

Nordisk Resource Management (NRF) Project Field Report



Eight semi-domestic reindeer bulls with growing antlers in velvet, June 2015. Photo C. Cuyler

Isortoq Semi-domestic Reindeer (*Rangifer tarandus tarandus*) **Minimum Count & Systematic Transect Survey** **South Greenland** **13-27 July 2015**

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31 July 2015

Field Report: Semi-domestic Reindeer, Isortoq Region, 13-27 July 2015

1) Minimum Count

2) Aerial Survey for Abundance

The Greenland Institute of Natural Resources (GN) in cooperation with the Isortoq Reindeer Station completed both a minimum count and a systematic transect survey for abundance of the Ivittuut semi-domestic reindeer population. Results presented here are preliminary only. Minimum count photo and video data has yet to be thoroughly assessed, while analysis of the transect survey data has not begun. Once both are ready, then minimum count results will be compared with the estimated population abundance calculated from the transect survey results.

Neither a minimum count nor a transect survey has ever been completed previously for the Isortoq reindeer. This report describes the field work and preliminary findings for reindeer in the Isortoq reindeer herding district. The detailed analysis will come later this year.

Study Area & History

The Isortoq reindeer herding region, ca. 60.9°N 47.5°W, is the northern most area of Kujalleq Kommune (municipality). In general, it is bounded to the northwest by the Nivaaq fjord (Figure 1), to the southeast by the Ikersuaq fjord, to the southwest is open sea and to the northeast the Greenland Ice Cap. The greater Isortoq reindeer region (not including lakes or Ice Cap) totals just under 1500 km².

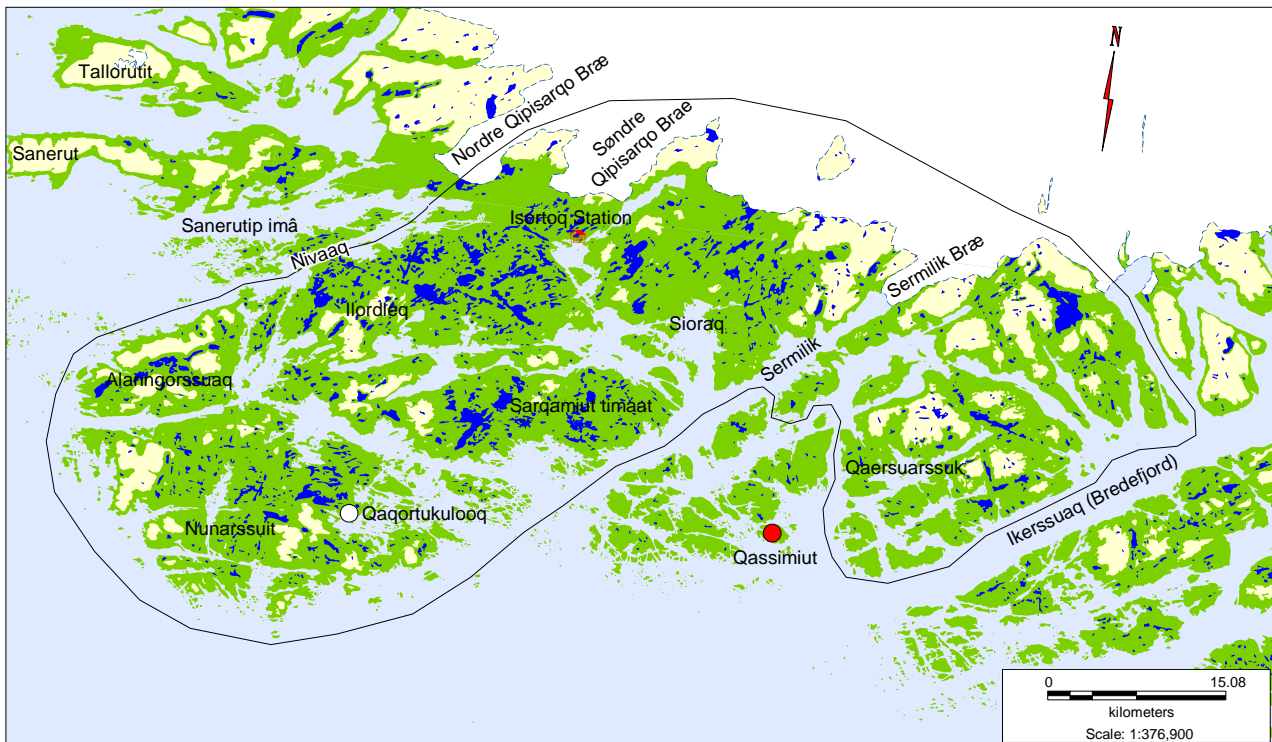


Figure 1. Isortoq place names with reindeer herding district borders given by black polygon.

