & D.G. Long**	**astérelle gracieuse**	**thin starwort**
Marchantia polymorpha L. subsp. *ruderalis* Bischl. & Boisselier-Dubayle[1]	marchantie rudérale	common liverwort
Marchantia quadrata Scop. subsp. *quadrata*	preissie commune	narrow mushroom-headed liverwort
Marsupella apiculata Schiffn.	gymnomitrion apiculé	pointed frostwort
Marsupella arctica (Berggr.) Bryhn & Kaal.	marsupelle arctique	arctic rustwort
Marsupella emarginata (Ehrh.) Dumort. var. emarginata	marsupelle échancrée	notched rustwort
Marsupella sphacelata (Giesecke ex Lindenb.) Dumort.	marsupelle amphibie	speckled rustwort
Mesoptychia collaris (Nees) L. Söderstr. & Váňa	lophozie à collier	collared notchwort
Neoorthocaulis floerkei (F. Weber & D. Mohr) L. Söderstr., De Roo & Hedd.	barbille dressée	Floerke's pawwort

LATIN	FRENCH	ENGLISH
Odontoschisma fluitans (Nees) L. Söderstr. & Váňa	vénusté des tourbières	bog notchwort
Odontoschisma macounii (Austin) Underw.	vénusté cylindrique	Macoun's flapwort
Orthocaulis cavifolius H. Buch & S.W. Arnell	gorgone à feuilles creuses	hollow-leaved notchwort
Plagiochila porelloides (Torr. ex Nees) Lindenb. var. *porelloides*	plumette infléchie	lesser featherwort
Prasanthus suecicus Lindb.	prasanthe des vents	Swedish frostwort
Pseudotritomaria heterophylla (R.M. Schust.) Konstant. & Vilnet	tritomaire à feuilles variables	variable-leaved notchwort
Ptilidium ciliare (L.) Hampe	ptilidie des rochers	ciliate fringewort
Scapania brevicaulis Taylor var. *brevicaulis*	scapanie à tige courte	short-stemmed earwort
Scapania gymnostomophila Kaal.	scapanie à lobes étroits	narrow-lobed earwort
Scapania irrigua (Nees) Nees	scapanie des rivages	heath earwort
***Scapania kaurinii* Ryan**	**scapanie inusitée**	**Kaurin's earwort**
Scapania nemorea (L.) Grolle	scapanie des bois	grove earwort
Scapania obcordata (Berggr.) S.W. Arnell	scapanie coeur-renversé	patch earwort
Scapania praetervisa Meyl.	scapanie délicate	ciliate earwort
Scapania spitsbergensis (Lindb.) Müll. Frib.	scapanie nordique	Spitsbergen earwort
Scapania uliginosa (Lindenb.) Dumort.	scapanie des marécages	marsh earwort
Schistochilopsis incisa (Schrad.) Konstant.	lophozie incise	jagged notchwort
Schistochilopsis opacifolia (Culm. ex Meyl.) Konstant	lophozie à feuilles opaques	alpine jagged notchwot
Schljakovia kunzeana (Huebener) Konstant. & Vilnet	barbille bilogée	Kunze's pawwort
Schljakovianthus quadriloba (Lindb.) Konstant. & Vilnet	barbille patte-de-lion	four-fingered pawwort
*Solenostoma sphaerocarpum (*Hook.) Steph.	jongermanne à capsules rondes	round-fruited flapwort
Sphenolobus minutus (Schreb.) Berggr.	petite gorgone	comb notchwort
Tetralophozia setiformis (Ehrh.) Schljakov	mélusine splendide	monster pawwort
Tritomaria quinquedentata (Huds.) H. Buch subsp. *quinquedentata*	grande tritomaire	Lyon's notchwort
Tritomaria scitula (Taylor) Jörg.	tritomaire des montagnes	mountain notchwort

Notes:
[1] taxa found by Bartley in 1965.
Bold type is used to identify rare species in Quebec, MDDELCC, February 2018.

Identification : Frances Anderson (cyanolichens); Jean Faubert (mosses); Alan Fryday (crustaceous lichens); Robert Gauthier (sphagnum); Linda Ley (mosses, liverworts); Claude Roy (macrolichens)

Sources:
English names: Brodo *et al*., 2002; Hinds and Hinds 2007
English and French names: Gouvernment of Canada, Termium Plus (online consultation, March 9-12, 2018)

Appendix 2 Additional Nonvascular Plant Taxa identified near the Study Area for the Parc national Iluiliq Project

Lichens and lichenicolous fungus

LATIN
Aspicilia elevata (Lynge) J. W. Thomson
Brodoa oroarctica (Krog) Goward
Caloplaca fraudans (Th. Fr.) H. Olivier
Cetraria ericetorum
Dactylina arctica (Richardson) Nyl.
Hypogymnia subobscura (Vainio) Poelt
Lecanora cenisia Ach.
Lecanora intricata
Lecidea atrobrunnea (Ramond ex Lam. & DC.) Schaerer
Lepraria eburnea J. R. Laundon
Miriquidica obnubila (Th. Fries & Hellbom) Hertel & Rambold
Peltigera membranacea (Ach.) Nyl.
Pertusaria glomerata (Ach.) Schaerer
Phaeophyscia kairamoi (Vainio) Moberg
Phaeophyscia sciastra (Ach.) Moberg
Protopannaria badia (Hoffm.) Hafellner
Rhizocarpon grande (Flörke ex Flotow) Arnold
Scoliciosporum umbrinum (Ach.) Arnold
Scytinium gelatinosum (With.) Otálora, P. M. Jørg. & Wedin
Stereocaulon arcticum Lynge
Tetramelas geophilus (Flörke ex Sommerf.) Norman
Umbilicaria arctica (Ach.) Nyl.

Bryophytes - Mosses

LATIN
Bryoerythrophyllum recurvirostrum (Hedw.) P.C. Chen
Bryum uliginosum (Brid.) Bruch & Schimp.
Dicranum bonjeanii De Not
Dicranum fuscescens Turner
Dicranum groenlandicum Brid.
Grimmia ovalis (Hedw.) Lindb.
Heterocladium dimorphum (Brid.) Schimp.
Hypnum recurvatum (Lindb. & Arnell) Kindb.
Mnium hornum Hedw.
Myurella tenerrima (Brid.) Lindb.
Rhytidium rugosum (Hedw.) Kindb.

FRENCH	ENGLISH	FAMILY	SOURCE
aspicilie	**disk lichen**	***Megasporaceae***	1
brodoée des montagnes	mountain sausage lichen	*Parmeliaceae*	1
caloplaque frauduleuse	fraudulent firedot lichen	*Teloschistaceae*	2a, 3a, 3c
cétraire des bruyères	Iceland moss lichen	*Parmeliaceae*	3a, 3b
dactyline arctique	arctic finger lichen	*Parmeliaceae*	2a, 3a, 3b
hypogymnie des bruyères	heath tube lichen	*Parmeliaceae*	1, 3b
lécanore du mont Cenis	smoky rim-lichen	*Lecanoraceae*	1
lécanore intriquée	intricate rim-lichen	*Lecanoraceae*	3a, 3c
lécidée brun foncé	brown tile lichen	*Lecideaceae*	3a, 3c
lépraire ivoirin	ivory dust lichen	*Stereocaulaceae*	1
miriquidice	disk lichen	*Lecanoraceae*	1
peltigère membraneuse	membranous dog-lichen	*Peltigeraceae*	3b
pertusaire agglomérée	glomerate wart lichen	*Pertusariaceae*	1
phéophyscie	shadow lichen	*Physciaceae*	1
phéophyscie ombragée	dark shadow lichen	*Physciaceae*	1
lichen chocolat	chocolate rim-lichen	*Parmeliaceae*	1
rhizocarpe grand	big map lichen	*Rhizocarpaceae*	1
scoliciospore terre d'ombre	umber dot lichen	*Scoliosporaceae*	1
leptogie	petalled jellyskin	*Collemataceae*	1
stéréocaule arctique	arctic foam lichen	*Stereocaulaceae*	3a, 3b
tétramèle	button lichen	*Caliciaceae*	1
ombilicaire arctique	arctic rock tripe	*Umbilicariaceae*	2a, 3b

