

NORSK POLARINSTITUTT
(Tidl. Norges Svalbard- og Ishavs-undersøkelser)

MEDDELELSER

Nr. 84

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IN EUROPE AND NORTH-AMERICA

II. TRANSPLANTATION OF HARES
TO SVALBARD

BY
ODD LØNØ



I kommisjon hos
UNIVERSITETSFORLAGET
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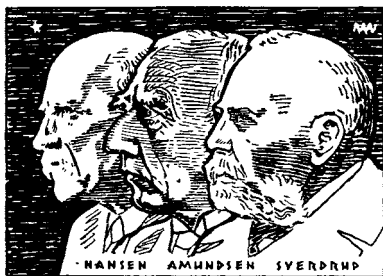
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Foreword.

This article is based mainly on information obtained from the archives of The Norwegian Polar Institute and The Norwegian State Game Research. I wish to thank the following persons heartily for much valuable information: Forest ranger John Angard, district judge Odd Birkevtedt, director E. E. Crawford, wireless operator Kåre Brathlien, wireless operator Olav Eggen, professor dr. Anatol Heintz, geologist Audun Hjelle, photographer Gunnar Melle, dr. E. L. Lewis, Søren Richter, M. A., consul Ignat Shejko, ensign A. Sundheim, director John J. Teal jr. The counting of muskoxen at Svalbard in the summer of 1959 was performed by the author.

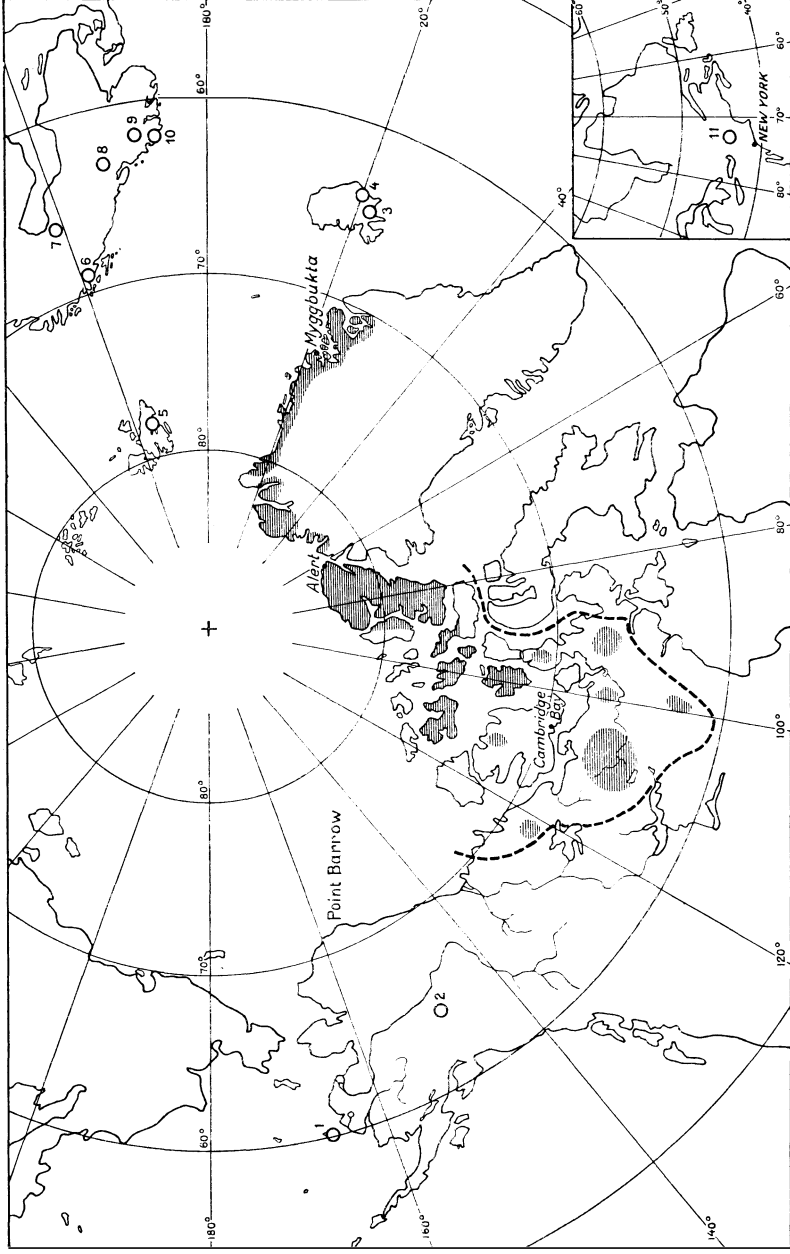


Fig. 1. The shaded areas show the distribution of the muskox in 1930 and the dotted line shows the distribution in 1870. The circles show the places where efforts have been made to transplant the muskox. 1. Numivak Island. 2. Fairbanks. 3. Grund in Skorradal. 4. Gunnarsholt. 5. Svalbard. 6. Bardufoss. 7. Holmfors. 8. Medstugan. 9. Dovre. 10. Gurskoy. 11. Vermont.

INTRODUCTION

The muskox, *Ovibos moschatus*, today lives on the tundra in northern Canada, on the North American islands and in Greenland. The dotted line in Fig. 1 shows the distribution in 1870 in Canada, and the shaded area shows the distribution in 1930 (Hone 1934). Before 1870 the muskox was even more widely distributed in Canada and Alaska. The eleven points in Fig. 1 show the places to which the muskox has been transplanted or where efforts have been made to transplant it.

There are three subspecies of the muskox. *Ovibos moschatus moschatus* Zimmermann and *Ovibos moschatus niphoecus* Elliot which both live on the Canadian mainland and *Ovibos moschatus wardi* Lydekker which is distributed on the North American islands and in Greenland.

TRANSPLANTATIONS OF THE MUSKOX

Sweden.

In 1900 the Swedish professor G. A. Nathorst bought 4 muskox calves in Tromsø that had been captured in East Greenland. They were placed in an enclosure at Medstugan in Jämtland (No. 8 Fig. 1). One of the calves died shortly after arrival of blood poisoning, caused by an injury which was probably contracted during transportation to Jämtland. After two years, in August 1902, two of the animals died of a contagious cattle disease. This cattle disease ravished Jämtland in 1901. It has not been possible to ascertain what the disease was. The last animal, a cow, lived somewhat longer. The cause of its death is not known.