Isortoq reindeer herding began in 1973 when Ole Christensen bought and brought 48 animals down from the Kapisillit / Itivnera reindeer herd which then was kept in the inner Godthåb/Nuuk fjord (ca. 64.4°N

50.5°W) (Cuyler 1999). He brought a further 50 reindeer in 1974. Stefan Magnusson joined in partnership with Ole in 1978 (Figure 2).



Figure 2. Two of the Isortoq reindeer herders / partners, Stefan Magnusson (left) and Ole Christensen (right). The third is Ingvar Garðarsson (not in photo). Photo C. Cuyler

The reindeer station was founded in 1990 and recently expanded to include a modern slaughterhouse and freezer storage capacity. A third partner, Ingvar Garðarsson joined Ole and Stefan in 2011. Today the reindeer station encompasses several houses, workshops, gyrocopter landing strip and hangar, slaughterhouse, corrals with ca. 30 km of fencing to ease the reindeer into enclosures and paddocks for ear tagging and slaughter (Figure 3). Herding and driving reindeer are accomplished using various seasonal combinations of persons-on-foot, dogs, skidoos, outboard motor boats and a gyrocopter (Figure 4).

By 1977 the herd numbered ca. 300 reindeer, and the winter 1995 herd was perhaps 3000. A GN vegetation study of the Isortoq region in the late 1990's mapped the habitat and documented overgrazing (Lund et al. 1996). Summer pasture was considered the limiting factor. Lund et al. 1996 suggested a maximum of 1150 to 1340 reindeer in the Isortoq reindeer area. For the heavily grazed Sioraq sub-area, however, the reindeer density was to be kept < 1 reindeer per km^2 . In 2014 Stefan Magnusson estimated that herd abundance was at ca. 2300 reindeer.

Today rumours abound concerning the actual number of reindeer in the Isortoq Reindeer area. Figures of 5,000 to 10,000 are commonly espoused. Those who have sailed through the often rocky barren shipping channels between Nunarsuit island and the mainland, e.g., Nybo Kanal, Torssukâtak and Ikerasarssuaq, typically believe these areas evidence serious overgrazing representative for the range in the entire region.



Figure 3. The Isortoq reindeer station July 2015.

Stefan's answer to the overgrazing observed by persons sailing through the 'shipping channel' area is that this is a dry desert area unlike any other in the Isortoq range. Further, conditions in the channel areas are not representative of the entire region.

In June 2015 Stefan estimated there were ca. 1200-1700 reindeer in total, with ca. 950 within the Isortoq reindeer area. Prior to this study, Ole Christensen estimated ca. 1000 reindeer within the Isortoq area, while Ingvar guesstimated 2000 reindeer.



Figure 4. The 2-seater gyrocopter.

Methods

Reindeer were located by flying an open 2-seater gyrocopter, during the period 5-23 July. Flight speed was ca. 100 km/hour for minimum count and 80 to 100 km/hour for survey transects. Flight altitude was typically 30-40 meters. Gyrocopter specifications:

- Able to fly in winds up to a maximum of 16 m/sec
- Fuel is gasoline (also known as petrol or benzin)
- Fuel capacity is 70 liters
- Fuel use is 17-23 liter/hour
- Cruising speed is 100 km/hour
- Slow speed is 80 km/hour
- Range before refueling is ca. 2.5-3 hours (30 minutes fuel required when land at refueling).

Minimum Count

To avoid double counting, an area was only begun if it could be flown entirely within 1-2 hours on the same day. If any doubt was possible, then those specific reindeer were not counted.

Observations of reindeer were assigned a sequential group number and a grid map cell location (Appendix 1). We recorded the number of groups seen, if the group was <20 animals then the total number of animals in each group, and when possible the sex and age of the individuals within a group. Large reindeer groups were photographed (18MB size photos) or videoed (4K) for later counting. Also noted were opportunistic observations of arctic fox, arctic hare, eagles or other occurrences, with location.