FRENCH	ENGLISH	FAMILY	SOURCE
pixie rouge	red beard moss	*Pottiaceae*	1
bryum des marécages	swamp bryum	*Bryaceae*	1
dicrane confondant	Bonjean's broom moss	*Dicranaceae*	2b, 3a
dicrane commun	curly heron's-bill moss	*Dicranaceae*	2b, 3a
dicrane arctique	Greenland broom moss	*Dicranaceae*	2b, 3a
grimmie ovale	oval grimmia	*Grimmiaceae*	1
cordelette à feuilles variables	dimorphous tangle moss	*Pterigynandraceae*	1
hypne recourbée	recurved plait moss	*Hypnaceae*	1
mnie à feuilles étroites	swan's-neck leafy moss	*Mniaceae*	1
myurelle délicate	dwarf mousetail moss	*Pterigynandraceae*	1
rhytidie rugueuse	wrinkle-leaved moss	*Rhytidiaceae*	1

Appendix 2 (cont'd) Additional Nonvascular Plant Taxa identified near the Study Area for the Parc national Iluiliq Project

LATIN
Sarmentypnum tundrae (Arnell) Hedenäs
Schistidium pulchrum H.H. Blom
Sphagnum compactum Lam. & DC.
Sphagnum fuscum (Schimp.) H. Klinggr.
Sphagnum incundum
Sphagnum mirum
Sphagnum obtusum
Sphagnum olafii
Sphagnum orientale
Sphagnum platyphyllum
Sphagnum rubellum Wilson
Straminergon stramineum (Dicks. ex Brid.) Hedenäs
Tetraplodon urceolatus (Hedw.) Bruch & Schimp.
Timmia austriaca Hedw.
Timmia megapolitana Hedw. subsp. bavarica (Hessl.) Brassard

Bryophytes - Liverworts

LATIN
Neoorthocaulis binsteadii
Orthocaulis atlanticus (Kaal.) H. Buch

Note:
Identifies rare species in Québec

Sources:
1 : Salluit: Jean Gagnon, 2015
2 : Erik Cove: Herbarium Consortium Online; 2a lichenportal.org; 2b bryophyteportal.org
3 : Literature: 3a Polunin, 1947; 3b Thomson, 1984; 3c Thomson, 1987

FRENCH	ENGLISH	FAMILY	SOURCE
lamie nordique	tundra spoon moss	*Calliergonaceae*	2b
grimmie ravissante	**showy bloom moss**	***Grimmiaceae***	1
sphaigne compacte	compact peat moss	*Sphagnaceae*	2b, 3a
sphaigne brune	brown peat moss	*Sphagnaceae*	2b, 3a
sphaigne agréable	pleasant peat moss	*Sphagnaceae*	2b
sphaigne étrange	**splendid peat moss**	***Sphagnaceae***	2b
sphaigne à feuilles obtuses	obtuse peat moss	*Sphagnaceae*	2b
sphaigne d'Olaf	Olaf's peat moss	*Sphagnaceae*	2b
sphaigne orientale	**oriental peat moss**	***Sphagnaceae***	2b
sphaigne à feuilles larges	flat-leaved peat moss	*Sphagnaceae*	2b
sphaigne rougeâtre	red peat moss	*Sphagnaceae*	2b, 3a
calliergon jaunâtre	straw moss	*Callergoniaceae*	3a
tétraplodon enflé	urceolate nitrogen moss	*Splachnaceae*	3a
timmie à gaine orangée	**Austrian timmia**	*Timmiaceae*	3a
timmie à gaine lisse	Bavarian timmia	*Timmiaceae*	1

FRENCH	ENGLISH	FAMILLE	SOURCE
barbille nordique	Binstead's pawwort	*Anastrophyllaceae*	2b
barbille bazinée	Atlantic pawwort	*Anastrophyllaceae*	3a

Appendix 3 New or Rare Invascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

Lichens and lichenicolous fungus

LATIN	NEW FOR SCIENCE	NEW FOR CANADA	NEW FOR QUÉBEC	RARE IN QUÉBEC
Acarospora moenium			X	
Acarospora rugulosa			X	
Agonimia gelatinosa				X
Arthonia lapidicola			X	
Aspicilia cingulata			X	
Bryonora curvescens			X	
Caloplaca approximata			X	
Caloplaca tornoensis			X	
Catillaria contristans			X	
Cecidonia umbonella		X		
Diplotomma hedinii		X		
Diplotomma nivalis			X	
Hymenelia epulotica			X	
Hymenelia heteromorpha			X	
Lecanora formosa		X		
Lecidea ecrustacea			X	
Lecidea swartzioidea		X		
Micarea inquinans		X		
Myriolecis torrida				X
Pertusaria subdactylina				X
Polyblastia gothica		X		
Polyblastia intermedia		X		
Polysporina urceolata			X	
Porpidia sp. nov. Fryday	X			
Rhizocarpon sp. nov. Fryday	X			
Rhizocarpon intermediellum			X	
Rhizocarpon pusillum			X	
Rhizocarpon simillimum			X	
Rinodina notabilis		X		
Schaereria endocyanea			X	
Sporodictyon terrestre			X	
Staurothele arctica			X	
Tetramelas insignis			X	
Toninia squalescens		X		

Bryophytes - Mosses

LATIN	NEW FOR SCIENCE	NEW FOR CANADA	NEW FOR QUÉBEC	RARE IN QUÉBEC
Andreaea nivalis Hook.				X
Cinclidium latifolium Lindb.				X
Oligotrichum falcatum Steere				X
Plagiomnium curvatulum (Lindb.) Schljakov				X
Schistidium venetum H.H. Blom				X
Tortella inclinata (R. Hedw.) Limpr.				X

Bryophytes - Liverworts

LATIN	NEW FOR SCIENCE	NEW FOR CANADA	NEW FOR QUÉBEC	RARE IN QUÉBEC
Clevea hyalina (Sommerf.) Lindb.				X
Jungermannia polaris Lindb.				X
Mannia gracilis (F. Weber) D.B. Schill & D.G. Long				X
Scapania kaurinii Ryan				X

Sources: Gagnon, 2018

Appendix 4 Alphabetical List of Vascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

Lichens and lichenicolous fungus

LATIN	FRENCH	ENGLISH
Agrostis mertensii Trin.	agrostide de Mertens	northern bentgrass
Alopecurus borealis Trin.	vulpin boréal	alpine foxtail
Anemone richardsonii Hook.	anémone de Richardson	Richardson's anemone
Antennaria alpina (L.) Gaertn. subsp. *canescens* (Lange) Chmiel.	antennaire grisâtre	greyish pussytoes
Antennaria friesiana (Trautv.) E. Ekman subsp. *friesiana*	antennaire de Fries	Fries' pussytoes
Antennaria monocephala DC. subsp. *angustata* (Greene) Hultén	antennaire étroite	narrow-leaved pygmy pussytoes
Anthoxanthum monticola (Bigelow) Veldkamp subsp. *alpinum* (Sw. ex Willd.) Soreng	hiérochloé alpine	bent-awned alpine sweetgrass
Arabidopsis arenicola (Richardson ex Hook.) Al-Shehbaz *et al.*	arabette arctique	arctic rockcress
Arabis alpina L.	arabette alpine	alpine rockcress
Arctagrostis latifolia (R. Br.) Griseb. subsp. *latifolia*	arctagrostide à larges feuilles	wide-leaved polargrass
Arctanthemum arcticum (L.) Tzvelev subsp. *polare* (Hultén) Tzvelev	chrysanthème polaire	polar daisy
Arctous alpina (L.) Nied.	busserole alpine	alpine bearberry
Armeria scabra Pall. ex Roem. & Schult.	arméria de Sibérie	sea thrift
Arnica angustifolia Vahl subsp. *angustifolia*	arnica à feuilles étroites	narrow-leaved arnica
Astragalus alpinus L. subsp. *alpinus*	astragale alpin	alpine milk-vetch
Astragalus eucosmus B.L. Rob.	astragale élégant	elegant milk-vetch
Betula glandulosa Michx.	bouleau glanduleux	glandular birch
Bistorta vivipara (L.) Delarbre	renouée vivipare	alpine bistort
Braya glabella Richardson subsp. *glabella*	braya glabre	smooth braya
Calamagrostis canadensis (Michx.) P. Beauv. subsp. *langsdorffii* (Link) Hultén	calamagrostide de Langsdorff	Langsdorff's reedgrass
Calamagrostis lapponica (Wahlenb.) Hartm.	calamagrostide de Laponie	Lapland reedgrass
Calamagrostis neglecta (Ehrh.) P. Gaertn., B. Mey. & Scherb. *s. lat.*	calamagrostide raide	slim-stemmed reedgrass
Campanula rotundifolia L. subsp. *rotundifolia*	campanule à feuilles rondes	harebell
Campanula uniflora L.	campanule uniflore	arctic bellflower
Cardamine bellidifolia L.	cardamine à feuilles de pâquerette	alpine bittercress
Cardamine polemonioides Rouy	cardamine à feuilles étroites	Nyman's cuckooflower
Carex aquatilis Wahlenb. s. lat.	carex aquatique	water sedge
Carex atrofusca Schkuhr	carex brun foncé	dark-brown sedge
Carex bigelowii Torr. subsp. *bigelowii*	carex de Bigelow	Bigelow's sedge
Carex brunnescens (Pers.) Poir. subsp. *brunnescens*	carex brunâtre	brownish sedge