In 1901 a Swedish expedition under the leadership of Gustaf Kolthoff brought home two muskox calves, a male and a female, from East Greenland. These were let loose on the Holmfors estate near Boden in Northern Sweden (No. 7 Fig. 1). These animals lived and thrived in February 1903 (Kolthoff 1903). Their further fate is not known, but according to information given by the Swedish professor dr. Einar Lönnerberg, they are presumed to have died out shortly after 1903.

The climate in the two places where the muskox has been released in Sweden is continental. It is least pronounced in Jämtland where the climate is influenced somewhat by the Atlantic ocean. There are low mountains here on the border of Norway. Fig. 2 shows the annual mean temperature for Storlien and the annual mean precipitation for Skalstugan, the two meteorological stations nearest Medstugan in Jämtland. Storlien is 595 metres above sea-level and Skalstugan 585 metres above sea-level.

Norway.

In Norway muskoxen have been released at three places, namely at Gurskøy, Dovre and in Bardu (Nos. 10, 9 and 6 Fig. 1).

Gurskøy. In 1924 11 calves of muskox were put ashore at Kiholmen near Kjelsund. This is a small grassy islet near Ålesund. All the calves were captured in East Greenland in July 1924. After some time 5 of them died. The cause of death was said to be that the pasture was actually too rich.

Owing to the difficulty of selling muskoxen to zoological gardens, the remaining 6 animals, 3 bulls and 3 cows were released on the island of Gurskøy in June 1925. Gurskøy, which lies about 35 kms south of Ålesund is about 70 kms in circumference with a lot of rock, moorland and good pastures. After a short time several calves came down to the home-fields and grazed there a whole night. Two calves died.

The year after, in June 1926, two calves, a bull and a cow, were released at the same place.

The animals were seen several times until the summer of 1927. At Whitsuntide of the same year two cows were seen, each with a suckling calf. One bull calf fell over a precipice and was killed. After this summer nothing has been seen of the animals. It is not known why the animals died out. The climate may have been unfavourable. However, without anything definite being known, there is reason to believe that they may have been shot by poachers.

Gurskøy has a very damp coastal type of climate. Fig. 3 shows mean annual temperature and precipitation for Ålesund, 6 metres above sea-level. The climate of Ålesund is similar to that of Gurskøy.

Dovre I. On the 7th October 1932 10 muskox calves, 7 cows and 3 bulls were released at Hjerkin in the Dovre mountains. These animals were captured in East Greenland in the summer of 1931. During the winter they were all fed indoors with mountain hay and some oats. During the summer 6 of them had grazed on an islet near Ålesund. When they were released, a bull and a cow were $2\frac{1}{2}$ years old and the others were $1\frac{1}{2}$ years old. They were all in very good condition. The animals spread out in small flocks or went about singly. During the first winter in the moun-

tains 4—5 of them chose a cellar under an outfarm as their permanent retreat. This place is used by goats in the summer. From February two of the smallest animals were partly fed indoors.

The autumn after they were released, the animals moved 25—30 kms northwards to the mountains west of Drivdalen, where they later remained (Fig. 4).

In the winter of 1933—34 there was much snow in the mountains. The animals made their way up the steep mountainside to find pasture. About the 27th April 1934, a flock which presumably consisted of 8 animals, was caught by an avalanche. When they were found, 4 were dead, one was shot as it was badly injured. Of these 5, 3 were cows and 2 were bulls. Two other muskoxen were injured, but their injuries were not so serious that they had to be shot. After some months they had fully recovered. At about the same time 30—40 reindeer perished in the same way in the same area. The dead muskoxen were carefully examined by the Veterinary Medical Clinic, Oslo. All the animals with the exception of one were in good condition and definitely fatter than they were at the same time of the year in East Greenland. A tapeworm was found in one of the animals. The one animal that was in a poor condition, had several old shot wounds, so poachers had tried to kill it. After this disaster there was only one bull left.

The first calf was born in the spring of 1936. The animals were now big and powerful, and the year after the calf was bigger than the calves released in the Dovre mountains. Another calf was born in 1938, but none in 1937 (Olstad and Tuff 1940).

As there was only one bull, it was of great importance to get more animals transferred from East Greenland, and in September 1938 two bull calves were released. One was 16 months old when it was released and the other 4 months. In 1939 there were at least 9 animals in the Dovre mountains. Two calves were born in 1941, possibly one or two more. The stock now consisted of at least 11 animals, probably more.

This small stock of muskoxen was now acclimatized and had got calves. The trial had shown that the animals thrived in the high mountain regions in Norway. They usually stayed at a height of 1000 to 1800 metres above sea-level. The trial must be said to be a success despite the avalanche disaster.

Nevertheless, the trial met with a sad end. In 1942 a muskox was gored

in the side by another muskox, fell over a precipice and perished. In 1940 the war came to Norway, and it was difficult to protect the animals effectively. It is known definitely that two muskoxen were shot by the Germans. The first in 1941 and the second in 1944. It is assumed that the others were shot either by Germans or Norwegians. Nothing has been seen of the animals since 1945.

In the summer of 1951 a man said that he saw about 15 muskoxen in small flocks in the mountains between the Geiranger fjord and the Tafjord. This is more than 100 kms from the place where the animals stayed in the Dovre mountains. A tourist is also of the opinion that he saw a muskox in the same terrain in 1942. These observations must be wrong as the animals have not been seen since in this area despite investigations.

Dovre II. After the war efforts were again made to get up a stock of muskoxen at Dovre. The following transfers have been made from East Greenland to Dovre:

1947. At the end of August 8 calves, 4 bulls and 4 cows were released at Dovre between Hjerkin and Snøhetta. Two of the bull calves died in the autumn of 1947 of unknown causes. One of the cow calves presumably died later. At any rate it was never seen again.

1949. This year 4 calves were brought home and placed in a corral at Dombås. 3 of the calves died the same autumn. They were carefully examined by the Norwegian Veterinary College. The examination showed that the presumable cause of death was lack of nutrition. Parasites were also found both externally and internally, sarcosporidean externally, cestodes (tapeworm) and trichostrongylider internally. The one remaining calf, a cow, was not released before the summer of 1951.

1950. This summer 8 calves were brought home and fed at Dombås, but this time in a larger corral. Seven of them were 4 months old and the eighth, a bull, was one year and 4 months. One calf was gored to death in January by one of the other calves in the corral. The 7 remaining calves and the one from 1949 were released at Dovre in July 1951. Again disaster occurred. After only a fortnight 2 cows and a bull of the summer's calves fell off a steep mountain and were killed. The animals had climbed up the mountain and fell down as they were descending.