Systematic Transect Survey

Transects were flown through the middle of each grid cell in either a north or south direction. The strip width was ca. 300 meters to either side of the gyrocopter. Reindeer observations were assigned into 'bins' of 100, 200, 300 and 400 meters from the zero transect line being flown by the gyrocopter. Observed reindeer were also assigned a sequential number with their grid cell location. Photos were often taken (Figure 5).



Figure 5. Nine semi-domestic reindeer. Seven are readily visible on the snow and includes three cow-calf pairs and one juvenile. A fourth cow-calf pair is relatively 'invisible' because they are farther away and not on snow, 24 July 2015. Photo C. Cuyler

PRELIMINARY RESULTS

Semi-domestic Reindeer Population:	Isortoq
Time period:	13-27 July 2015
Location:	Isortoq Reindeer Husbandry Region, South Greenland
Area Isortoq Region:	1500 km ²
Hours flown:	ca. 23 hours
Kilometers flown:	ca. 2200
Observation strip width:	600 m (300 m to each side of gyrocopter)
Area coverage:	ca. 88 %

MINIMUM Count: [final number pending photo analysis](#)

Semi-domestic reindeer seen **inside** Isortoq area: ca. **1043**

Semi-domestic reindeer seen **outside** Isortoq area: ca. **738**

TOTAL reindeer **inside** + **outside** Isortoq area: ca. **1781**

Details for the 738 reindeer seen **OUTSIDE** Isortoq area

Reindeer seen in Ivittuut:	93	(observed June 4-10)
Reindeer seen north at Sanersut:	15	(observed July 15)
Reindeer seen on islands north of Qassimiut:	606	(observed July 21)
Reindeer seen east of Ikerssuaq:	24	(observed July 15)

Most reindeer were observed at elevations under 100 m.

Natural Mortality Winter 2015

4 winter 2015 dead reindeer H15, found by Stefan Magnusson at Easter 2015.

4 winter 2015 dead reindeer G15, found by Stefan Magnusson at Easter 2015.

1 winter 2015 dead reindeer M14 (north east shore of Nunarsuit island), found by Chris Cuyler on 19th July 2015.

Gyrocopter

The gyrocopter was a success. It proved to be an excellent tool for counts and surveys.

This method could be used to advantage on the Ivittuut muskoxen population next year, i.e., for an aerial minimum count and survey to compliment and compare with the traditional minimum count method used since 1998. Gyrocopter counts could also be considered for other regions, e.g., Kangerlussuaq, Akia-Nordlandet, Naternaq, Nuussuaq Halvø and Svartenhuk.

Field Journal 13-24 July 2015

Monday 13 July 2015:

Weather was sunny with some overcast.

I flew with Air Greenland Dash 8 from Nuuk to Narsarsuaq and then with Air Greenland helicopter (seats 9 passengers) from Narsarsuaq to Qaqortoq heliport, arrival ca. 15:00. The weather was sunny and warm. I walked to the harbor and connected with Pitsi Høegh (Kenneth's wife) at the tourist office café, she told me that Ole Christensen would depart at 17:00. I bought groceries and met Ole Christensen at the dock at 17:00. Because Ole's boat is an open outboard, he gave me a survival suit to wear. This kept the cold and wind at bay during the ca. 2-hour boat ride from Qaqortoq up to the Isortoq Reindeer Station. We passed many icebergs; some were a good size and picturesque. The two other passengers were a family member to Ole (a young woman) and a Dutch man, Edwin (Mark) Ligt. The latter will be taking a working holiday at the Isortoq Reindeer Station.

Two friends of Stefan were already at the station, Kaj Lyberth and Jens Korsgaard. They were here for the fishing in the Isortoq. They caught many in their net and either salted or smoked these over the next week.

Tuesday 14 July 2015:

Weather was overcast with sunny periods, cool temperatures ($< 10^{\circ}\text{C}$).

Ingvar showed how to work the main and small generators, and also where to shower and do laundry. We looked over the gyrocopter. Ingvar taped the blades of the rotor to protect them from grit and pebbles. He flew to the Sanerut Island to complete the moving of reindeer he had begun before my arrival. I worked out new north-south transects that will pass through the 'middle' of each grid cell, and began preparing this field report.

Wednesday 15 July 2015:

Weather was foggy most of the morning. Later this became low cloud cover that hid the hilltops. By afternoon the cloud had lifted and there were strong winds from the southwest.