LATIN	FRENCH	ENGLISH
Carex capillaris L. subsp. *fuscidula* (V.I. Krecz. ex T.V. Egorova) Á. Löve & D. Löve	carex à épis sombres	dusky-spike sedge
Carex fuliginosa Schkuhr	carex fuligineux	short-leaved sedge
Carex glacialis Mack.	carex des glaces	glacier sedge
Carex glareosa Wahlenb. subsp. *glareosa*	carex des graviers	gravel sedge
Carex holostoma Drejer	carex à bec entier	arctic marsh sedge
Carex krausei Boeck.	carex de Krause	Krause's sedge
Carex lachenalii Schkuhr	carex de Lachenal	Lachenal's sedge
Carex marina Dewey	carex marin	sea sedge
Carex maritima Gunnerus	carex maritime	seaside sedge
Carex membranacea Hook.	carex membraneux	fragile sedge
Carex microglochin Wahlenb. subsp. *microglochin*	carex à petite arête	few-seeded fen sedge
Carex myosuroides Vill.	carex queue-de-souris	Bellard's kobresia
Carex nardina Fr.	carex nard	nard sedge
Carex norvegica Retz.	carex de Norvège	Norway sedge
Carex rariflora (Wahlenb.) Sm.	carex rariflore	loose-flowered alpine sedge
Carex scirpoidea Michx. subsp. *scirpoidea*	carex faux-scirpe	single-spike sedge
Carex simpliciuscula Wahlenb.	carex simple	simple kobresia
Carex subspathacea Wormsk.	carex subspathacé	Hoppner's sedge
Carex vaginata Tausch	carex engaîné	sheathed sedge
Carex williamsii Britton	carex de Williams	William's sedge
Cassiope tetragona (L.) D. Don subsp. *tetragona*	cassiope tétragone	four-angled mountain heather
Cerastium alpinum L. subsp. *alpinum*	céraiste alpin	alpine chickweed
Cerastium alpinum L. subsp. *lanatum* (Lam.) Ces.	céraiste laineux	woolly alpine chickweed
Cerastium arcticum Lange	céraiste arctique	arctic chickweed
Cerastium cerastoides (L.) Britton	céraiste à trois styles	starwort chickweed
Chamerion angustifolium (L.) Holub subsp. *angustifolium*	épilobe à feuilles étroites	fireweed
Chamerion latifolium (L.) Holub	épilobe à feuilles larges	arctic fireweed
Chrysosplenium tetrandrum (N. Lund ex Malmgren) Th. Fr.	dorine à quatre étamines	northern golden-saxifrage
Cochlearia groenlandica L.	cranson du Groenland	Greenland scurvygrass
Comarum palustre L.	comaret des marais	marsh cinquefoil
Comastoma tenellum (Rottb.) Toyok.	gentiane délicate	slender gentian
Cystopteris fragilis (L.) Bernh.	cystoptère fragile	fragile fern
Deschampsia cespitosa (L.) P. Beauv. subsp. *cespitosa*	deschampsie cespiteuse	tufted hairgrass
Deschampsia sukatschewii (Popl.) Roshev.	deschampsie naine	dwarf hairgrass

Appendix 4 (cont'd) Alphabetical List of Vascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

LATIN	FRENCH	ENGLISH
Diapensia lapponica L.	diapensie de Laponie	Lapland diapensia
Draba alpina L.	drave alpine	alpine draba
Draba arctica J. Vahl subsp. *ostenfeldii* (E. Ekman) Böcher ex Kartesz & S.K. Gandhi	drave d'Ostenfeld	Ostenfeld's draba
Draba cayouettei Mulligan & Al-Shehbaz	drave de Cayouette	Cayouette's draba
Draba corymbosa R. Br. ex DC.	drave en corymbe	flat-top draba
Draba crassifolia Graham	drave à feuilles charnues	snowbed draba
Draba glabella Pursh	drave glabre	smooth draba
Draba lactea Adams	drave laiteuse	milky draba
Draba nivalis Lilj.	drave des neiges	snow draba
Draba subcapitata Simmons	drave subcapitée	Ellesmere Island draba
Dryas integrifolia Vahl subsp. *integrifolia*	dryade à feuilles entières	entire-leaved mountain avens
Dupontia fisheri R. Br.	dupontie de Fisher	Fisher's tundra grass
Empetrum nigum L. subsp. *hermaphroditum* (Lange ex Hagerup) Böcher	camarine hermaphrodite	black crowberry
Epilobium arcticum Sam.	épilobe arctique	arctic willowherb
Equisetum arvense L. subsp. *alpestre* (Wahlenb.) Schönswetter & Elven	prêle alpine	polar horsetail
Equisetum variegatum Schleich. ex Weber & Mohr subsp. *variegatum*	prêle panachée	variegated scouring-rush
Erigeron humilis Graham	petite vergerette	low fleabane
Erigeron uniflorus L. var. *eriocephalus* (J. Vahl) B. Boivin	vergerette à capitule laineux	one-flowered fleabane
Eriophorum angustifolium Honck. subsp. *angustifolium*	linaigrette à feuilles étroites	narrow-leaved cottongrass
Eriophorum callitrix Cham. ex C.A. Mey.	linaigrette à belle crinière	beautiful cottongrass
Eriophorum medium Andersson subsp. *medium*	linaigrette moyenne	intermediate cottongrass
Eriophorum russeolum Fr. ex Hartm. subsp. *leiocarpum* M.S. Novos.	linaigrette à fruits glabres	smooth-fruited russet cottongrass
Eriophorum scheuchzeri Hoppe subsp. *scheuchzeri*	linaigrette de Scheuchzer	Scheuchzer's cottongrass
Eriophorum vaginatum L. subsp. *spissum* (Fernald) Hultén	linaigrette dense	dense cottongrass
Euphrasia wettsteinii G. Gusarova	euphraise de Wettstein	Wettstein's eyebright
Eutrema edwardsii R. Br.	eutréma d'Edwards	Edwards' mock wallflower
Festuca baffinensis Polunin	fétuque de Baffin	Baffin Island fescue
Festuca brachyphylla Schult. & Schult. f. subsp. *brachyphylla*	fétuque à feuilles courtes	short-leaved fescue
Festuca hyperborea Holmen ex Fred.	fétuque hyperboréale	high arctic fescue
Harrimanella hypnoides (L.) Coville	cassiope hypnoïde	moss heather
Hippuris lanceolata Retz.	hippuride à feuilles lancéolées	lance-leaved mare's-tail
Hippuris vulgaris L.	hippuride vulgaire	common mare's-tail

