Appendix A

Wild reindeer, Iceland
Photo: Skarphédinn Tórisson

"Wild Reindeer" in Iceland

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Background

The Reindeer of Iceland are the descendants of domesticated reindeer (*Rangifer tarandus tarandus*) imported from the Finnmark region of Norway. Reindeer were transported to Iceland four times: The first translocation of 13-14 reindeer in 1771 was from Sørøya, an island off the north coast of Norway, to Vestmanna Islands. Only 3 reindeer survived and they were moved to the mainland in the southern part of Iceland a year later. The second transfer was in 1777, when 23 reindeer were transported from Sørøya to Hafnarfjördur on the west side of Iceland. The third relocation occurred in 1784, when 35 reindeer from Kautokeino were transported to Eyjafjördur on the northern part of Iceland. The fourth and last transfer happened in 1787 when 35 reindeer from Avjovarre were transported to Vopnafjördur on the eastern part of Iceland.

Status of population

The first group transferred to Vestmannaøyene in 1771 became extinct in 1783. The second and third introductions to Hafnarfjördur and Eyjafjördur also died out either from overhunting, or because of difficult winter grazing conditions. The last group of reindeer in Hafnarfjördur became extinct in the 1920's, and the last few survivors of the group in Eyjafjördur became extinct in 1936, or joined the population in eastern Iceland. S. Thórisson (1983) concludes that the main reason the reindeer became reduced or extinct was the difficult winters between 1850 and 1920.

The current "wild reindeer" in Iceland are the descendants from the 35 reindeer translocated in 1787 to Vopnafjördur. The reason for their survival could be the specific landscape in the northeastern part of Iceland, north and east of Vatnajökull, a rugged region less traversable for hunters.

Today we find all the Icelandic reindeer population in the eastern part of Iceland. The main areas are from Jökulsá in Fljotsdal to Kringilsárrani in Bruaröæfi, where half of the population graze in summer. The rest are found from the North East to the South East of the country. The weather conditions in Iceland are highly variable, and it can therefore be particularly difficult for the reindeer in some years. Many reindeer, especially calves and old animals, die in difficult years, resulting in annual fluctuations in the overall size of the population. The population reached a high in the 1800's, but in the 1940's decreased to about 100-300 reindeer. Many reindeer did not survive the winters of 1954 and 1962. The population then increased gradually until about 1980, and to the present has remained relatively stable at 3000-4000 reindeer. As in Finnmark, Norway, the rutting season is in late September and the main calving occurs in the third week of May.

Grazing areas

The reindeer ranges consist of plateaus at 500-600 metres above sea level, some mountain ridges, and lichen–covered valleys, situated 0-200m above sea level within the fjord regions. During summertime, half of the reindeer population are found in the inland areas north of Vatnajökul, where the reindeer utilize the pastures and water available in the valley passes. During the fall and wintertime, some of the reindeer migrate to the coast. The range between the seasonal pastures is about 10-200 km.

Management

From 1790 to 1849 there was only selected hunting of reindeer, even though no hunting restrictions were implemented until 1882. In 1901 a total prohibition against hunting was introduced, and this restriction lasted until 1943 when the prohibition was lifted. Since 1995, new management regulations of the reindeer herds have been implemented. Today the management of wild reindeer is organised around nine reindeer areas under the control of the Ministry of Environmental Affairs and the Wildlife Management Institute.