1951. This summer 2 calves were brought home and immediately

released at Dovre. Nobody has seen anything of these, and it is doubtful whether they have survived.

1952. 4 calves were brought home, and 2 of these died in the autumn of abdominal inflammation. The cause of the disease is unknown. The two remaining animals were kept in a corral and were released at Kongs-vold on the 30th June 1953.

1953. A bull calf was brought home and released at Dovre. In the period 1947 to 1953 a total of 27 calves were brought home. Despite long experience there has been a lot of bad luck with these animals. As mentioned, 11 died of disease and injuries, and three are presumed to have perished. No more animals are now being brought to Norway.

Besides the loss of the 14 calves there have also been other difficulties. The two bulls from the flock that was released in 1947, soon parted from the other animals and stayed down at Sunndalen. It was impossible to drive them back to the other animals as the terrain was too rugged. Both these bulls were shot. It was therefore thought that there was no possibility of calves in 1953 as there were no bulls left with propagative power. Nevertheless a calf was born in the spring of 1953, so the three-years-old bulls must have had the power of propagation.

However, in the summer of 1953 the stock consisted of only 11 muskoxen. As mentioned, a calf was born, but a bull had to be shot when it injured a heifer on an outfarm.

Reliable information about the muskoxen in the Dovre mountains in recent years is as follows:

1957 — 23 muskoxen, thereof 2 yearling calves.

1958 — 25 muskoxen, thereof 2 yearling calves.

1959 — 14 muskoxen, thereof one yearling calf. In addition to the 14 at Dovre there are two muskoxen seen at Breiskaret south of Atna, 90 kms from Dovre (Fig.4). Apart from one which was shot by poachers at Dovre, it is not known what has become of the others.

The shaded areas in Fig. 4 show where the muskoxen stay. Stray animals are marked with dots. The animals are very stationary and live in the same areas as in the 1930's. They find abundant food in the winter, and the pastures are considerably better than in East Greenland. As in other Norwegian mountain districts there is an abundance of willows at Dovre, and this is the favourite plant of the muskoxen. None of our

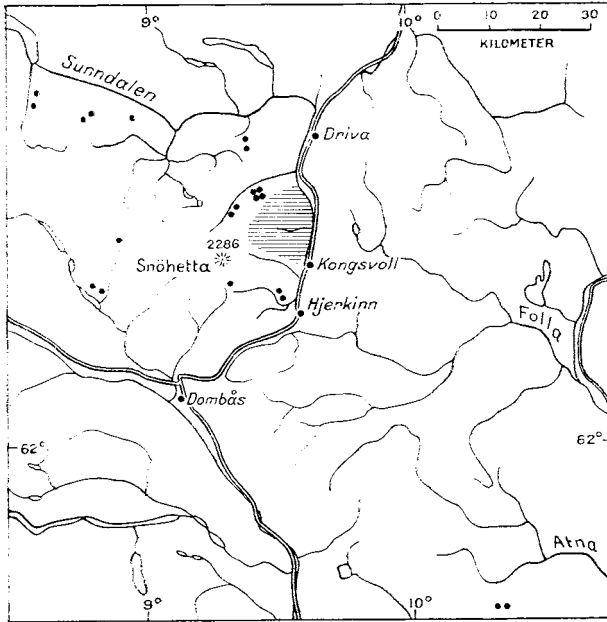


Fig. 4. The shaded areas show the haunts of the muskoxen at Dovre. Dots show stray animals after 1947. Informations from John Angard.

domestic animals or wild animals feed on willows to any extent, so now we have an animal that makes use of this plant.

However, the future is not secure for the small stock that lives at Dovre. Chance accidents, such as avalanches, for example, can destroy the stock. Poachers seem to be even more dangerous. As mentioned, one animal was shot in the summer of 1959, and there is reason to believe that others have shared the same fate.

Mean annual temperature and precipitation for Hjerkinn, 953 metres above sea-level, is shown in Fig. 5. Dovre lies in the area of Norway where there is least precipitation. That is one of the reasons why the muskoxen were released there.

Bardufoss. From several quarters in Norway interest has been shown in having the muskox released in more places, but the desire was to concentrate the animals as much as possible in one place. For several reasons, however, permission was granted to transfer some animals to Northern

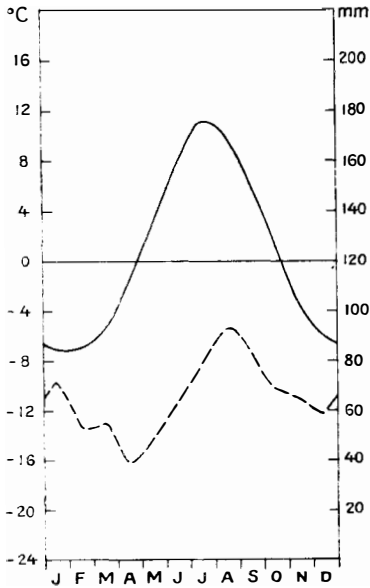


Fig. 2. Mean annual temperature (—) for Storlien and mean annual precipitation (---) for Skalstugan. The stations nearest to Medstugan.

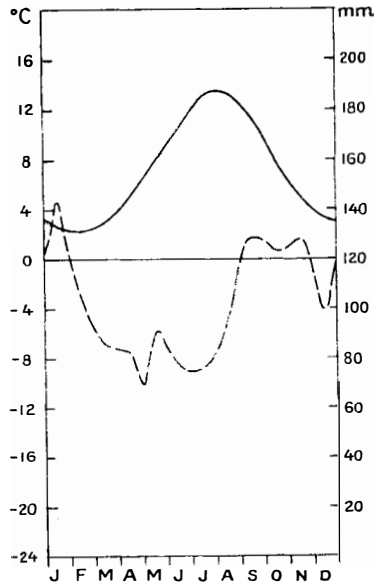


Fig. 3. Mean annual temperature and precipitation for Ålesund.

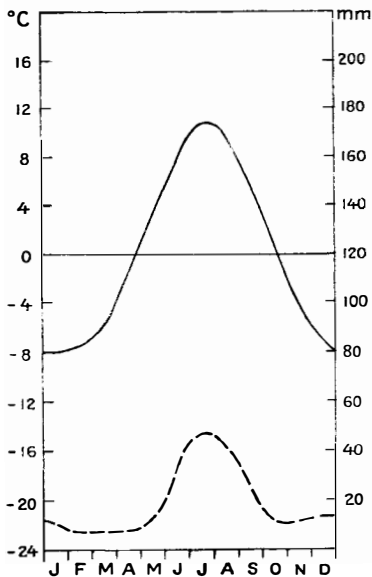


Fig. 5. Mean annual temperature and precipitation for Hjerkin at Dovre.