LATIN	FRENCH	ENGLISH
Honckenya peploides (L.) Ehrh. subsp. *diffusa* (Hornem.) Hultén ex V.V. Petrovsky	honckénye diffuse	northern seabeach sandwort
Hulteniella integrifolia (Richardson) Tzvelev	marguerite à feuilles entières	entire-leaved daisy
Huperzia appressa (Desv.) Á. Löve & D. Löve	lycopode des Appalaches	mountain firmoss
Huperzia selago (L.) Bernh. ex Schrank & Martius	lycopode sélagine	northern firmoss
Juncus arcticus Willd. subsp. *arcticus*	jonc arctique	arctic rush
Juncus biglumis L.	jonc à deux glumes	two-glumed rush
Juncus leucochlamys V.J. Zinger ex V.I. Krecz.	jonc à capsules pâles	Asian chestnut rush
Juncus triglumis L. subsp. *albescens* (Lange) Hultén	jonc blanchâtre	northern white rush
Koenigia islandica L.	koenigie d'Islande	Iceland purslane
Leymus mollis (Trin.) Pilg. subsp. *villosissimus* (Scribn.) Á. Löve & D. Löve	élyme des sables velu	arctic lymegrass
Luzula confusa Lindeb.	luzule trompeuse	northern woodrush
Luzula groenlandica Böcher	luzule du Groenland	Greenland woodrush
Luzula multiflora (Ehrh.) Lej. subsp. *frigida* (Buchenau) V.I. Krecz.	luzule des frimas	northern many-flowered woodrush
Luzula nivalis (Laest.) Spreng.	luzule arctique	arctic woodrush
Luzula spicata (L.) DC. subsp. *spicata*	luzule en épi	spiked woodrush
Luzula wahlenbergii Rupr.	luzule de Wahlenberg	Wahlenberg's woodrush
Mertensia maritima (L.) Gray subsp. *maritima*	mertensie maritime	sea-lungwort
Micranthes foliolosa (R. Br.) Gornall	saxifrage à bulbilles	leafy saxifrage
Micranthes nivalis (L.) Small	saxifrage des neiges	snow saxifrage
Micranthes tenuis (Wahlenb.) Small	saxifrage ténue	slender saxifrage
Minuartia biflora (L.) Schinz & Thellung	minuartie à deux fleurs	mountain stitchwort
Montia fontana L. subsp. *fontana*	montie des sources	water blinks
Oreojuncus trifidus (L.) Záveská Drábková & Kirschner	jonc trifide	highland rush
Oxyria digyna (L.) Hill.	oxyrie de montagne	mountain-sorrel
Oxytropis deflexa (Pall.) DC. subsp. *dezhnevii* (Jurtz.) Jurtz.	oxytrope à folioles nombreuses	foliose locoweed
Oxytropis maydelliana Trautv.	oxytrope de Maydell	Maydell's locoweed
Papaver labradoricum (Fedde) Solstad & Elven	pavot du Labrador	labrador poppy
Parnassia kotzebuei Cham. ex Spreng.	parnassie de Kotzebue	Kotzebue's grass-of-Parnassus
Pedicularis flammea L.	pédiculaire flammée	red-tipped lousewort
Pedicularis hirsuta L.	pédiculaire hirsute	hairy lousewort
Pedicularis labradorica Wirsing	pédiculaire du Labrador	Labrador lousewort
Pedicularis lanata Willd. ex Cham. & Schltdl.	pédiculaire laineuse	woolly lousewort
Pedicularis lapponica L.	pédiculaire de Laponie	Lapland lousewort

Appendix 4 (cont'd) Alphabetical List of Vascular Plant Taxa in the Study Area for the Parc national Iluiliq Project

LATIN	FRENCH	ENGLISH
Phippsia algida (Sol.) R. Br.	phippsie arctique	icegrass
Phyllodoce caerulea (L.) Bab.	phyllodoce bleue	purple mountain heather
Plantago maritima L.	plantain maritime	seaside plantain
Pleuropogon sabinei R. Br.	pleuropogon de Sabine	Sabine's semaphoregrass
Poa alpina L. subsp. *alpina*	pâturin alpin	alpine bluegrass
Poa arctica R. Br. subsp. *arctica*	pâturin arctique	arctic bluegrass
Poa glauca Vahl subsp. *glauca*	pâturin glauque	glaucous bluegrass
Poa hartzii Gand. subsp. *hartzii*	pâturin de Hartz	Hartz's bluegrass
Poa pratensis L. subsp. *alpigena* (Lindm.) Hiitonen	pâturin alpigène	alpine meadow bluegrass
Potentilla anserina L. subsp. *groenlandica* Tratt.	potentille du Groenland	Greenland silverweed
Potentilla arenosa (Turcz.) Juz. subsp. *chamissonis* (Hultén) Elven & D.F. Murray	potentille de Chamisso	Chamisso's cinquefoil
Potentilla hyparctica Malte subsp. *elatior (Abromeit) Elven & D. F. Murray*	grande potentille arctique	sans nom officiel
Potentilla hyparctica Malte subsp. *hyparctica*	petite potentille arctique	arctic cinquefoil
Potentilla nivea L.	potentille des neiges	snow cinquefoil
Potentilla pulchella R. Br.	potentille jolie	pretty cinquefoil
Potentilla vahliana Lehm.	potentille de Vahl	Vahl's cinquefoil
Puccinellia phryganodes (Trin.) Scribn. & Merr. subsp. *neoarctica* (Á. Löve & D. Löve) Elven	puccinellie rampante	creeping alkaligrass
Puccinellia tenella (Lange) Holmb. subsp. *langeana* (Berlin) Tzvelev	puccinellia de Lange	Lange's alkaligrass
Pyrola grandiflora Radius	pyrole à grandes fleurs	arctic pyrola
Ranunculus arcticus Richardson	renoncule arctique	nornthern buttercup
Ranunculus hyperboreus Rottb.	renoncule hyperboréale	far-northern buttercup
Ranunculus nivalis L.	renoncule des neiges	snow buttercup
Ranunculus pygmaeus Wahlenb.	renoncule naine	pygmy buttercup
Rhododendron lapponicum (L.) Wahlenb.	rhododendron de Laponie	Lapland rosebay
Rhododendron tomentosum Harmaja subsp. *decumbens* (Aiton) Elven & D.F. Murray	petit thé du Labrador	northern Labrador tea
Sabulina rubella (Wahlenb.) Dillenberger & Kadereit	sabline rougeâtre	reddish stitchwort
Sabulina stricta (Sw.) Rchb.	sabline dressée	bog stitchwort
Sagina caespitosa (J. Vahl) Lange	sagine cespiteuse	tufted pearlwort
Sagina nivalis (Lindblom) Fr.	sagine des neiges	snow pearlwort
Salix arctica Pallas	saule arctique	arctic willow
Salix arctophila Cockerell	saule arctophile	northern willow
Salix calcicola Fernald & Wiegand	saule calcicole	limestone willow

LATIN	FRENCH	ENGLISH
Salix glauca L. var. *cordifolia* (Pursh) Dorn	saule à beaux fruits	beautiful willow
Salix herbacea L.	saule herbacé	snowbed willow
Salix planifolia Pursh	saule à feuilles planes	tea-leaved willow
Salix reticulata L.	saule réticulé	net-veined willow
Salix uva-ursi Pursh	saule raisin-d'ours	bearberry willow
Saxifraga aizoides L.	saxifraga jaune	yellow mountain saxifrage
Saxifraga cernua L.	saxifrage penchée	nodding saxifrage
Saxifraga cespitosa L.	saxifrage cespiteuse	tufted saxifrage
Saxifraga hirculus L.	saxifrage œil-de-bouc	yellow marsh saxifrage
Saxifraga hyperborea R. Br.	saxifrage hyperboréale	pygmy saxifrage
Saxifraga oppositifolia L. subsp. *oppositifolia*	saxifrage à feuilles opposées	purple mountain saxifrage
Saxifraga rivularis L. subsp. *rivularis*	saxifrage des ruisseaux	alpine brook saxifrage
Saxifraga tricuspidata Rottb.	saxifrage à trois dents	three-toothed saxifrage
Silene acaulis (L.) Jacq.	silène acaule	moss campion
Silene involucrata (Cham. & Schltdl.) Bocquet subsp. *involucrata*	silène involucré	arctic catchfly
Silene uralensis (Rupr.) Bocquet subsp. *uralensis*	silène de l'Oural	nodding catchfly
Stellaria humifusa Rottb.	stellaire déprimée	saltmarsh starwort
Stellaria longipes Goldie subsp. *longipes*	stellaire à longs pédicelles	long-stalked starwort
Taraxacum ceratophorum DC.	pissenlit tuberculé	horned dandelion
Taraxacum lapponicum Kihlman ex Handel-Mazzetti	pissenlit de Laponie	Lapland dandelion
Tofieldia pusilla (Michx.) Pers.	tofieldie naine	small tofieldia
Trisetum spicatum (L.) K. Richt.	trisète à épi	spike trisetum
Vaccinium uliginosum L.	airelle des marécages	bog bilberry
Vaccinium vitis-idaea L.	airelle rouge	mountain cranberry
Veronica wormskjoldii Roem. & Schult.	véronique de Wormskjöld	Wormskjold's alpine speedwell
Woodsia alpina (Bolton) Gray	woodsie alpine	alpine woodsia

Notes:
The taxa composing the vascular flora of the study area are presented in alphabetical order of their Latin name. French and English names (from Brouillet *et al.* (2010+)) are provided as an indication for each taxon.