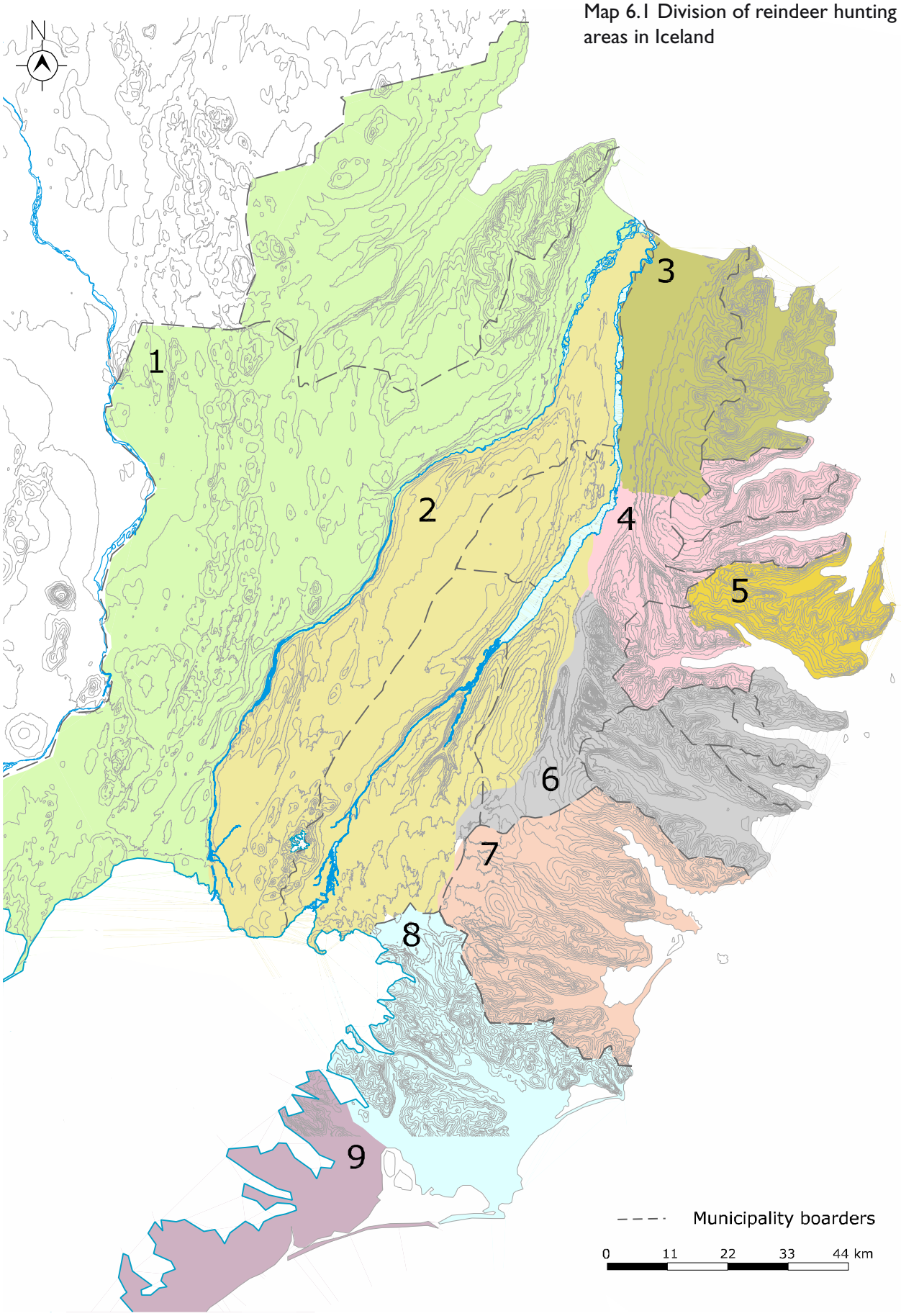
The authorities do not want the reindeer to migrate to other parts of Iceland due to risk of them infecting domestic animals, for instance sheep. The glacier and the unvegetated areas in central Iceland hinder most natural dispersion of the reindeer. Those individuals that do wander from their traditional range are therefore killed.

The wild herds are regulated through hunting, using hunting licenses and quotas. The hunting quotas are determined by the Wildlife Management Institute and the Ministry based on proposals from the East Iceland Environmental Research Institute. Hunting quotas are carefully calculated on the basis of aerial surveys in July and ground surveys between March and April, in order to maintan a sustainable population. Currently the population is estimated to be about 4000 individuals. In 2000 the hunting quota was 400 reindeer, while in 2002 the quota was increased to 800 individuals. The main hunting season occurs from August 1 to September 15.

The harvest is mainly on the highland plateau, but is also conducted in the coastal areas, and mainly on private property. As well some harvest occurs on state-owned public areas in the inland areas. The hunting rights as well as the income from the game licenses go to the property owners. In addition, the state charges hunters a seasonal fee.