Ingvar applied more aircraft tape to the propellers (carbonate) to protect them from nicks and dents caused by gravel and dirt. He practiced flying with various weights of sand/rocks in the passenger seat and was surprised by the great difference in how the gyrocopter handled for maneuvers and landings/take-offs. Ingvar then flew to Sanerut until 18:30. He is still waiting for the permission to fly passengers (me) from the gyrocopter association. Ingvar has sent three e-mails but still no reply, likely because of summer holidays.

I assisted Stefan with his letters to government agencies regarding veterinarians at the August slaughter, and revised my field report figures and text. Then Stefan sailed for the Tourist Fish camp to pick up his daughter, Freya, and I went along for the ride. The camp is picturesque and well set up. All buildings are log (manufactured) structures stained a red-brown hue. All are connected by board-walks. There was a central main hall surrounded by 11 individual sleeping cabins, each with a set of white reindeer antlers at the apex of the roof beams. With two campfire pits, and modern shower and toilet facilities (ecological microbial breakdown) this camp is the one I will recommend to fishing enthusiasts like Veiga and her family from Iceland. Further, there was a comfortable dock with floating gang-plank to adjust for tides, and once on shore a leveled pathway around to the cabins. This is a well thought out fish camp.

Thursday 16 July 2015:

Weather looked good in the early morning with blue skies to the south.

Today's weather turned out to be sunny and warm, perfect for flying. Unfortunately, Ingvar still has not received permission/license from the gyrocopter association for him to fly with a passenger. He will not fly with me onboard until he gets this. Ingvar has been e-mailing and telephoning everyone he could possibly contact. The result is that someone named Michael will ring around 15:00 and to tell Ingvar whether the permission is coming in an e-mail or not.

So in the morning Ingvar did fence work with Stefan (and working visitor Edwin), and after lunch Ingvar flew alone to the Sanerut area to drive the last few reindeer over to the mainland.

I finished preparing all of the survey transects (by area) and putting these onto Ingvar's iPad for the gyrocopter. Then I went for a walk about the corrals and to look at the hundred little lakes between the station and the Ice Cap. Subjectively the vegetation appeared lush and plentiful. Then I updated this report and began preparing the AUC presentation about the Ivittuut muskoxen. I also made brownies for this evening's dessert to follow the dinner I made: BBQ ribs and 4 rib-eye steaks (Stefan gave me charcoal bricks and I had a glowing 'barbie' going outside). Kaj complimented all this with his fish soup appetizer.

Friday 17 July 2015: Isortoq, Minimum Count Ice Cap, Ikerssuaq

Weather was good, sunny with light winds. We went out and flew the transect survey of Isortoq first. After all transects were complete, we refueled and did the minimum count along edge and up on the Ice Cap for the entire length of Isortoq reindeer herding district from west to east. We refueled once more and headed out to do the transect survey of the Ikerssuaq, which is the far eastern portion of the Isortoq reindeer range. A heated jacket kept me toasty warm all day.

Ingvar put new layer of protective propeller tape on the cutting edge of the propeller blades to protect them from the grit and gravel that comes up and hits them when we land and even when we take off.

Today the Icelandic Ambassador, Petur Oscarsson, to Greenland visited the Isortoq Reindeer Station, with his son, Oscar. He arrived with a Greenlandic journalist, Peter Muller, and his wife Lis Stander. Ria Nielson (ex-sister-in-law to Stefan) arrived also today with her two kids, a little boy, Milo, and the youngest a 3-year old girl named Naja.

Saturday 18 July 2015: Sarqamiut timaat, Alanngorssuaq, Sioraq

Weather was sunny today, however the winds were heavy. This made flying low next to impossible. Today we flew at 50 to 100 meters above the ground, and at speeds of 90 to 100 km/hour.

We flew to Sarqamiut Timaat and did the transect survey of this area. Once completed, we continued on and flew over to the Alanngorssuaq Island where we did a minimum count. Neither Stefan nor Ole thought we would find many there, if we found anything at all. We scoured Alanngorssuaq and found only one group of eight, which included one calf.

On Sarqamiut timaat, I saw for the first time some well trodden reindeer trails. Well trodden trails are seldom to be seen everywhere else we've flown. Vegetation has overgrown most trails elsewhere.