Sources: Tremblay, 2016

Appendix 5 Mammals in the Study Area for the Parc national Iluiliq Project

ENGLISH	FRENCH	LATIN
Marine mammals		
White whale	**Béluga**	*Delphinapterus leucas*
Narwhal	Narval	*Monodon monoceros*
Killer whale	Épaulard	*Orcinus orca*
Minke whale	Petit rorqual	Balaenoptera acutorostrata
Bowhead whale	Baleine boréale	*Balaena mysticetus*
Ringed seal	**Phoque annelé**	*Phoca hispida*
Bearded seal	**Phoque barbu**	*Erignathus barbatus*
Harp seal	**Phoque du Groenland**	*Phoca groenlandica*
Harbour seal	**Phoque commun**	*Phoca vitulina*
Walrus	Morse	*Odobenus rosmarus*
Polar bear	**Ours blanc**	*Ursus maritimus*
Big Terrestrial Mammals		
Black bear	**Ours noir**	*Ursus americanus*
Caribou (migratory)	**Caribou (écotype migrateur)**	*Rangifer tarandus*
Muskox	**Bœuf musqué**	*Ovibus moschatus*
Fur and small terrestrial mammals		
Arctic hare	**Lièvre arctique**	*Lepus arcticus*
Gray wolf	**Loup gris**	*Canis lupus*
Red fox	**Renard roux**	*Vulpes vulpes*
Arctic fox	**Renard arctique**	*Alopex lagopus*
Least weasel	Belette pygmée	*Mustela nivalis*
Wolverine	Carcajou	*Gulo gulo*
Ermine	Hermine	*Mustela erminea*
River Otter	Loutre de rivière	*Lontra canadensis*
Micromammals		
Ungava lemming	**Lemming d'Ungava**	*Dicrostonyx hudsonius*
Meadow vole	**Campagnol des champs**	*Microtus pennsylvanicus*
Northern Bog Lemming	**Campagnol lemming-boréal**	*Synaptomys borealis*

Confirmed species or for which its range overlaps the study area

Species potentially present in the study area

[1]Provincial Status: V (Vulnerable); T (Threatened); LDTV (Likely to be designated threatened or vulnerable species)

[2]COSEWIC Status (Federal): SC(Special Concern); E (Endangered)

INUKTITUT Roman/Syllabics	FAMILY	RISK CATEGORY[1,2]
Qilalugaq	*Monodontidae*	LDTV et E (population EHB) SC (WHB)
Allanguaq	*Monodontidae*	SC
Aaluasiaq	*Delphinidae*	SC
Pamiuligajuk	Balaenopteridae	
Arvik	*Blaaenidae*	SC
Natsiq (en général) Natsiajuq (juvénile) Natsimarik (adulte) Illaulik (gravide)	*Phocidae*	
Utjuk	*Phocidae*	
Qairulik	*Phocidae*	
Qasigiaq	*Phocidae*	
Aivik	*Odobenidae*	LDTV, SC
Nanuk	*Ursidae*	V, SC
Atsak	*Ursidae*	
Tuktuq	*Cervidae*	Under evaluation from COSEWIC
Umimmak	*Bovidés*	
Ukaliq	*Leporidae*	
Amaruq	*Canidae*	
Kajurtuq	*Canidae*	
Tiriganniaq	*Canidae*	
Tiriaq	*Mustelidae*	LDTV
Qavvik/Qavvikallak	*Mustelidae*	T, E
Tiriaq	*Mustelidae*	
Pamiurtuuq	*Mustelidae*	
Avinngaq	*Cricetidae*	
Nunivakkaq	*Cricetidae*	
Avingaq	*Cricetidae*	

Appendix 6 Birds in the Study Area for the Parc national Iluiliq Project

ORDER	FAMILY ENGLISH NAME	FRENCH	LATIN
ANSERIFORMES	**ANATIDAE**		
	Snow goose	Oie des neiges	*Chen caerulescens*
	Cackling Goose	Bernache de Hutchins	Branta hutchinsii
	Canada Goose	Bernache du Canada	*Branta canadensis*
	Tundra Swan	Cygne siffleur	*Cygnus columbianus*
	American Black Duck	Canard noir	*Anas rubripes*
	Blue-winged Teal	Sarcelle à ailes bleues	*Anas discors*
	Northern Pintail	Canard pilet	*Anas acuta*
	Green-winged Teal	Sarcelle d'hiver	*Anas crecca*
	King Eider	Eider à tête grise	*Somateria spectabilis*
	Common Eider	Eider à duvet	*Somateria mollissima*
	Harlequin Duck	Arlequin plongeur	*Histrionicus histrionicus*
	Long-tailed Duck	Harelde kakawi	*Clangula hyemalis*
	Common Merganser	Grand harle	*Mergus merganser*
	Red-breasted Merganser	Harle huppé	*Mergus serrator*
PHASANIFORMES	**PHASIANIDAE**		
	Rock Ptarmigan	Lagopède alpin	*Lagopus muta*
CHARADRIIFORMES	**CHARADRIIDAE**		
	Semipalmated Plover	Pluvier semipalmé	*Charadrius semipalmatus*
	SCOLOPACIDAE		
	Dunlin	Bécasseau variable	*Calidris alpina*
	Baird's Sandpiper	Bécasseau de baird	*Calidris bairdii*
	White-rumped Sandpiper	Bécasseau à croupion blanc	*Calidris fuscicollis*
	Semipalmated Sandpiper	Bécasseau semipalmé	*Calidris pusilla*
	Red-necked Phalarope	Phalarope à bec étroit	*Phalaropus lobatus*
	ALCIDAE		
	Thick-billed Murre	Guillemot de Brünnich	*Uria lomvia*
	Black Guillemot	Guillemot à miroir	*Cepphus grylle*
	LARIDAE		
	Herring Gull	Goéland argenté	*Larus argentatus*
	Iceland Gull	Goéland arctique	*Larus glaucoides*
	Lesser Black-backed Gull	Goéland brun	*Larus fuscus*
	Glaucous Gull	Goéland bourgmestre	*Larus hyperboreus*
	Great Black-backed Gull	Goéland marin	*Larus marinus*

INUKTITUT SYLLABICS	INUKTITUT ROMAN	BREEDING STATUS IN THE STUDY AREA OR IN ITS VICINITY[1,2]	RISK CATEGORY[3]
ᑲᖏᒍᑲ	Kanguq	Possible Breeding[1,2]	
		Possible Breeding[2]	
ᓂᕋᓪᓕ	Nirliq	Confirmed Breeding[1,2]	
ᖃᐅᔨᓪᓕ	Qutjuq	Confirmed Breeding[2]	
ᒥᑎᕋᓗᒃ	Mitirluk	Possible Breeding[2]	
		Probable Breeding[2]	
ᕿᑲᓗᑐᓪᓕ	Ivujaq	Possible Breeding[2]	
ᐃᒡᓗᐱᐸᑲ	Ivugapiq	Possible Breeding[2]	
ᖃᑭᖏᓚᓂᑲ	Qingalik	Confirmed Breeding[2]	
ᒥᑎᓪᓕ	Mitiq	Confirmed Breeding[2]	
ᑐᑦᓂᑭᓇᓪᓕ / ᐊᑲᓂᐅᑐᑲ / ᑐᑦᓂᐅᖃᓚᐸᑲ	Kuutsiutik	Probable Breeding[2]	SC-V
ᐊᒡᑎᓪᓕ / ᐊᒡᑎᐊᑲᓐᓇᓪᓕ	Aggiq / Aggiakannaq	Confirmed Breeding[2]	
ᐱᐊᓪᓕ/ᓄᔨᓂᑲ	Paiq / Nujalik	Possible Breeding[1,2]	
ᓄᔨᓂᑲ / ᕿᐃᓪᓕ	Nujalik / Paiq	Possible Breeding[2]	
ᐊᖏᒡᑎᑐᐃᓐᓇᓪᓕ	Aqiqituinaq	Confirmed Breeding[2]	
ᖃᐅᓂᖃᐅᓂᐊᓪᓕ	Qulliqulliaq	Confirmed Breeding[2]	
		Possible Breeding[2]	
ᓱᑦᔨᓇᐊᑲ	Sitjariaq	Observed[2]	
ᓯᑦᔨᓇᐊᑲ	Sitjariaq	Observed[2]	
ᓱᑦᔨᓇᐊᓪᓕ	Iuviluvilaaq	Confirmed Breeding[2]	
ᓴᐅᖏᕐᓪᓕ	Sarvaq	Observed[2]	(Suggested SC)
		Confirmed Breeding[1]	
		Probable Breeding[1]	
ᓇᐅᔨᓪᓕ	Naujaq	Confirmed Breeding[2]	
ᓇᐅᔨᓪᓗᒍᓪᓕ	Naujarlugaq	Confirmed Presence[1,2]	
		Observed[2]	
ᓇᐅᔨᕕᑲ	Naujavik	Confirmed Breeding[1,2]	
ᑯᓕᓕᒃ	Kulilik	Confirmed Breeding[2]	