Impact of predators and diseases on the reindeer population

Predators are of little threat to the reindeer in Iceland. The only predator is the Arctic fox (*Alopex lagopus*), whose numbers are limited and potentially could only kill calves. Insects do not bother the reindeer either, because there are no mosqiutos or Tabanidae (gadflies), only blackflies. When dead reindeer are examined, the predominant cause of death is famine. The



Map 6.1 Division of reindeer hunting areas in Iceland

close contact between sheep and reindeer increases the chance of spreading parasites and diseases like scrapie and paratuberculosis. These diseases are not sufficiently documented. Historically, we see that the harsh climate and poor grazing conditions have been the main limiting factors, while there are different opinions about whether hunting has been a serious threat to the reindeer. The government of Iceland is planning to expand power plants to the central parts of the reindeer ranges, something that will be a challenge for the reindeer as well.

Research interests

Reindeer is an introduced species, as are also sheep, goats, dairy cows and horses. However, the fact that the reindeer in Iceland have been separated from the reindeer in Scandinavia for more than 200 years means that they are a valuable species for comparative studies in genetics and behaviour in relation to their decendants in Finnmark and to other wild herds. For example, differences in behavioural patterns of the reindeer in Iceland compared to other wild reindeer could be influenced by the domestication of the reindeer in Scandinavia where they originated.

Parasitological research could contribute to greater knowledge of the conditions that affect the transfer of parasites and how they are spread in new areas.

Parasites found in Icelandic reindeer are mostly intestinal worms also found in sheep. Recently, however, host specific nematode *Capillaria* sp. and two coccidian species were reported (Karl Skirnisson, pers. comm.). The two parasitic flies (the nasal bot fly and the warble fly), sinus worm, brain worms, lung worm, tape worms other than *Moniezia* and rumen and liver flukes, seem all to be absent from the reindeer ranges in Iceland.

It is noteworthy that only intestinal sheep parasites have been found in Iceland reindeer, especially as it is highly likely that the imported reindeer from Norway were infected with a number of reindeer parasites. The question remains as to how the reindeer rid themselves of these parasites. Could the reason be that the weather in Iceland is not favourable for the survival of these parasites, or that the research sample was not comprehensive enough?

Literature

Studies were done in 1979-1981 in connection with a proposed hydroelectric power project, the Austurlandsvirkjun development. These studies resulted in information about the demography of the reindeer herd (Skarphédinn Thórisson. 1983. Hreindýrannsóknir 1979-1981. Lokaskýrsla. Orkustofnum, Reykjavik. OS-83072/VOD-06, pp 210.) and the pasture conditions (Kristbjörn Egilsson, 1983. Fæda og beitilönd íslensku hreindýranna. Orkustofnum, Reykjavik OS-83073/VOD-07, pp 235). Thórisson, S. 1984. The history of reindeer in Iceland and reindeer study 1979-1981. *Rangifer* 4 (2): 22-38.

EIA report:

Skarphéðinn G. Þórisson og Inga Dagmar Karlsdóttir. 2001. Áhrif Kárahnjúkavirkjunar á íslenska hreindýrastofninn. Unnið fyrir Náttúrufræðistofnun Íslands og Landsvirkjun. *NA-36. LV-2001/023.* 122 bls.

This overview is written by vetrinarian Sigurdur Sigurdarson, Institute for Experimental Pathology, Keldur, 112 Reykjavik, Iceland, and secretary Rolf Egil Haugerud, Nordic Council for Reindeer Husbandry Research (NOR), Centre for Saami Studies, University of Tromsø, N-9037 Tromsø, Norway.
The article is based on information from The Wildlife Management Institute, and personal observations of S. Sigurdarson and S. Thórisson (1983).