We returned to the Isortoq station to refuel, and then we headed out again to do the transect survey of Sioraq. We had intended to do Nunarssiut, however, the winds today are just too heavy. Ingvar thought the winds would be lighter over Sioraq. They were not.

Temperatures were cold today and the heavy winds made for a very chilly ride in the gyrocopter. My heated jacket stopped working ½-way through the first trip. It never worked again, ever.

The protective tape had come loose on one of the propeller tips and made flying 'weird' for Ingvar. He cut that away and replaced with new tape.

Sunday 19 July 2015: Nunarssuit

Weather was foggy in the morning so made Icelandic pancakes, eggs, bacon and beans for breakfast. Fog cleared by noon, and there was very little wind, so we flew to Nunarssuit and did the transect survey, unfortunately fog was rolling in so we could not complete the short last transect number 11 at the far southwest end. (We did manage to do this transect 21 July. The area is mostly barren rock, however, we did find one cow there.)

Similar to Sarqamiut Timaat, Nunarssuit has some well trodden trails. Still many trails were overgrown too. Today with little wind we were able to fly at 40 m above the ground most of the time. The very little wind today made flying pleasant, but temperatures were still cold.

East of the long fjord that bisects Nunarssuit from the south, and south of the little east running 'arm' there were literally +100 reindeer and most were cows with calves-at-heel. I hardly had time to write them down as Ingvar called out the groups. North of the little 'arm' were also 30-50 reindeer, again mostly cows with calves.

While flying transect 10, which took us up over the highest peaks, we flew to over the top of the highest peaks on Nunarssuit. We found 5 reindeer at an elevation of ca. 500m in the snow close to top of the 'saddle' that spanned between two sharp mountain peaks. It contained a mature bull, a juvenile bull and what looked like 3 cows (no calves).

When we returned to fuel, Ingvar flew off the second time alone. He must herd the reindeer back into Isortoq from areas just north of the river that is the border of Isortoq reindeer herding area. Some may even have tried to return to Sanerut Island. He must prevent that.

Ingvar returned around 19:00 but only to refuel as he took off once more. He wants to drive the reindeer further, and make them cross the second river. Then he will be more certain that they will stay put. The sun was shining, the fog was staying off the land and there is little wind so the conditions were best for flying now.

Klaus Jakobsen, a Greenlander in his late 40's, came to the station today. He is from Qassimiut and has worked for Stefan and Ole since he was a boy.

I entered today's data, photos, updated this journal and went through all the aerial photos from the Ice Cap minimum count so that I could give Stefan, Ole and Ingvar an idea of how many reindeer were seen there.

Monday 20 July 2015: Reindeer arrive at the Isortoq Reindeer Station

Weather was heavy fog in the morning.

Ingvar flew off to collect the reindeer he had gathered yesterday and drive them the last 5-7 km into the Isortoq Station fenced area.

Kaj Lyberth and Jens packed up their fish, juniper and herbs and left the station today. Mark Edwin Ligt had also expected to leave today with Klaus Jakobsen, however, Stefan will see to getting him to Qaqortoq tomorrow. I went through the photos of reindeer on the Ice Cap with Stefan. Then I found and transferred photos over to Stefan's hard drive.

Using the gyrocopter, Ingvar drove ca. 133-140 reindeer to the Isortoq reindeer station. Stefan took us all by boat to where the gate was. The reindeer appeared high on the hill and continued on up. Stefan and the rest of us went up and closed the gate (a ca. 40m portion of fencing). Then Ole in the boat kept them from heading too far down the lake, and Ingvar drove them back the way they'd come (but now with gate closed) so the reindeer ended up in the large corral on the other side of the hill from the station (Figure 6). Stefan then closed that portal too. It was an elegant dance of gyrocopter, people on foot, boat and reindeer, with the reindeer moving sedately along to where they were meant to go. Now there are reindeer at the station (Figure 7).



Figure 6. A portion of the 133 to 140 reindeer being herded into the corrals at the Isortoq station.

In Stefan's experience the optimal semi-domestic reindeer herd structure for production is when there are 60-70% cows, 14% bulls and the rest calves. When they have Trophy hunting for bulls then they prefer to have the bull percentage at ca. 20-25%.