Appendix 6 (cont'd) Birds in the Study Area for the Parc national Iluiliq Project

ORDER	FAMILY ENGLISH NAME	FRENCH	LATIN
GAVIFORMES	**GAVIIDAE**		
	Red-throated Loon	Plongeon catmarin	*Gavia stellata*
	Pacific Loon	Plongeon du Pacifique	*Gavia pacifica*
	Common Loon	Plongeon huard	*Gavia immer*
ACCIPITRIFORMES	**ACCIPITRIDAE**		
	Rough-legged Hawk	Buse pattue	*Buteo lagopus*
	Golden Eagle	Aigle royal	*Aquila chrysaetos*
STRIGIFORMES	**STRIGIDAE**		
	Snowy Owl	Harfang des neiges	*Bubo scandiacus*
	Short-eared Owl	Hibou des marais	*Asio flammeus*
FALCONIFORMES	**FALCONIDAE**		
	Gyrfalcon	Faucon gerfaut	*Falco rusticolis*
	Peregrine Falcon	Faucon pèlerin	*Falco peregrinus*
PASSERIFORMES	**CORVIDAE**		
	Common Raven	Grand corbeau	*Corvus corax*
	ALAUDIDAE		
	Horned Lark	Alouette hausse-col	*Eremophila alpestris*
	MUSCICAPIDAE		
	Northern Wheatear	Traquet motteux	*Oenanthe oenanthe*
	TURDIDAE		
	American Robin	Merle d'Amérique	*Turdus migratorius*
	MOTACILLIDAE		
	American Pipit	Pipit d'Amérique	*Anthus rubescens*
	FRINGILLIDAE		
	Common Redpoll	Sizerin flammé	*Acanthis flammea*
	Hoary Redpoll	Sizerin blanchâtre	*Acanthis hornemanni*
	CALCARIIDAE		
	Lapland Longspur	Plectrophane lapon	*Calcarius lapponicus*

INUKTITUT SYLLABICS	INUKTITUT ROMAN	BREEDING STATUS IN THE STUDY AREA OR IN ITS VICINITY[1,2]	RISK CATEGORY[3]
ᖃᖅᓴᐅᒃ	Qarsauk	Confirmed Breeding [2]	
		Probable Breeding [2]	
ᑐᓪᓗᖅ	Tuulliq	Possible Breeding [2]	
ᑭᐅᓚᐃᒃ / ᖃᑭᓂᐊᔪᐊᖅ	Qinuajuaq	Probable Breeding [1]	
ᓇᓪᑐᕿᓕᒃ	Natturalik	Confirmed Presence [2]	V
ᐅᒃᐱᒃ	Ukpik	Confirmed Presence[2]	
ᐅᓂᓇᐊᓯᐅᑎᐊᐱᒃ	Unnuasiutiapik	Possible Breeding [2]	
ᑭᐅᓚᐃᒃ	Kiggavirtlaq	Possible Breeding [2]	
ᑭᐅᓚᐃᒃ / ᑭᐅᓚᐃᐊᖅᓴᒃ	Kiggavik	Confirmed Breeding [1,2]	SC (*anatum* and *tundrius)* V (*anatum*)
ᑐᓗᓚᖅ	Tulugaq	Confirmed Breeding [1,2]	
ᖃᐅᔨᓇᐊᖅᓯᖅ	Qupanuarpaq	Confirmed Breeding [2]	
ᐃᖅᐄᓕᓚᖅ	Iquligaq	Confirmed Breeding [2]	
ᐃᒃᑲᓕᓕᒃ	Irkarilik	Confirmed Breeding [2]	
ᐃᖏᑦᑕᔪᖅ	Ingittajuuq	Confirmed Breeding [2]	
ᓴᒃᓴᑭᐊᒃ	Saksagiaq / Sirsigiaq	Confirmed Breeding [2]	
ᓴᒃᓴᑭᐊᒃ	Saksagiaq / Sirsigiaq	Confirmed Breeding [2]	
ᓇᓴᓕᐊᐱᒃ	Nasaliapik / Nasauligaq	Confirmed Breeding [2]	

Appendix 6 (cont'd) Birds in the Study Area for the Parc national Iluiliq Project

ORDER	FAMILY ENGLISH NAME	FRENCH	LATIN
PASSERIFORMES	Snow Bunting	Plectrophane des neiges	*Plectrophenax nivalis*
	EMBERIZIDAE		
	American Tree Sparrow	Bruant hudsonien	*Spizella arborea*
	Savannah Sparrow	Bruant des prés	*Passerculus sandwichensis*
	White-crowned Sparrow	Bruant à couronne blanche	*Zonotrichia leucophrys*
	Dark-eyed Junco	Junco ardoisé	*Junco hyemalis*
	PARULIDAE		
	Wilson's warbler	Paruline à calotte noire	*Cardellina pusilla*

Note :

[1] Breeding information from AONQ

[2] Breeding information from the study area of Deception Bay and Raglan Mine (SNC-Lavalin, 2015)

[3] Provincial Status: V (Vulnerable); T (Threatened); LDTV (Likely to be designated threatened or vulnerable species).
COSEWIC Status (Federal): SC (Special Concern); E (Endangered)

INUKTITUT SYLLABICS	INUKTITUT ROMAN	BREEDING STATUS IN THE STUDY AREA OR IN ITS VICINITY[1,2]	RISK CATEGORY[3]
ᐊᒪᐅᓕᓂᐱᒃ	Amaulligaaq	Confirmed Breeding [2]	
ᐅᑭᐅᖅᓯᐅᓕᒃ	Ukiursiulik	Probable Breeding [1]	
ᐃᖃᒋᑕᕐᖅ	Ingittajuq	Confirmed Breeding [2]	
ᖁᔭᐳᑦᓕᒃ	Quupuutalik	Confirmed Breeding [1,2]	
		Confirmed Breeding [2]	
		Possible Breeding [1]	

Appendix 7 Fish of the Study Area for the Parc national Iluiliq Project

ENGLISH	FRENCH	LATIN
Arctic alligatorfish	**Poisson-alligator Arctique**	***Ulicina olerikii***
Arctic char	**Omble chevalier**	***Salvelinus alpinus***
Arctic cod	Saïda franc	*Boreogadus saida*
Arctic eelpout	Lycode arctique	*Lycodes reticulatus*
Arctic sculpin	**Chaboisseau Arctique**	***Myoxocephalus scorpioides***
Arctic shanny	Stichée Arctique	*Stichaeus punctatus*
Arctic staghorn sculpin	**Tricorne Arctique**	***Gymnocanthus tricuspis***
Atlantic cod	**Morue franche**	***Gadus morhua***
Atlantic salmon	Saumon Atlantique	*Salmo salar*
Atlantic spiny lumpsucker	Petite poule de mer Atlantique	*Eumicrotremus spinosus*
Banded gunnel	Sigouine rubannée	*Pholis fasciata*
Brook trout	**Omble de fontaine**	***Salvelinus fontinalis***
Canadian plaice	**Plie canadienne**	***Hippoglossoides platessoides***
Capelin	Capelan	*Mallotus villosus*
Daubed shanny	Lompénie tachetée	*Leptoclinus maculatus*
Fish doctor	Unernak caméléon	*Gymnelus viridis*
Fourhorn sculpin	**Chaboisseau à quatre cornes**	***Myoxocephalus quadricornis***
Fourline snakeblenny	**Quatres-lignes Atlantique**	***Eumesogrammus praecisus***
Gelatinous seasnail	Limace gélatineuse	*Liparis fabricii*
Greenland cod	**Ogac**	***Gadus ogac***
Greenland halibut	Flétan du Groenland	*Reinhardtius hippoglossoides*
Greenland shark	Requin du Groenland	*Somniosus microcephalus*
Kelp Snailfish	**Limace des laminaires**	***Liparis tunicatus***
Lake trout	Touladi	*Salvelinus namaycush*
Lake whitefish	**Grand corégone**	***Coregonus clupeaformis***
Leatherfin lumpsucker	Petite poule de mer Arctique	*Eumicrotremus derjugini*
Longnose sucker	Meunier rouge	*Catostomus catostomus*
Mailed sculpin or bigeye sculpin	Faux-trigle à grand yeux	*Triglops nybelini*
Moustache sculpin or mailed sculpin	Faux-trigle armé	*Triglops murrayi*
Ninespine stickleback	Épinoche à neuf épines	***Pungitius pungitius***
Northern sand lance	Lançon du Nord	*Ammodytes dubius*
Pacific sand lance	Lançon gourdeau	*Ammodytes hexapterus*
Ribbed sculpin	**Faux-trigle bardé**	***Triglops pingelii***
Round whitefish	**Ménomini rond**	***Prosopium cylindraceum***
Shorthorn sculpin	Chaboisseau à épines courtes	*Myoxocephalus scorpius*
Slender eelbleeny	Lopénie élancée	*Lumpenus fabricii*
Stout eelbleeny	Lopénie naine	*Anisarchus medius*
Threespine stickleback	Épinoches à trois épines	***Gasterosteus aculeatus***