Appendix B

Reindeer, Greenland
Photo: Christine Cuyler

Greenland Caribou / Reindeer

Christine Cuyler *Greenland Institute of Natural Resources*

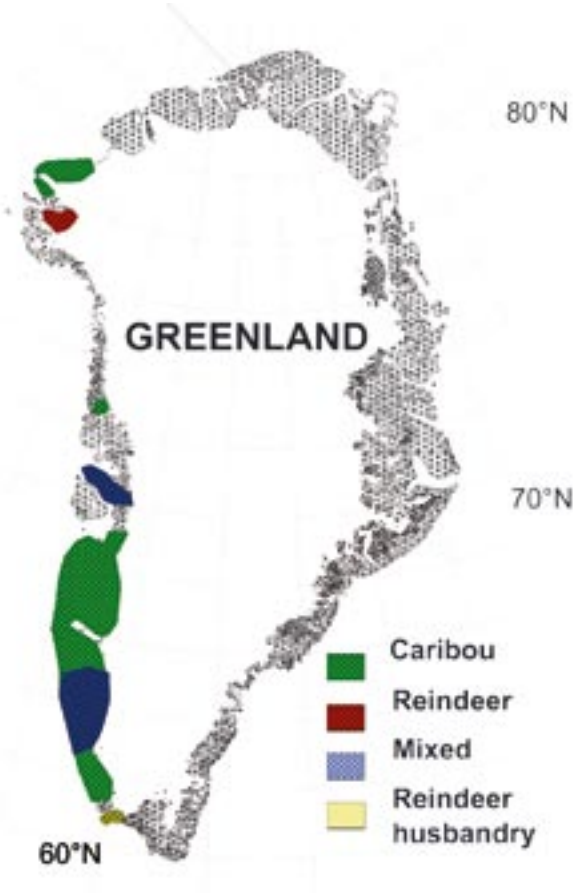
Wild caribou / feral reindeer

Greenland's west coast is inhabited by two subspecies of *Rangifer*, the native wild caribou (*Rangifer tarandus groenlandicus*) and feral semi-domestic reindeer (*Rangifer tarandus tarandus*), see map 6.1. Reindeer, brought from Norway, were first introduced at Kapisillit, Godthåbsfjord in 1952, see map 6.2. Later animals from Kapisillit were released at several more locations to establish feral populations, which might support a hunting harvest. There is evidence for genetic mixing of native caribou and feral reindeer at some of the locations where reindeer were released.

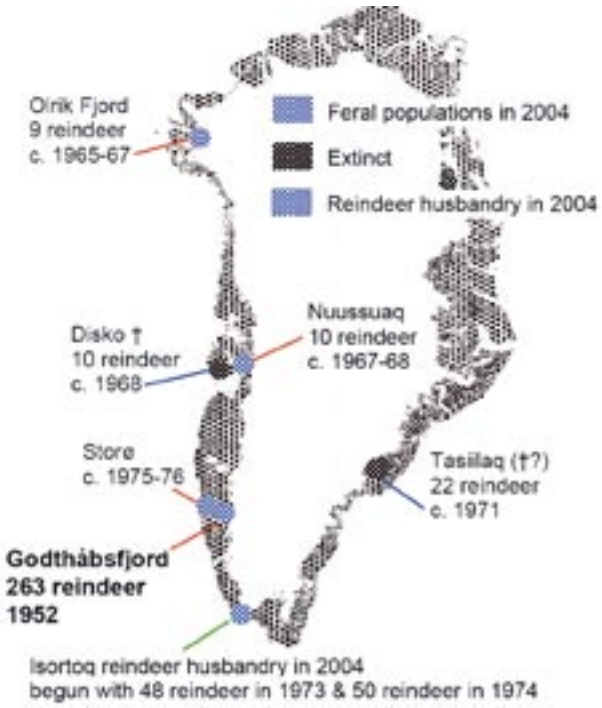
The primary distribution, 74 percent of total abundance, is in West Greenland (61°-69°N), which may by roughly identified as the southern half of Greenland's west coast. No wolves (*Canis lupus*) or other potential predators (non-human) have existed in West Greenland for at least the last few hundred years. Small *Rangifer* populations also exist further north: the Nuussuaq peninsula (70°-71°N), Svartenhuk peninsula (72°-73°N), Olrik Fjord (77°N), Qaanaaq (c. 77.5°N), and Inglefield Land (78°-79°N). There is no current evidence for the presence of caribou or reindeer on the east coast of Greenland. The wild caribou (*Rangifer tarandus eogroenlandicus*) of northeast Greenland (c. 70°-78°N) disappeared around 1900. Further, although 22 semi-domestic reindeer were released on the east coast in the Sermilik Fjord (66°N) behind Tasiilaq about 1971, there have been no recent observations of animals, and the population is assumed extinct. Reindeer husbandry of semi-domestic reindeer is restricted to the south coast (c. 60.5°-61°N).