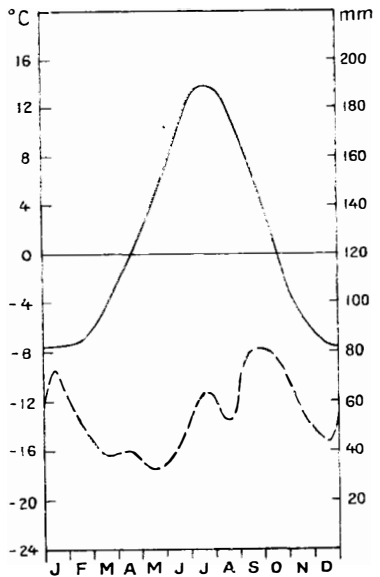


Fig. 6. Mean annual temperature and precipitation at Fagerlidal, Bardu.

Norway. In 1948 10 calves were transferred from East Greenland to Bardufoss. They were placed in a corral near Bardufoss airfield. After some time 2 of the calves managed to get out of the corral and into a meadow where the pasture was too rich. They both died. The remaining 8 animals, 4 bulls and 4 cows were released in the autumn of 1948 in the Skoelv valley, about 6 kms from Bardufoss. These animals stayed for the most part near the mountain district of Hjerttind. One perished in 1949 from an unknown cause. Only remains of the animal were found. In the summer of 1951 there were definitely 5 muskoxen left, possibly 7.

Little has been seen of the animals since then, and they have possibly wandered around to some extent. Several people saw what they thought were traces of muskoxen in Vittangi and Øvre Soppero in Sweden in 1952 (Dahlskog 1953). It is 190 kms from Bardufoss to Øvre Soppero. It was immediately forbidden to shoot the muskox in Sweden. There is also great interest in Sweden for getting a stock of this rare animal.

In October 1957 a muskox cow had to be killed in Salangen as it had become entangled in barbed wire. It was not with young. Calves have never been seen. The reason must be that the animals live so spread that they do not find each other in the mating season. This transfer has not been a success.

However, there are still some in the mountains round Hjerttind. Three were seen in the autumn of 1959.

Fig. 6 shows mean annual temperature and precipitation for Fagerlidal in Bardu, 72 meters above sea level.

Iceland.

In the summer of 1929 7 muskox calves were brought to Iceland. The calves were caught in East Greenland by the Icelandic «Gotta» expedition. In order to capture the 7 calves, 27 grownup muskoxen had to be shot. To begin with the calves were kept on a pasture near Reykjavik, but they were later moved to Gunnarsholt in South Iceland (No. 4 Fig. 1). Here a shelter was built for them where they stayed during the night. They grazed during the day. The calves were fed daily on cow milk and a little oatmeal. In the course of October and November of the same year 6 of the calves died. The cause of death was presumably braxy. It is assumed that the infection was conveyed through the ground. Braxy (gastromycosis ovis) is a disease which attacks sheep, and it is common in Iceland

and Scotland. It was formerly quite common in the western part of Norway. Braxy is caused by an anaerobic bacteria which infects the intestines. Sheep and cattle had previously grazed where the muskox calves grazed. The last of the 7 calves died early in 1931. It had been severely attacked by tapeworms, and liver and lungs were covered with bladderworms. In the summer of 1930 this calf had grazed together with some bulls.

In 1930 7 muskox calves were again imported to Iceland. These were brought from Norway who had in turn imported them from East Greenland. Of these, 5 were taken to Gunnarsholdt, but they were released at a place where no domestic animals had grazed for the past 5 years. They were also vaccinated against braxy. These were also fed on some cow milk and oatmeal. They all died after some time, the last one on the 1st October 1932. The cause of death is stated to be a deficiency of nutrition, probably a lack of vitamins.

The last two calves were released near Grund in Skorradal in West Iceland (No. 3 Fig. 1). The one perished in September 1931. The other died in May 1932 after having been moved over to Gunnarsholt.

South West Iceland has a mild wet coastal climate, and Gunnarsholt and Grund have similar climates. Fig. 7 shows mean annual temperature and precipitation for Hæll, 130 metres over sea-level, which is the nearest meteorological station to Gunnarsholt.

Svalbard.

In September 1929 18 muskox calves were sent from Ålesund in Norway to Svalbard by the sealer «Veslekari». On the trip over one of the calves died, but the other 17 were in good condition when they were released at Moskushamn in the Advent fjord on the 24th September. There were 3 bull calves and 3 cow calves of about 1½ years of age, and 7 bull calves and 4 cow calves of about ½ a year of age. All had been caught in East Greenland.

The 6 oldest were caught in 1928 and had been held in captivity in Norway for a year. While they were in Norway, the calves had all the time been fed on mountain hay from non-fertilized ground. On the way over to Svalbard the calves were fed on the same kind of hay and given water morning and night. On Svalbard mountain hay was laid out at the

place where the calves were released. During the first two years this stock of hay was visited several times by the calves. They became very skittish soon after they were released, but on the whole they always stayed within a radius of 25 kms from the place where they were released during the first years.

The animals thrived from the first moment, and none of the 17 that were released were lost in the course of the first 3—4 years. The third winter the animals lived on Svalbard, the winter of 1931—32, was very unfavourable for them. In the course of the winter it began to rain and ice formed on the pastures, but the animals managed this all right.

4 calves were born in the spring of 1932. It is presumed that one of the oldest cows which was then 4 years, must have had twins. The next year 3 calves were born, and as far as is known, calves have been seen every year since then. One of the calves from the year before perished in 1933. It was butted off a precipice by another muskox.

In the course of time the muskoxen spread out over the terrain between Isfjorden and Van Mijenfjorden. This terrain is most favourable with many valleys having good pasture and relatively few glaciers.

No count was ever made of the muskoxen, but after Xmas 1936 30 animals were seen in the same place. It was assumed that the stock then consisted of about 40 animals.

Everybody on Svalbard, both miners and sealers protected the muskoxen, and apart from some doubtful cases, there is nothing to indicate that any animal has been shot up to August 1941 when Svalbard was evacuated by Russians and Norwegians. A small German garrison was on Svalbard from 1941 till June 1942. It is certain that one muskox was shot by a German officer at that time, as the head was brought to Norway and stuffed. No other cases are known, but it is hardly probable that this was the only animal the Germans shot.

