# Population Status of Introduced Reindeer on the Belcher Islands, Northwest Territories, in March 1982

Michael A. D. Ferguson
NWT Wildlife Service
Frobisher Bay, NWT

1985

Northwest Territories Renewable Resources

File Report No. 45

## ABSTRACT

The reindeer (Rangifer tarandus tarandus) population on the Belcher Islands was estimated at 287 after an aerial survey during 8-10 March 1982. The proportion of the land area which was surveyed averaged 32% over areas where no sign of reindeer was found, and was 75 and 76% over two areas where reindeer were present. The count of 222 indicated an increase of at least 3.7 times since 60 reindeer were introduced to the Belchers in March 1978. The animals were in dense groups of 169, 26, 23 and 4 reindeer. Only adult males were observed in the group of 26; while only adult females, yearlings and calves were detected in the other groups. No reindeer or their signs were observed outside of southwestern Flaherty and Tukarak Islands.

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# INTRODUCTION

Native caribou (Rangifer tarandus) disappeared from the Belcher Islands about 1880 when they may have changed their migratory patterns (Flaherty 1918). Manning (1976) found little evidence of caribou remains on the islands, which he accepted as support for the above hypothesis. Local residents have suggested that caribou starved when forage became unavailable due to icing conditions (Edmonds 1979). Alternatively, unavailable forage may have caused caribou to emigrate from the Belchers. Miller et al. (1977a) suggest that forage unavailability due to groundfast ice may be responsible for some interisland movements of Peary caribou on the Queen Elizabeth Islands.

Since the extirpation of caribou, residents have obtained caribou from the Quebec mainland and elsewhere. In March 1978, the Department of Renewable Resources transplanted 50 female and 10 male adult reindeer from the Reindeer Reserve, Tuktoyaktuk, NWT to the Belcher Islands. Reindeer were selected apparently because they were readily available for capture and transport, and are non-migratory (i.e. less apt to move off the islands). The transplant was undertaken to provide the residents of Sanikiluaq with a sustainable meat source.

Following the release, the reindeer dispersed over Flaherty and Weigand Islands (Fig. 1) (Edmonds 1979). In July 1979, an aerial reconnaissance was completed to determine the general distribution and number of reindeer on the Belcher Islands (Popko 1979). During that survey only 22 reindeer were observed, but from hunter interviews Popko (1979) estimated a population size of about 110. Because of the lack of information following the release, and in response to queries by the Weasels Hunters and Trappers