Caribou herd sizes in West Greenland were believed low in the early 1990's and resulted in a 2-year hunting ban followed by several years of low harvest quotas. Meanwhile, reproduction was good. In

1996-97 there were pregnancy rates of c. 81 percent, a high percentage of pregnant sub-adults, and excellent fertility. 25 percent attained maximum potential number of pregnancies for their reproductive lifetime (age minus 1 year), while 2-4 percent exceeded the maximum. The 2000-2001 population estimates were about 5 to 7 times larger than earlier (table 6.1), and the largest ever obtained for West Greenland. Where late winter calf percentage and recruitment are high (table 6.2), the capability for rapid and continued population growth remains. The 2000-2001 caribou densities (table 6.3), were such that they would cause rangedegradation. Any further increases in density would worsen an already bad situation.. Recent harvest quotas have aimed at reducing caribou abundance if possible. There are two types of hunters in Greenland, commercial (c. 3,000) and sport (c. 8-9,000) (table 6.4). Commercial hunters are permitted to sell caribou and other meat / fish at local markets. As the allowed catch of caribou increased, however, the percentage of the quota taken decreased. Since 2000 the reported harvests have fallen far short of quota targets intended to reduce the size of wild caribou / reindeer populations. Given the above, population collapse may occur among the major herds in West Greenland in the foreseeable future.



Map 6.2 Distribution of caribou /reindeer in Greenland, 2004.



Map 6.3 Reindeer introduction at Godthåbsfjord in 1952, and subsequent releases in Greenland. Colouration indicates current status of the populations as feral, extinct or under husbandry.

Table 6.1 Recent estimates or minimum counts for wild caribou / feral reindeer populations in West Greenland.

Rangifer Population	Rangifer Type1	Rangifer Region2	Region no.	1993	1995 -1996	2000	2001	2002
Inglefield Land	Caribou	Thule	12	---	---	c. 2,300	---	---
Qaanaaq	Caribou	Thule	11	---	---	123*	---	---
Olrik Fjord	Reindeer	Thule	10	---	---	---	38*	---
Svartenhuk	Caribou	Upernavik	9	---	---	---	---	---
Nuussuaq	Mixed	Nuussuaq	8	---	c. 400	---	---	1,164*
Naternaq	Caribou	Naternaq	1	---	c. 300	---	---	---
Kangerlussuaq-S3	Caribou	North	2	c. 3,800	c. 10,900	c. 51,600	---	---
Akia-Maniitsoq	Mixed	Central	3	c. 3,500	c. 6,800	---	c. 46,200	---
Ameralik	Mixed	South	4	c. 1,200	c. 4,500	---	c. 31,900	---
Qeqertarsuatsiaat	Mixed	South	5	c. 181	---	---	c. 5,400	---
Qassit	Caribou	Paamiut	6	---	---	196*	---	---
Neria	Caribou	Paamiut	7	---	c. 407	332*	---	---

[1] Caribou (*Rangifer tarandus groenlandicus*), Reindeer (*Rangifer tarandus tarandus)* or mix of these.
[2] Regions are arranged in north to south in descending latitude. All are on the west coast of Greenland.
[2] Full name is the "Kangerlussuaq-Sisimiut" caribou population.
**Italized numbers are minimum counts*; these give the number of actual animals observed, and must not be confused with a population estimate.

Table 6.2 Late winter (March) herd structure parameters 2000-2001, for four wild caribou / feral reindeer populations in West Greenland.

Population	Region	Calf %	Cow %	Bull %	Bull/Cow ratio	Calf/100 Cows	Mean Group size
Kangerlussuaq-Sisimiut	North	26.5	39.2	34.3	0.83	68 1	2.7
Akia-Maniitsoq	Central	16.6	52.8	30.6	0.58	31 2	3.2
Ameralik	South	17.8	44.9	37.3	0.83	40 2	4.3
Qeqertarsuatsiaat	South	26.2	43.0	30.8	0.72	61 2	2.9

1 late winter recruitment 2000
2 late winter recruitment 2001

Table 6.3 Approximate density of wild caribou / feral reindeer in 2000 – 2001 in West Greenland.

Population	Region	Region no.	Density 2000 – 2001 (Animals per square km)
Kangerlussuaq-Sisimiut	North	2	c. 1.2 to 2.8
Akia-Maniitsoq	Central	3	c. 1.1 to 4.0
Ameralik	South	4	c. 3.7
Qeqertarsuatsiaat	South	5	c. 1.1
Qassit	Paamiut	6	-
Neria	Paamiut	7	c. 0.8 to 2.1

Table 6.4 Total abundance estimates for wild caribou / feral reindeer in Greenland and associated total harvest quotas.