From May 1942 and till the end of the war there was a Norwegian garrison on Svalbard. According to reliable sources the Norwegian soldiers shot at least 19 muskoxen. All these were shot to provide meat, with the exception of one that was shot at night. It did not stop when the guard at Kapp Linné hailed. It has been stressed by several of the soldiers who shot animals that mainly bulls were shot out of regard to the stock.

When the Russians evacuated in 1941, they let loose 20—30 sledge dogs which killed many reindeer. Two dead fully grown muskoxen were

found in the terrain by the Norwegian soldiers in 1943. It is assumed that the two animals, one in Lundstrømdalen and one in Semmeldalen, had been torn to death by the dogs. These must have been single animals that have been attacked by a flock of dogs, as it is known that the muskox can protect itself effectively against dogs and wolves. The wild dogs died out in 1945. Even if some animals have fallen as prey to the wild dogs, these can hardly have damaged the stock to any great extent.

A muskox was taken to Leningrad by the Russians on Svalbard. After some years it died and was stuffed and is now in the Zoological Museum of the Academy of Science in Leningrad. The Norwegian authorities have not granted permission for export of dead or live muskoxen from Svalbard.

In the summer of 1959 efforts were made to count the muskoxen on Svalbard. The whole terrain along the north side of the Van Mijen fjord, Bellsund, Adventdalen and the west side of the Grønfjord, that is to say about $\frac{3}{4}$ of the areas where the muskoxen stay, has been investigated. The Russian consul on Svalbard said that no muskoxen had been seen at their plant in the summer of 1959. 36 animals have been seen. In the summer of 1959 I should say that there were about 50 muskoxen on Svalbard.

Fig. 8 shows where the muskoxen have their haunts. Outside the shaded areas only stray animals have been observed at various times, these are marked with dots. Nothing definite is known of the distribution in the eastern areas, as there have not been enough observations from that area. The muskoxen live in the same terrain as the reindeer. A remarkable exception is that the muskoxen have not yet been in the Sassen valley, Svalbard's best reindeer terrain. Only a few stray animals have been seen here. A flock of 7 animals that had come over Brentskaret from the Advent valley, turned and went back after a short stay in Sassen valley.

Of the 36 muskoxen observed last summer, 2 were calves — that is a calf percentage of 5.5. Reindeer in the same area had a calf percentage of 24, but the number of calves was unusually low in 1959. Observations from previous years indicate that the percentage for muskox calves is often higher, but no reliable counts have been made.

According to the few available observations, it seems as if the calves are born at the same time on Svalbard as in East Greenland, i. e. between the end of April and the beginning of June. Dead calves have been seen on

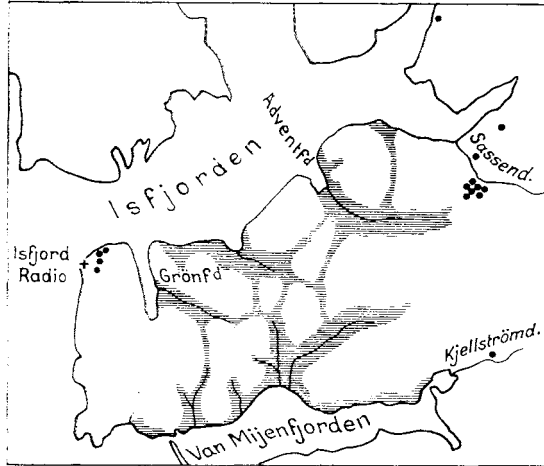


Fig. 8. The shaded areas show the haunts of the muskoxen on Svalbard. Dots show stray animals.

4 occasions. In three of the cases death was accidental. As previously mentioned, one was butted off a precipice. One was found floating in the sea. It had presumably drowned in a river and been carried out to sea. On the 17th May 1959 a calf was found on its own in the Advent valley. Two days later it was found dead. It weighed 9 kgs. and could not have been many days old. The calf had suckled its mother. There is every indication that the calf has slipped over the edge of a plateau shaped mountain where it was together with its mother. It had slid over 200 metres down on the snow and its mother had not been able to find it. The calf had tried to eat. A small willow branch and some moss were found in its stomach, 3—4 gms in all. A dead calf was found up in the snow in May a few years ago. The cause of death is unknown.

There is greater mortality among the muskox calves than among the reindeer calves on Svalbard. Dead reindeer calves are very seldom seen. This may be due to the fact that the reindeer calves later in the spring, in June.

Fig. 9 shows mean annual temperature and precipitation at Isfjord Radio, 7 metres above sea-level.

There is tundra everywhere on Svalbard, and the vegetation consists of moss with grass and flower plants. The muskox is very fond of willows,

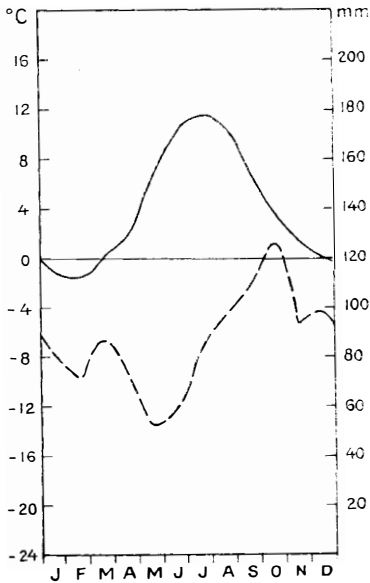


Fig. 7. Mean annual temperature and precipitation at Hæll near Gunnarsholt.

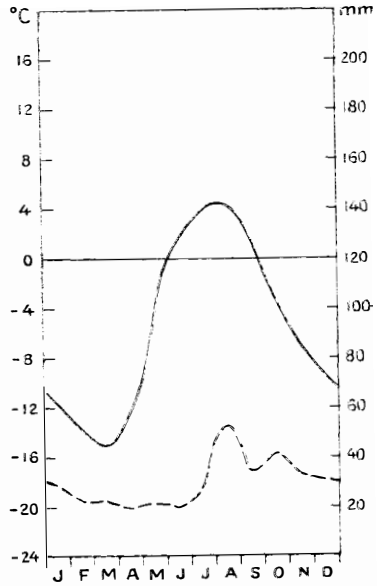


Fig. 9. Mean annual temperature and precipitation at Isfjord Radio, Svalbard.