Today I realized that the camera is NOT auto-focusing on far distances. This has been the situation since the first day, e.g., not focusing during the minimum count on the Ice Cap when I zoomed in. The problem is affecting all photos. The distance shots from the gyrocopter are focusing to within 1-2 m. Thus, although maximum pixel size photos, they are blurry in distance. Reindeer at 150 meters are blurry. I'll have to see if

I can 'see' well enough to manually put it onto infinity focus whenever I turn it on for a photo while in the gyrocopter and no eyeglasses on.

Millions of mosquitoes today. I needed a bug net and they were on the lens causing trouble with photos and videos. You can hear them on the videos. Ingvar's helmet not working: fogging up visor and microphone not working. I made supper. Freya made a pudding for the children. Electric bug killer/racket did a good job on the bugs.



Figure 7. Clockwise: a wide 'gate' being closed with fencing and burlap; some of the many kilometers of fencing; a portion of the 133 to 140 reindeer in the far paddock.

Tuesday 21 July 2015: *Minimum count of Nunarssuit & the islands north of Qassimiut*

Weather was very foggy in the morning.

Mark Edwin Ligt left with Stefan in outboard at 07:30. Mark is going to the fish camp, where he'll get a 'Blue Ice' boat taxi all the way to Narsarssuaq.

I did up photos for Ingvar, and tested the focus on the Nikon camera. The auto focus does NOT work at all. If a photo of beyond a few feet is desired then the camera must be manually set to 'mountain' each time it is turned on. While doing this, it was apparent that the battery was completely DEAD. Unfortunately, after using the reserve battery for the 6-7 'test' photos for the auto-focus, well it died too. I had to start up the big generator once more, and let things charge up for a few hours before we flew today.

11:30 and there is still low cloud, but at least the fog has finally lifted. We hope to finish the minimum count today. The areas to cover are Nunarssuit and the islands around Qassimiut. We did fly Nunarssuit and found hundreds of animals. There were more, however, we had to return to refuel and with little time left we flew the islands north of Qassimiut on our second flight. We completed those today. There were many reindeer on the largest of the three islands just north of Qassimiut. There were surprisingly many cow-calf pairs.

Wednesday 22 July 2015: Ear tagging/marking and slaughter selection

Weather was overcast with sunny periods, light winds with occasional calm. Temperatures were cool. Today I keyed-in the data from yesterday, prepared gear/food and packed for the 2-3 day ground work on Nunarsuit. I made certain that Stefan and Ingvar have all the grid maps on their computers, and also photos and videos. Today I finally got a shower and some clothes washed.

Corrals were prepared and repaired today. Water was sprayed in every corral for several hours to keep the dust down once the reindeer come in. Then the reindeer that were driven to the station two days ago were brought down to the station's small sorting corrals for ear tagging or slaughtering. We worked until 23:00 and all the reindeer were processed, i.e., ear-tagged, ear-marked, collared for slaughter and grouped in separate small corrals for further work. All calves were ear tagged and ear marked (Figure 8). Cows with calves were slipped out to pasture.



Figure 8. Stefan Magnusson's daughter Freya holding the calf she has just ear tagged.

Among the reindeer handled today, several already were either ear-tagged (green or orange plastic tags) or ear marked (clipped 'V' notch on tip of ear), and two 'leader' cows carried collars with bells (Figure 9). The orange collared belled cow was one Stefan and Ole retrieved from Ivittuut two or three years ago.



Figure 9. Orange and purple bell collared 'leader' cows among the 133 to 140 reindeer that were brought into the small station paddocks for handling. Note the two green ear tags visible behind orange collared cow.

Thursday 23 July 2015: Nunarsuit roundup

Weather was overcast with light winds, and turned sunny by the afternoon.

Ole Christensen, Klaus Jakobsen and I sailed for Nunarsuit in the morning.

Today we went ashore at separate locations and began driving the reindeer towards the northeast end of island. Ole used his trained herding dog Felix to aid him. Radio communication with Ingvar, who was in the gyrocopter, made round-up relatively easy.

Walked into the tent camp set up on the east running little 'arm' of the fjord around 21:15. Ole and Klaus has made a nice reindeer soup.

Friday 24 July 2015: Nunarsuit roundup

Weather was overcast.

Today Ole and Klaus cleared grid cells E13 and F13, while I did the mountains and areas south of the Ghost mountain. By the end of the day I had driven about 200-300 reindeer north. I returned to camp by about 21:45. Ole and Klaus had some hot soup and reindeer meat set aside for me.

Saturday 25 July 2015: Nunarsuit roundup

Weather was overcast.