Year	Total Estimated Abundance*	Harvest quota	Number Sport Hunters	Number Commercial Hunters	Reported Harvest Licenses	Used Licenses (%)	Reported Harvest Piniarnaq6	Used Piniarnaq (%)
1993	c. 9,000	0	---	---	0	---	---	---
1994	c. 13,000	0	---	---	0	---	---	---
1995	c. 18,000	2,000	---	---	1,314	65.7	---	---
1996	c. 22,000	2,600	---	---	1,995	76.7	2,048	78.8
1997	----	3,2111	---	---	2,472	77.0	2,755	85.8
1998	----	4,1802	7,642	2,573	2,966	80.6	3,692	88.3
1999	----	5,5923	8,320	2,706	3,400	60.8	3,959	70.8
2000	----	13,330	8,194	2,585	6,803	51.0	9,672	72.6
2001	c. 140,000	24,300	9,315	2,677	10,695	44.0	13,432	55.3
2002	----	36,1504	9,685	2,870	N.Y.A.5	N.Y.A.5	13,936	38.6
2003	----	Open	7,746	2,716	N.Y.A.5	N.Y.A.5	N.Y.A.5	N.Y.A.5
2004	----	Open	N.Y.A.5	N.Y.A.5	N.Y.A.5	N.Y.A.5	N.Y.A.5	N.Y.A.5

* Based on aerial transect surveys.

[1] Combined summer harvest (3,111) and winter research cull (100).

[2] Combined summer harvest; wild populations (3,680) and now designated feral Godthåbfjord reindeer (500).

[3] Combined summer & winter harvests: summer wild populations (4,050) and designated feral Godthåbfjord reindeer (400); winter designated feral Godthåbfjord reindeer (1,142).

[4] Combined summer harvest (32,150) and winter harvest (4,000).

[5] Not yet available (N.Y.A.).

[6] based on where a hunter resides, not on which animal population the harvest occurred. Therefore it is difficult to know exactly which caribou population was harvested, but assumed to be the population within reach of the hunter's home community.

Greenland reindeer husbandry

Reindeer husbandry has existed in Greenland for about 50 years. Reindeer husbandry was first established in mid-west Greenland in 1952, and later (1973) in southern Greenland. In mid-west Greenland, semi-domestic reindeer husbandry by Greenlanders was a failure and officially ended in 1998. The population is now managed as feral and falls under hunting regulations for wild caribou. In 2004 commercially successful husbandry is limited to one herd in the Isortoq area (1477 km^2) of southern Greenland. The Isortoq herd is under private co-ownership by Ole Kristiansen (Greenlander) and Stefan H. Magnusson (Icelander). The herd supports 11 people (two families and three apprentices). The slaughter is well organised and under veterinary supervision. Between 1997-99 about 2 500 to 3 200 semi-domestic reindeer were slaughtered annually.

In 1998, the end-of-year herd size was supposedly 1800 reindeer, and the intention was to keep winter herd size around 1400 animals (Stefan Magnusson, pers. comm.). The current herd size, however, more likely numbers in the several thousands (i.e., 3 000 to 5 000). Overgrazing occurred already by 1996. Between 1998 and 2004 a steady emigration of reindeer out of the Isortoq area has been observed. There are indigenous wild caribou to the north and local concern has been raised because genetic mixing with native caribou is not desired. Today there is pressure to permit hunting of unmarked reindeer beyond the boundaries of the Isortoq reindeer husbandry district.

Reindeer, Greenland
Photo: Christine Cuyler

Literature

Cuyler, L.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*, Rep. 3: 81-92.

Cuyler, C., Rosing M., Linnell J.D.C., Loison A., Ingerslev, T., & Landa A. 2002. Status of the Kangerlussuaq-Sisimiut caribou population (*Rangifer tarandus groenlandicus*) in 2000, West Greenland. Greenland Institute of Natural Resources. Technical report No. 42. 52 pp.

Cuyler, L.C., Rosing, M., Linnell, J.D.C., Lund, P.M., Jordhøy, P., Loison, A., & Landa, A. 2003. Status of 3 West Greenland caribou populations; 1) Akia-Maniitsoq, 2) Ameralik & 3) Qeqertarsuatsiaat. Greenland Institute of Natural Resources. Technical report No. 46. 74 pp.