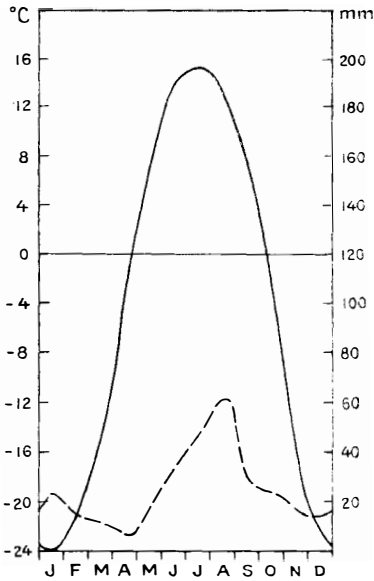


Fig. 10. Mean annual temperature and precipitation in Fairbanks.

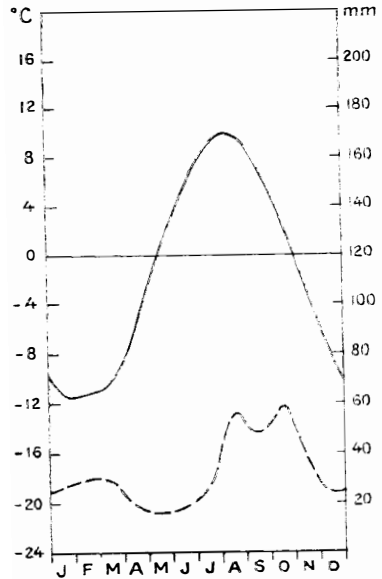


Fig. 11. Mean annual temperature and precipitation for Nunivak reporting station.

but the species found here are very small and are of no account as fodder. The areas where the muskoxen have their haunts, are Svalbard's best pasture land. Conditions are better than in East Greenland, where the vegetation in large areas is often damaged by drought in the summer, but that never happens on Svalbard.

The areas on Svalbard where the muskox has its haunts, are very seldom visited by polar bears, there are no reports of these two animals having met. Relations between the polar bear and the muskox will probably be the same as relations between the polar bear and the reindeer. The polar bear shows no interest for the reindeer. Experience from Greenland shows that the polar bear shows no interest for the muskox. Only one case is known from Greenland where a polar bear took a muskox (Hone 1934).

Alaska.

Muskoxen have lived in Alaska up to recent times. The last that is known was a flock of 13 animals that was shot near Point Barrow, presumably in 1858 (Hone 1934). It was therefore to be expected that the muskox would thrive when it was again brought to Alaska.

College near Fairbanks. In 1930 34 calves, 15 bulls and 19 cows were imported to the Survey Experiment Station at College near Fairbanks. All the calves had been caught in East Greenland in 1930 and were from half a year to two years old. The calves were sent from Norway to New York. As regards feeding and care of the animals, L. J. Palmer says in his «Muskoxen Report» to the Biological Survey of the 12th November 1930: «... Animals were fed on native hay en route to New York, but upon reaching quarantine were immediately placed on alfalfa hay. They took to the new feed at once and no difficulty whatever was experienced in the feeding. Salt was also given, a block placed in each crate, and a considerable amount was taken. Animals drank much water due to the warm weather prevailing. The muskoxen seemed distressed during warm weather, breathing heavily and feeding less. They much preferred the cooler days...».

The calves were in good condition on arrival at College the same autumn. To begin with they were kept in a corral of 40 acres for further examination. Later they were released in a larger fenced in area, 325 acres for spring pasture, 600 acres for summer, 82 for autumn, 60 for winter and hay meadow, 10 for hay meadow. The animals thrived here, but a

somewhat unexpected foe turned up in the form of Alaska's common black bear. Up to the 9th October 1933 there was a loss of 9 calves: 6 were killed by bears, 1 broke a leg, 1 died of meningitis, resulting from neck injury and one died of another disease. All the 25 that were left were in good condition, with the exception of one that had been temporarily blinded by midge bites round the eyes, and which damaged its eyes itself by running round in the enclosure (Hone 1934).

The first calves were born in the spring of 1934, the cows that calved were then in their 5th year. Calves were also born the next year, but none in 1936.

The climate at College is typical inland with cold winters, warm summers and little precipitation. Fig. 10 shows mean annual temperature and precipitation in Fairbanks, 133 metres above sea-level, where the climate is very similar to that of College.

The calves were much pestered by midges. Especially they were bitten round the eyes, the only place where they are not protected by their long coat.

In 1935 and 1936 all the animals were transferred to Nunivak Island.

Nunivak Island. Partly because of the bears, 4 of the muskoxen from College were transferred to Nunivak National Wildlife Refuge in the Bering Straits in 1935. As this experiment seemed to be a success, the rest of the animals were transferred in July of the following year. 31 muskoxen in all were transferred, and these immediately split up into small groups and wandered round in the mountains on this big island. The first year a young bull drowned in a bog. In 1937 the total number of animals was 30 plus an unknown number of calves which were born that year.

In June 1952 the muskoxen on Nunivak Island were counted from the air. 76 were observed. Besides these, 9 animals which the airmen did not see, have been taken into account. The total number is thereby 85 (Dalskog 1953).

On my inquiry, E. E. Crawford, Acting Chief, Branch of Wildlife Refuges, states in a letter of the 25th June 1959: .While there has been a steady increase in the animals on the Nunivak National Wildlife Refuge since their introduction in the 1930's, the rate of reproduction has been slow. The Bureau does not intend to make any disposition of animals

for private, commercial, or other purposes until the herd number exceeds their contemplated requirements. In this connection, a substantial number are planned to be transplanted to the proposed Arctic Wildlife Range when and if this project becomes a reality. Bureau personnel making a survey of Nunivak Island during July of 1958 counted 181 musk ox, including 32 calves. No evidence of any loss was found..

Fig. 11 shows mean annual temperature and precipitation for Nunivak reporting station on Nunivak Island. 8 metres above sea-level. The vegetation consists mainly of Iceland moss, grass and heather.

U. S. A.

In 1954 and 1955 the Institute of Northern Agricultural Research, U. S. A. imported seven muskox calves to the experimental farm at Vermont. The calves were captured 500 miles north east of the Great Slave Lake. Permission was obtained from the Canadian government to capture calves providing no adults were killed or injured in the process. John J. Teal jr. (1958) who has tried a totally new and humane way of capturing calves, explains this: .In August 1954, during the height of the breeding season, a technique of capture was discovered. It was based upon outbluffing the herd, setting an ambush, driving the animals into the water, and then diving in and pulling out the calves. This method was successfully repeated in 1955. Immediately after capture, the calves were hogtied and brought back to our camp, where they were released in a corral.. The captured calves were first flown to Yellowknife in 1954 and to Fort Churchill in 1955 and thence on to Vermont. It is the first time muskoxen have been transferred from other places than East Greenland.