Note:

Confirmed species or for which its range overlaps the study area

Species potentially present in the study area

[1] Provincial Status: V (Vulnerable); T (Threatened); LDTV (Likely to be designated threatened or vulnerable species), COSEWIC Status (Federal): SC (Special Concern); E (Endangered)

FAMILY	INUKTITUT (Roman)	RISK CATEGORY[1]
Agonidae		
Salmonidae	**Iqaluppiq**	
Gadidae	Uugaq	
Lycodinae		
Cottidae	**Kanajuq**	
Stichaeidae		
Cottidae		
Gadidae	**Uugaq**	**E (pop of Newfoundland and Labrador)**
Salmonidae	Saama	
Cyclopteridae		
Pholidae		
Salmonidae	**Aanak**	
Pleuronectidae		
Osmeridae	Ammajaq	
Stichaeidae		
Zoarcidae		
Cottidae	**Kanajuq**	**LDTV**
Stichaeidae		
Cyclopteridae		
Gadidae	**Uagaq**	
Pleuronectidae	Natamaq	
Liparidae	Iqalutjuaq	
Cyclopteridae	**Nipisaq**	
Salmonidae	Isiuralittaaq	
Salmonidae	**Kapisilik**	
Cyclopteridae		
Catostomidae	Milugiaq	
Cottidae		
Cottidae		
Gasterosteidae	**Kakilassak**	
Ammodytidae		
Ammodytidae		
Cottidae		
Salmonidae	**Kavisilik**	
Cottidae	Kanajuq	
Stichaeidae		
Stichaeidae		
Gasterosteidae	**Kakilassak**	

Appendix 8 Molluscs of the Study Area for the Parc national Iluiliq Project

PHYLUM	CLASS	LATIN	FRENCH	ENGLISH
MOLLUSCA	**GASTROPODA**	*Boreocingula castanea*	Buccin	
		Buccinum glaciale	Buccin	
		Buccinum scalariforme	Buccin	
		Buccinum undatum	Buccin	
		Clione limacina		
		Cylichna alba		White chalice-bubble
		Erginus rubellus		Reddish limpet
		Limacina helicina		Helicid pteropod
		Littorina saxatilis	Littorine des rochers	Black-lined periwinkle
		Margarites helicinus		Pearly top shell
		Margarites costalis		Boreal rosy margarite
		Margarites groenlandicus		Greenland margarite
		Oenopota pyramidalis		
		Plicifusus kroeyeri		
		Puncturella noachina		Diluvian puncturella
		Retusa obtusa		
		Scabrotrophon fabricii		Trophon
	CEPHALOPODA	*Gonatus fabricii*		Boreoatlantic armhook squid
	BIVALVIA	*Acmea testudinalis*		
		Astarte borealis		
		Astarte elliptica		Elliptical astarte
		Astarte montagui		Narrow-hinge astarte
		Axinopsida orbiculata		Orbicular axinopsid
		Chlamys islandica		
		Ciliatocardium ciliatum		
		Crenella faba		Bean crenella
		Cyclocardia borealis		
		Ennucula tenuis		Smooth nutclam
		Hiatella arctica		Arctic hiatella
		Macoma balthica		Baltic macoma
		Macoma calcarea		
		Musculus discors	Moule	Discordant mussel
		Musculus corrugatus		Corrugate mussel
		Mya pseudoarenaria	Mye	False softshell
		Mya truncata	Mye tronquée	Truncate softshell
		Mytilus edulis	Moule bleue	Blue mussel
		Nuculana minuta		Minute nutclam
		Nuculana oernula		Northern nutclam
		Serripes groenlandicus	Coque du Groenland	Greenland cockle
		Yoldia hyperborea		

Appendix 9 Crustaceans of the Study Area for the Parc national Iluiliq Project

SUB-PHYLUM	CLASS	LATIN	FRENCH	ENGLISH
CRUSTACEA	**BRANCHIOPODA**	*Atretia gnomon*		
		Branchinecta paludosa		Circumpolar fairy shrimp
		Cryptopora gnomon		
		Daphnia pulex	Puce d'eau	Water fleas
		Hemithiris psittacea	Rhynchonella grise	
		Lepidurus arcticus		Arctic tadpole shrimp
	MALACOSTRACA	*Ampelisca eschrichti*		
		Ampelisca macrocephala		
		Anonyx laticoxae		
		Anonyx lilljeborgi		
		Anonyx nugax		
		Apherusa glacialis		
		Argis dentata		Arctic argid
		Boeckosimus edwardsi		
		Boreomysis nobilis		
		Calliopius laeviusculus		
		Caprella septentrionalis		
		Diastylis rathkei		
		Ektonodiastylis robusta		
		Eualus fabricii		
		Eualus gaimardi		
		Eugerda tenuimana		
		Eurysteus melanops		
		Eusirus cuspidatus		
		Gammarus locusta		
		Gammarus oceanucus		
		Gammarus setosus		
		Gammarus wilkitzkii		
		Guernea nordenskioldi		
		Haploops tubicola		
		Hardametopa carinata		
		Hyas coarctatus		Arctic lyre crab
		Hyperia galba		
		Hyperia medusarum		
		Ischyrocerus anguipes		
		Lebbeus groenlandicus		Spiny lebbeid
		Lebbeus polaris		Polar lebbeid

Appendix 9 (cont'd) Crustaceans of the Study Area for the Parc national Iluiliq Project

SUB-PHYLUM	CLASS	LATIN	FRENCH	ENGLISH
CRUSTACEA		*Melita dentata*		
		Melita formosa		
		Monoporeia affinis		
		Mysis mixta		
		Mysis oculata		
		Mysis polaris		
		Onisimus glacialis		
		Onisimus nanseni		
		Onisimus litoralis		
		Onisimus sextoni		
		Oradarea longimana		
		Orchomene minuta		
		Orchomene pinguis		
		Pagurus pubescens		
		Paroediceros lynceus		
		Pontogeneia inermis		
		Pontoporeia femorata		
		Protomedeia fasciata		
		Rostroculodes schneideri		
		Sclerocrangon boreas		
		Spirontocaris phippsi		
		Spirontocaris spinus		
		Themisto abyssorum		
		Themisto libellula		
		Thysanoessa raschii		
		Weyprechtia pinguis		
	MAXILLOPODA	*Balanus balanoides*		Northern rock barnacle
		Balanus balanus		Rough barnacle
		Balanus crenatus	Balane	Barnacle
		Calanus hyperboreus		
		Diaptomus eiseni		
		Metridia longa		
		Paracyclops fimbriatus		
		Paraeuchaeta norvegica		
	OSTRACODA	*Acanthocythereis dunelmensis*		

Appendix 10 Other Invertebrates in the Study Area for the Parc national Iluiliq Project

PHYLUM	CLASS	LATIN
ANNELIDA	POLYCHEATA	*Ampharete finmarchica*
		Ampharete sibirica
		Apistobranchus tullbergi
		Aricidea nolani
		Axiothella catenata
		Bipalponephtys neotena
		Capitella capitata
		Circeis spirillum
		Cistenides granulata
		Dipolydora caulleryi
		Dipolydora quadrilobata
		Euchone analis
		Exogone naidina
		Exogone hebes
		Exogone longicirris
		Galathowenia oculata
		Glycera capitata
		Harmothoe imbricata
		Laonome kroyeri
		Lysippe labiata
		Manayunkia aestuarina
		Neoamphitrite groenlandica
		Nereis pelagica
		Ophelia limacina
		Paradexiospira violaceus
		Paraonides nordica
		Pholoe longa
		Pholoe minuta
		Phyllodoce groenlandica
		Phyllodoce maculata
		Polydora quadrilobata
		Praxillella praetermissa
		Prionospio steenstrupi
		Pygospio elegans
		Scalibregma inflatum
		Schistomeringos caeca