We broke camp early this morning because Klaus had to return home for a family birthday. While Ole sailed Klaus to Qassimiut, I walked from campsite to north east shore, driving reindeer along ahead of me and got picked up there at the shore by Ole in the mid-afternoon. Ingvar, using the gyrocopter, collected 400-500 reindeer in the northeast portion of Nunarsuit in the crossing area. Then night fell and we all returned to the Isortoq reindeer station.

Sunday 26 July 2015: Nunarsuit roundup

Weather was overcast.

We sailed to the northeast portion of Nunarsuit Island today. We were in radio contact with Ingvar in the gyrocopter. While we waited for the gyrocopter to locate the reindeer, burlap was arranged on the fencing for driving the reindeer, a blown-down tent camp was dismantled and packed away and any reindeer found were driven toward the crossing point, which will be at the northeast end of Nunarsuit. Unfortunately the reindeer used last night to return to their previous locations throughout Nunarsuit. We were unable to drive them over the sound to the mainland today.

Although reindeer lichens, i.e., *Cladina rangiferina* and *C. stellaris*, are grazed right down most places we have flown in Isortoq and where I have walked over Nunarsuit the past 3 days. Surprisingly, there were places, typically on rocky steep slopes or the smaller islands, where the reindeer lichens appeared in good condition (Figure 10). Photos of the typically overgrazed lichen patches will appear in the later technical report.



Figure 10. Lichens, *Cladina rangiferina* and *C. stellaris*, preferred by reindeer were in relatively good condition on the steeper slopes in the northeast portion of Nunarsuit and the offshore islands.

Stefan and Ole told how they prefer to gather the reindeer together on Nunarsuit in late winter with the intention of driving them over the sea ice of the 'shipping channel' onto Sarqamiut Timaat and then further deeper into the Isortoq mainland. This past March 2015 Stefan and Ole used skidoos to gather and drive many reindeer to the crossing point; however, Grønlands Kommando ran their ice breaker through the 'shipping channel' a day or two before Stefan and Ole were ready for the final push. This is not the first spring this has occurred. Regardless, this is why there remain so many reindeer on Nunarsuit this July. I will investigate if communication between Isortoq reindeer station and Grønlands Kommando can be improved to prevent similar situations in future years. Perhaps cooperation between the two would permit ice break up immediately following the return of reindeer to the mainland and effectively prevent any animals from returning to Nunarsuit that same spring.

Monday 27 July 2015:

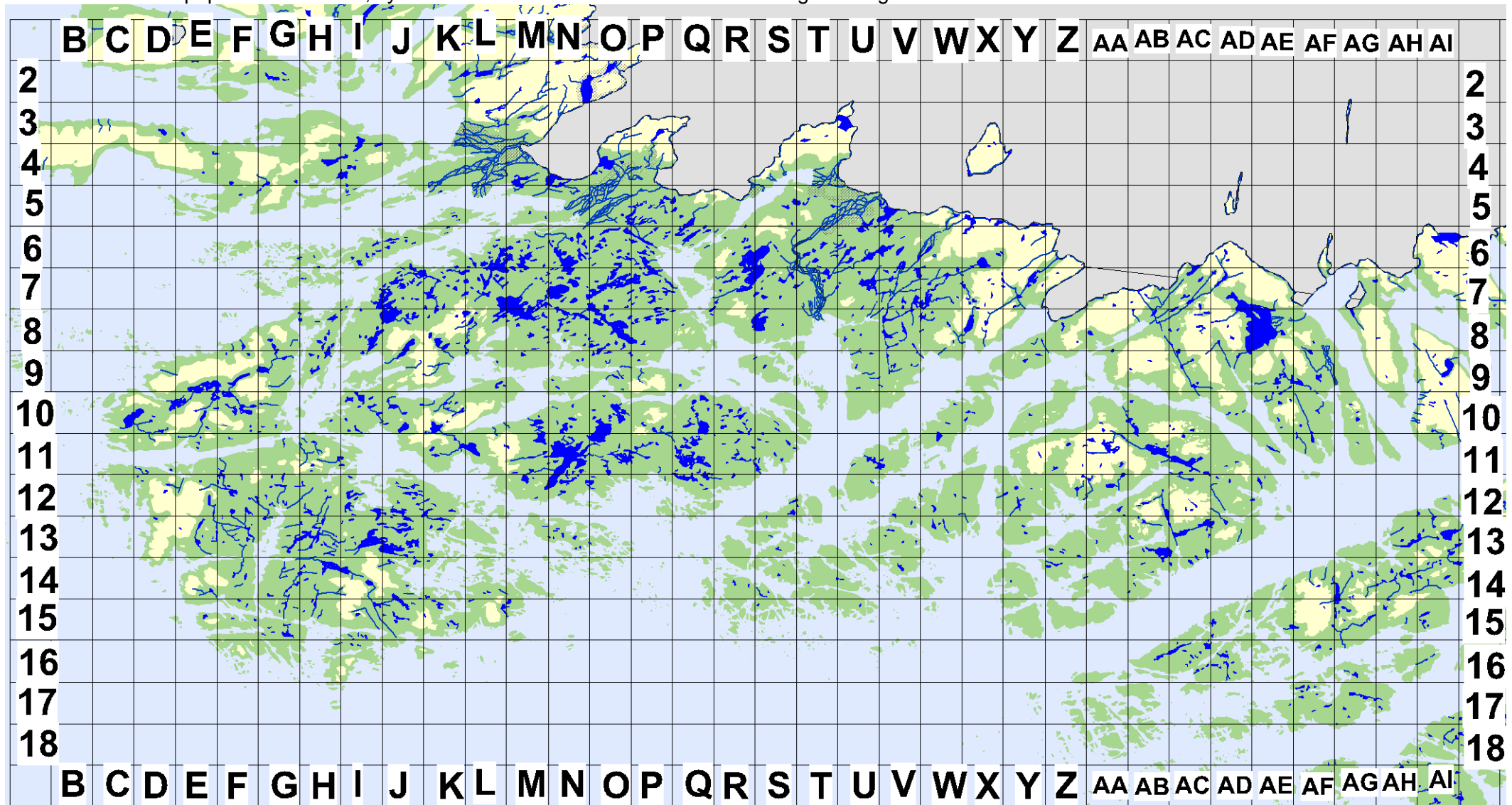
Weather was overcast and looked like it would rain.

Boat trip from Isortoq Reindeer Station to Qaqortoq. Helicopter from Qaqortoq to Narssarsuaq, and on to Nuuk with Dash 8. Arrival Nuuk at 16:30.

References

- Cuyler C. 1999.** Success and failure of reindeer herding in Greenland. Proceedings of the 10th Nordic Conference on Reindeer Research, Kautokeino, Norway, 13-15 March 1998. *Rangifer*, No. 3: 81-92.
- Lund et al. 1996.** Vegetations- og føderessourcekortlægning baseret på satellitdata i tamrenområdet Isortoq, Sydvestgrønland. Grønlands Naturinstitut Rapport. ISBN nr.: 87-90024-16-8 (NORUT Informasjonsteknologi AS)

Appendix 1: Map over entire Isortoq reindeer herding region with 3x3 km grid cells used for caribou locations during the minimum count. For the population estimate, systematic transects followed a mid-line through each grid cell in a north-south direction.



Appendix 2

Telephone numbers

Christine Cuyler:	48 23 23 (Project leader/researcher)
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Nette Levermann:	34 53 44 (APNN, Nuuk Greenland)
Stefan Magnusson:	49 34 36 (Isortoq reindeer herder)
	VHF Radio frequency 60
Isortoq Station Landline:	19 92 56
Ingvar Garðarsson (pilot)	+354 820 5050 cell / +354 581 1503 telephone ingvar@svinnur.com
Boat Charter 'Jacky':	49 73 71 (Qaqortoq/Narsaq/Narsarssuaq)
Kenneth Høegh:	64 54 13 / cell 56 56 04 (Fåreavltjenesten Qaqortoq)
Royal Arctic Line (RAL):	64 16 33 (Qaqortoq)
Qaqortoq TAXI 1	64 11 11
Qaqortoq TAXI 2	64 44 44
Qaqortoq Heliport AIR GREENLAND	34 32 70
AIR GREENLAND	34 34 34

Accommodation in Qaqortoq

Folk High School (Sulisartut højskoliat)	64 24 66 / cell 49 31 54 www.sulisartut.gl (Kaj Lyberth)
Vandrehjem Qaqortoq Hostel: (Siniffik Inn, Aaningivit B-242)	64 27 28 / 49 46 35; www.siniffik-inn.dk
Hotel Qaqortoq	64 22 82