The muskoxen in Vermont are to be used in an effort to produce a new domestic animal. In the first place importance is attached to producing an animal which gives the best wool. The wool of the muskox is one of the finest kinds in the world.

In August 1955 one of the calves died. Stomach worms, tapeworms, and lungworms were found in the muskox. Stomach worm disease (*haemonchosis*) caused the death of the animal. (W. B. Durrel and W. D. Bolton 1957). But apart from this the trials in Vermont seem to be developing satisfactorily. Teal jr. says that calves were born both in 1958 and 1959 (personal information).

Experience.

As appears from the foregoing it is not easy to work up a stock of the high arctic mammal, the muskox, outside its natural area of distribution. There have been many difficulties.

The muskox calves must not get at succulent grass on cultivated ground. They often overeat on this. The belly swells, and they die in the course of a short time. In Norway hay from nonfertilized meadows and mountain hay, and in America alfalfa hay have proved to be good food for the calves.

Calves and young animals are easily driven in open and flat mountain terrain. In the Dovre mountains the muskoxen have several times been driven 25—30 kms. In broken and steep mountain terrain it is very difficult to drive them as they hide themselves. Dogs cannot be used for driving as the muskoxen attack them. If the animals have found a place where they thrive, they are very much bound to that place.

Relations between reindeer and muskoxen on Svalbard and at Dovre are the best both summer and winter. As previously mentioned from Alaska, it seems as if the black bear can be a danger to the muskoxen. The 6 muskoxen that were killed were all young animals up to 4 years old. It is possible that the danger of bears would not be so great later when the herds had a more natural combination of calves and adult bulls and cows.

In Norway the muskoxen have in many cases been in touch with domestic animals. The muskoxen have several times been near flocks of sheep, but as a rule they show no interest for each other. In only one or two cases sheep have been frightened off, but none have been injured. Muskoxen that come near cattle usually wander away again after a short while. On one or two occasions cattle have been frightened off. As previously mentioned, a heifer on an outfarm was butted in the side by a muskox, and had to be killed. On one occasion a muskox had gone together with a herd of bulls in the mountains for several days, and it proved to be difficult to separate it from the flock. Relations to other animals have always been the best. A muskox that had for some time been together with a flock of bulls, got into a fight with a bull, and the muskox had to withdraw. It is said that horses have been frightened some times.

The climate in the natural distribution areas for the muskox is arctic inland with little precipitation. Figs. 12, 13 and 14 show temperature

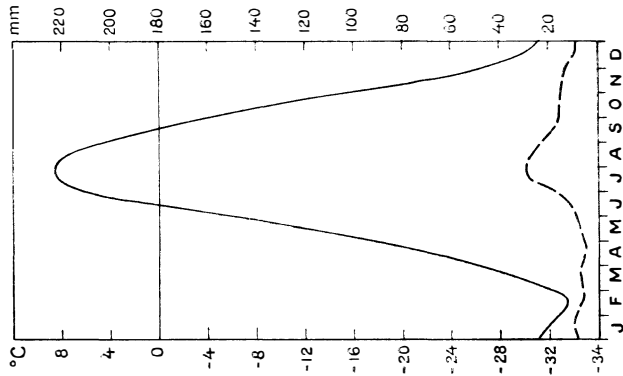
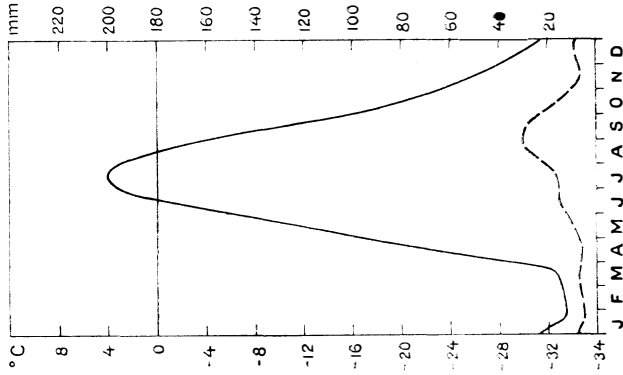
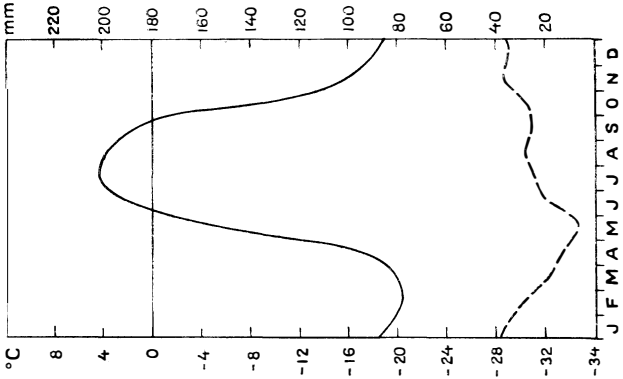
and precipitation for three stations: Cambridge Bay, Alert and Myggbukta (Fig. 1) which all lie within the area of distribution of the muskox.

The three places, Svalbard, Dovre and Nunivak Island where the release of new, wild herds has been a success, all have a climate very similar to that of East Greenland from where the animals come. In all probability the climate of South West Iceland and Gurskøy does not suit the muskoxen. The climate in these places is mild and wet. This has probably been one of the main reasons why the transplantation has not been a success.

On Svalbard and at Dovre the muskoxen have calved in their 4th year, in Alaska in their 5th year. At Dovre a 3 year-old-bull has taken part in the reproduction. The cows are not on heat the year they calve and they therefore have calves only every other year at the most. In 1936 no calves were born in Alaska despite the fact that there were 13 mature cows from 6 to 7 years old. Calves were born both in 1934 and 1935. On the experimental farm at Vermont breedings took place in the fall of 1957. The bulls were two years old. One of the heifers was two years old and the other three years old. The heifers produced calves the following May and June, respectively (Teal jr. 1959). On Svalbard the number of calves has varied greatly from year to year. The reason why few or no calves are born some years is not known. In the summer of 1959 5.5 % of the animals observed on Svalbard were calves. In East Greenland the reproduction seems to have been normal in the summer of 1959. The leader of the Norwegian Polar Institute Expedition to East Greenland in 1959 counted 109 muskoxen, whereof 15 calves at Revet, Loch Fyne and Reinbukta. That is 13 % calves. In East Greenland the average percentage of calves is 15 (Jennow 1945).