Appendix 10 (cont'd) Other Invertebrates in the Study Area for the Parc national Iluiliq Project

PHYLUM	CLASS	LATIN
ANNELIDA		*Scoloplos armiger*
		Spio filicornis
		Streptospinigera niuqtuut
		Terebellides stroemii
		Travisia forbesii
LOPHOPHOTATES	BRYOZOA	*Caberea ellisii*
		Celleporella hyalina
		Cystisella saccata
		Escharella abyssicola
		Harmeria scutulata
		Hippoporina propinqua
		Microporina borealis
		Parasmittina jeffreysi
		Schizomavella auriculata
		Schizoporella crustacea
		Smittina rigida
		Tegella arctica
ECHINODERMATA	ASTEROIDEA	*Leptasterias groenlandica*
	OPHIUROIDEA	*Gorgonocephalus arcticus*
		Ophiacantha bidentata
		Ophiopholis aculeata
		Ophiura robusta
		Ophiura sarsii
		Stegophiura nodosa
	ECHINOIDEA	*Strongylocentrotus droebachiensis*
	HOLOTHUROIDEA	*Psolus fabricii*
		Cucumaria frondosa
CNIDARIA	ANTHOZOA	*Gersemia rubiformis*
		Tealia felina
	HYDROZOA	*Aglantha digitale*
		Filellum serpens
		Sarsia princeps

Appendix 11 Additional Pictures of the Region of the Study Area of the Parc national Iluiliq Project

Johnnie, his wife and child looking at a Arctic fox fur in a HBC trading post
Credit: Arthur H. Tweedle. Library and Archives Canada. E002344213

Inuit family (from right to left; Audlaluk, Arnaituk, Susie, Kidlasirk, Josipi, and Mary) in front of their tent in *Kangirsukallak* in 1933
Credit: Max Sauer, Jr. Hudson Bay Company Archives (HBCA Album 1/34)

Group of women in *Kangirsukallak* in 1933
Credit: Max Sauer, Jr. Hudson Bay Company Archives (HBCA Album 1/35)

Inuit women working on a *qajaq* in 1932
Credit: D.L. McKeand, Indigenous and Northern Affairs Canada. Library and Archives Canada, PA 102104

Supply transfer from the *Nascopie* to the Cap Wolstenholme trading post in 1937
Credit: Edwin Mills. Hudson Bay Company Archives (HBCA 1987/363-E-348/19)

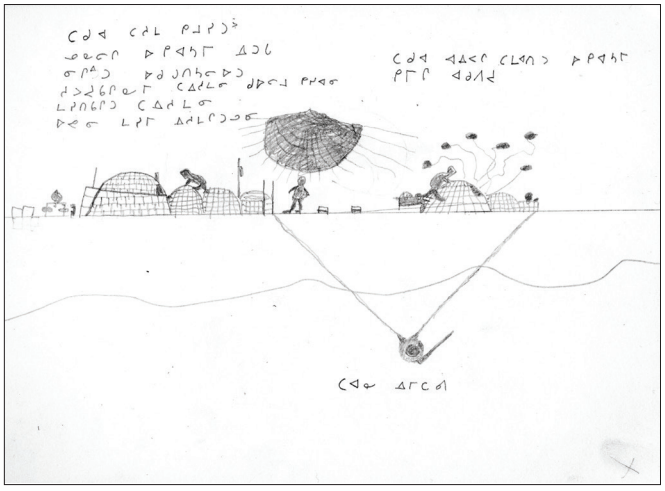
View over the Cap Wolstenholme trading post, HBC, 1925
Credit: Captain George E. Mack, McCord Museum. MP-0000.597.84

Supply ship on the coast of the Cap Wolstenholme trading post around 1910-1927
Credit: Captain George E. Mack, McCord Museum. MP-0000.597.112

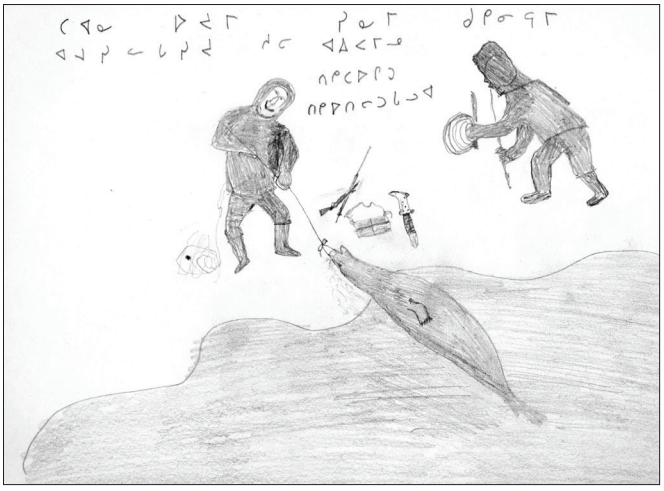
Group of Inuit on board the *S.S. Nascopie* in 1926
Credit: Frederick W. Berchem. McCord Museum. MP-1984. 127.27

Amauti from Hudson Strait region decorated with trading goods from *Qallunaat* (one cent piece dated 1848-1855, spoons and beads in the front). Brought back by Dr. William Wakeham during his expeditions.
Credit : McCord Museum. M5836

Funerary monument in memory of Christopher and Sarah-Jane Sheperd as well as William Ford at the Cap Wolstenholme cemetery
Credit: Captain George E. Mack, McCord Museum. MP-0000.597.520



Left text: This is the hunters' camp in the fall. The old man of the camp is patching the holes of the igloo, because there is no Coleman stove- they only used *qulliq*, at that time there were no matches.
Right text: It is still fall, the other team is unpacking their sled, and the dogs are kneeling down
Bottom text: Water hole
Credit: Sketch by Markusi Iyaituk of Ivujivik in 1968. Avataq Cultural Institute, Bernard Saladin d'Anglure fonds, RES09_J05, 001_3014.



Sketch of Markusi Iyaituk from Ivujivik of a seal hunting scene
Credit: Markusi Iyaituk. 1968. ACI. Bernard Saladin d'Anglure fonds, RES09_J05, 001_3015

Appendix 12 Pictures of the Cemetary of the Cap Wolstenholme trading post taken in 2015

View of the Cap Wolstenholme cemetery at *Kangirsukallak*
Credit: Elsa Cencig

Grave of James Pallisser (died on November 16, 1924) and his young son (deceased on June 9, 1925)
Credit: Elsa Cencig

Grave of Sarah Kumarluk (died on April 21, 1925)
Credit: Elsa Cencig

Grave of Joanasi, 6 years old and Mary, 3 years old, siblings who died from sleeping sickness on September 16, 1926
Credit: Elsa Cencig

Oosey's grave, 33 years of age, died on August 23, 1927 of a pneumonia
Credit: Elsa Cencig

Grave of Joani (or Juani, or Johanni) died of the flu on September 11, 1928, 21 years old
Credit: Elsa Cencig

Grave of Napatsi who died from the flu on September 13, 1928 at the age of 35 (wife of Alaku-Mark, they left behind 7 children aged 1 to 12 years old)
Credit: Elsa Cencig

Grave of Alaku-Mark died from the flu on September 14, 1928 he was 33 years old.
Credit: Elsa Cencig

Grave of Angnavegak (Arnaviaq), who died on September 14, 1928 from the flu and complications from a miscarriage, she was 23 years old.
Credit: Elsa Cencig

Appendix 12 Pictures of the Cemetary of the Cap Wolstenholme trading post taken in 2015 (cont'd)

Grave of Marsee, 48 years of age, died on September 14, 1928 from the flu
Credit: Elsa Cencig

Grave of Ameako (Amiakku), who died on September 16, 1928 at the age of 7
Credit: Elsa Cencig

Grave of Charlie B. who died from tuberculosis on September 9, 1929, he was 22 years old
Credit: Elsa Cencig

Unidentifiable grave: « ….TT…SOK », 4 years old, died in September 1932
Credit: Elsa Cencig

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Administration régionale KATIVIK Regional Government
KATIVIK