Cuyler, L.C., Rosing, M., Linnell, J.D.C., Lund, P.M., Loison, A., & Landa, A. 2004. Neria & Qassit caribou minimum count & herd structure, in 2000, Paamiut, West Greenland. Greenland Institute of Natural Resources. Technical report No. 48. XX pp.

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Appendix C

Recommendations from the International Steering Committee

After consideration of the report on Family-Based Herding and Hunting Economies, and the Status and Management of Wild Reindeer/Caribou Populations, the International Steering Committee (ISC) makes the following recommendations:

Research and management

1. Recognise that people who live in reindeer/caribou herding and hunting communities perceive their activities as a way of life, manifested in cultural traditions and supported by a traditional knowledge base. This should be taken into account by the nation states of the Arctic when shaping local, national and international management institutions, and when implementing management plans. Management structures should incorporate the co-operation of the indigenous peoples organizations and incorporate traditional community knowledge into management practices.

2. Note the importance of a circumpolar monitoring program that tracks the health and the co-existence of wild and domesticated herds in a coordinated manner and incorporates community knowledge and the latest technical expertise, especially the use of remote sensing. The ISC encourages implementation of this monitoring program to establish sustainable management practices.

3. Acknowledging the importance of comparative research to better understand the regulation of wild populations, the ISC recommends that a research project should be established on the major herds in North America and Russia focusing on vulnerability of herds, impacts of global change (for example, industrial development and climate change), continental scale regulatory mechanisms (e.g. North Atlantic Oscillation, Arctic Oscillation). This project should involve a knowledge exchange between scientists, managers and community representatives.

4. Recognise that management of the large migratory herds requires a cooperative effort. The ISC thus support a formalized review of the different approaches to co-managing the herds and its users, especially involving the role of the local communities. This study should consider the strengths and weaknesses of the cooperative arrangements, especially in the ability to respond to future global change.

5. Draw attention to the serious problems many regions experience with co-existence between wild and domesticated herds. The ISC support research on how herders and managers can best manage their herds and their activities to reduce the conflict between domestic and wild reindeer stocks.

Education and training

6. Acknowledge the importance of linking formal education and practical experience. While it is essential to participate in herding and hunting in order to become a professional, it is equally important to receive a formal education in order to participate in modern society. Therefore, it is essential to create an educational system that can accommodate reindeer/caribou herding and hunting. The ISC encourages the authorities in the different countries of the Arctic to provide for such a development of the educational system incorporating the traditional community knowledge.

Role of women

7. Appreciate the knowledge and values acquired and maintained by women. The ISC encourages the reinforcement of women's position in reindeer husbandry. Special attention should be drawn to the strengthening of the formal ownership status, equal participation and legal rights of women.

Marketing and commercial activities

8. Recognize that the national and international regulation on meat inspections does not always reflect the

realities of small scale productions. The ISC recognise the need to adapt these regulations to reflect the current production challenges in the Arctic regions.

9. Emphasize that the concept of value-added production in this report incorporates meat production, handicraft and tourism. Thus, reindeer/caribou herding and hunting is an integrated activity where all elements are equally important for increased earnings in the industry. The ISC encourages projects and training programs to be developed to improve the viability of the value-added activities.

10. Support the efforts made by the industry itself towards value-added production in the different countries of the Arctic. The ISC encourages reindeer herders to produce a sustainable supply of high quality meat for the market.

11. Pay attention to the market situation in the different countries, and recognise the challenges herding and hunting economies face. The ISC encourage the establishment of national and regional programs aimed at improving the socio-economic situation for the herding and hunting communities and secure a sustainable development of the industry.

Information exchange and cooperation

12. As also recognised in the Sustainable Reindeer Husbandry report from 2002, the ISC appreciates the important role played by the Arctic Council. The ISC encourages the Arctic Council to keep reindeer and caribou on the Arctic Council's agenda. We also ask the Arctic Council to review and assess the progress made on implementing the recommendations of the Sustainable Reindeer Husbandry, Phase 1 report.

13. The ISC encourages the different Arctic countries to foster international cooperation and information exchange regarding domestic and wild reindeer and the societies that depend on them

Legal rights and institutions

14. Recognizing the important role of reindeer/caribou to the subsistence and economic livelihood of hunters and herders, the ISC recommends that in the development of regulations and legislation, aboriginal rights for traditional land uses, family business and subsistence harvesting activities are supported.