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Figs. 12, 13 and 14. Mean annual temperature and precipitation for Cambridge Bay, Alert and Myggbukta.

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II. TRANSPLANTATION OF HARES TO SVALBARD

Hares have been released 4 times in all on the island of Svalbard. In the autumn of 1930, district judge Erik Håvie released 4 hares, and 10—12 in the autumn of 1931. It is not known how many there were of each sex, but there were males and females both years. The hares were released at Moskushamn in the Advent fiord. This place was chosen as the hares could, to begin with, find shelter under buildings and other remains from the disused coalmine there. These hares were all snow hares, *Lepus timidus*, from Norway. Most of them had been caught on the island Store Tamsøy in Porsanger, and some few were from Sør-Varanger.

In the summer of 1931 A. Hoel (1937) caught 16 fully-grown arctic hares, *Lepus arcticus*, in East Greenland. On the way over to Svalbard 13 of the hares perished. The 3 remaining hares, all males, were released at Colesbukta in the Isfiord in the autumn of 1931. This is about 25 kms from Moskushamn where the snow hares were released. The last hares were released in the autumn of 1936. 10 arctic hares were released at Moskushamn. The distribution of sex is not known.

In the summer of 1932 it was simply stated that the hares had propagated. It is not known how many young ones were seen. In August 1935 3 young hares were seen among some scrap-iron on the beach at Moskushamn. At Wimanfjell at a height of 5—600 metres many tracks of hares were seen in September 1937, most of these belonged to young hares. In 1939 2 young hares were seen at Moskushamn. One was later found dead.

The hares were seen in the terrain round the Advent fiord every year up to 1940. Later, from 1942 to 1945 while the Norwegian garrison was at Longyearbyen, the hares were seen several times during the winters. In November 1942 2 hares were shot at Longyearbyen by a soldier. After 1945 the hares have seldom been seen. The last hare was seen in the summer of 1954 at Longyearbyen.

Some of the hares seem to have stayed permanently round the Advent fiord where they were released. One of the reasons for this may have been that before 1940 the hares were often fed during the winter by the people in Longyearbyen. Some hares have roamed far. As early as the winter of 1934 H. Ingstad (1948) saw a hare track as far north as Mosselbukta, 180 kms. from Moskushamn. Southwards the hares have been in the Bolter Pass, about 20 kms from Moskushamn. A ski stave standing in the snow there had been gnawed off by a hare. At the end of July 1949, T. Winsnes saw a hare up in the Sassen valley on the east side of the river. At least one hare has managed to make its way to Nordaustlandet. A hare was seen here on the 19th September 1944 (Dege 1947, 1954) near Bodley Bay at the bottom of the Wahlenberg fiord, 220 kms from Moskushamn. That is the only hare that has been seen at Nordaustlandet, but W. Dege has also reported two observations of hare tracks on the ice on the Rjip fiord, 40 kms north of Bodley Bay. There have been no observations westwards.

A find of 10 dead hares is known. In the autumn of 1932 the remains of 3 hares were found at Moskushamn, and it was thought that the snowy owl or the gerfalcon had taken them. A gerfalcon had been seen several times that autumn. Two dead hares were examined by doctor J. Friis at Longyearbyen. One of them, a snow hare weighing 3800 gms was found at Moskushamn in December 1937. It is presumed that it died from eating bad food that was 10 years old, including flour, that had been thrown out from the plant. The other one was possibly an arctic hare weighing 3200 gms, and was found in March 1938 at Longyearbyen. It was very emaciated and was presumed to have died of hunger. As previously mentioned, a young hare was found in the summer of 1939, it had died of an unknown cause. Three hares have been found during the winter in the terrain round Longyearbyen, the last one in 1954. It is presumed that two of these have died of starvation. The last one that was found dead at the end of June 1954, was presumably killed by a dog. This hare had its resting place high up on the hillside in the Longyear valley, and it came down to the bottom of the valley every day to feed.

The hare has fewer enemies on Svalbard than in Greenland. There are no wolves, stoats or raven. The snowy owl and the gerfalcon do not nest on Svalbard. The gerfalcon is an uncommon guest, but some years the snowy owl is more common. The fox seems to have shown a great

interest for the hares. Many observations have been made during the winter of the fox having followed hare tracks over long distances, but no indications have been found of the fox having killed hares.

The snow hare which was alone in the terrain round the Advent fiord until 1936 managed the first winters well and propagated. They have certainly lived till the summer of 1940 when A. Egge saw two hares at Moskushamn, which he identified as snow hares. They were both totally grey and very shy.

The three arctic hares that were released at Coles Bay, have never been heard of. According to the available observations, it seems as if the arctic hare has lived the longest on Svalbard. According to S. Richter who knows hares both from Norway and Greenland, the two hares that were shot in November 1942, were arctic hares. They were both very tame. The hare that was seen in the Sassen valley at the end of July 1949 was a totally white arctic hare. Doctor Løvenskiold identified the hare found in the summer of 1954 as an arctic hare. This is the last known observation that has been made. As the young hares of the two species are very similar, it is not known whether the young hares seen in 1939 were snow hares or arctic hares. There are therefore no accurate observations of the young of the arctic hare. But on account of the long period of 18 years from the time the arctic hare was released, and till the last observation was made, the arctic hare must also have propagated. In .Brehm. Djurens Liv. Flower estimates the life-time of the snow hare to be 5—6 years, and it should be possible to estimate a similar life-time for the arctic hare.

As time passed, the hares were seldom seen, and it is presumed that they have now (1959) died out. Apart from the two hares that were shot during the war, it is not known if others have been shot. The reason why the hares died out, is not known. However, it is possible that the few hares have lived too spread out and have not found each other in the mating season. Observations of the hares at Nordaustlandet and in Mossel Bay show that some of them have roamed far afield. It must be presumed that the wild dogs that ravished Svalbard from 1941 to 1945, hunted the hares. This may also be the reason why the hares have spread out in the terrain.

The trials that have been made with the setting out of hares on Svalbard, show that it is possible to get a stock of hares there. In my opinion

the arctic hare ought to be released if the trial is to be repeated. This arctic species ought to have better possibilities than the snow hare. The transplantation of the muskox from East Greenland to Svalbard has been a success. There is therefore also reason to believe that the arctic hare which comes from the same district, should be able to acclimatize itself. However, more animals ought to be released. The hares could propagate in captivity on Svalbard and then be released in a suitable terrain over a period of 5—6 years.

Finally I wish to thank the persons who have helped me with informations.

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