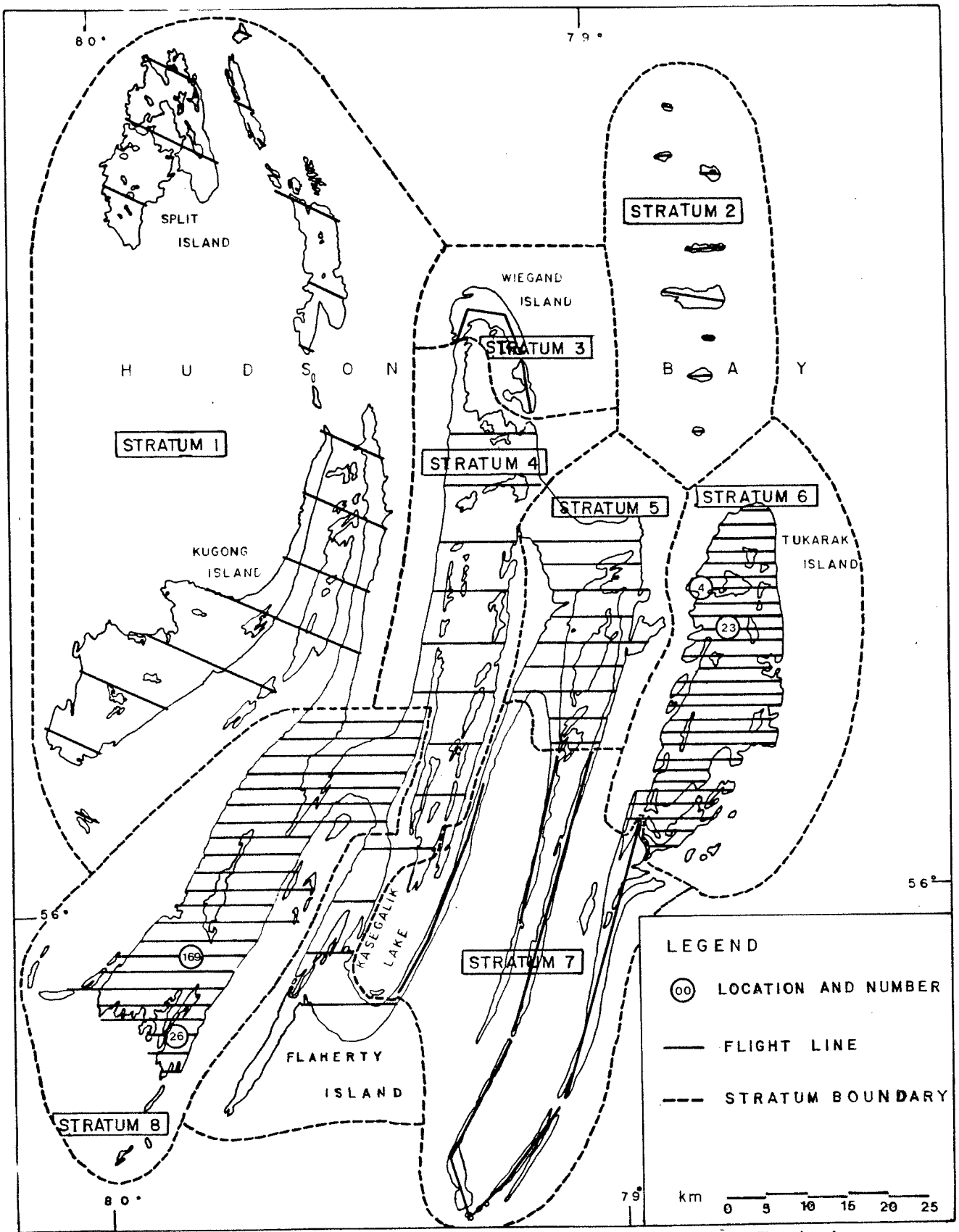


Figure 1. Distribution of reindeer on the Belcher Islands, NWT, during Aerial surveys, 8-10 March 1982.

Association (HTA) of Sanikiluaq, the present survey was conducted during March 1982 to estimate population size and sex and age composition.

## Study Area

The Belcher Islands lie within the Northwest Territories in south-eastern Hudson Bay, about 100 km northwest of Poste-de-la-Baleine, Quebec. The land area of the Belchers occupies about 2830 $km^2$, after excluding all marine waters and Kasegalik Lake which were considered non-habitat for reindeer. Flaherty (1562 $km^2$), Tukarak (346 $km^2$), Kugong (320 $km^2$) and Split (155 $km^2$) Islands are the largest in the archipelago. Sedimentary and volcanic rock form bands which give the islands their north-northeasterly orientation (Kirwan 1961). The topography is generally low and gradual, rising to a maximum of 155 m above sea level on Tukarak Island. Some cliffs rise 50 to 70 m (Jackson 1960).

Vegetation on the islands has been classified as low arctic tundra, dominated by mosses, dwarf shrubs, lichens, and sedges (Edmonds 1979). Mixed lichen - dwarf shrub flats, which occupy only 8% of the land area, should provide fair summer and good winter range for reindeer; while hummocky lowlands over 25% of the area should provide good summer and fair winter range. The winter range was considered to be fair to good when compared to other parts of the Arctic (Edmonds 1979).

## METHODS

During 8-10 March 1982, reindeer on the Belcher Islands were censused by an aerial strip-transect method. After an initial reconnaissance flight, and interviews with members of the Weasels HTA, the islands were divided into 8 strata (Fig. 1). Tape on wing struts delineated 0.8-km-wide strips on the ground on each side of the Cessna 337 aircraft, when it was flown 122 m above ground and at 175-190 km/h. Strata without recent sign of reindeer were sampled at 19 to 75% coverage. In the two strata where reindeer sign was observed, 75 and 76% of the total land area was surveyed. Most transects were flown parallel across the narrowest width of the islands. However, some were parallel to the long axis depending on the width and orientation of individual islands. The pilot marked animal group locations on 1:250,000 topographical maps, while two rear observers counted the reindeer in each group and determined whether they were inside or outside the census strip. To later verify the number of animals, all observed groups were photographed with hand-held 35-mm cameras fitted with 135-mm lenses. Each group was identified as containing predominantly adult males or other reindeer. Densities, estimated numbers and standard errors were calculated from the numbers of animals counted within the census strips using the following formulae from Miller et al. (1977b).

1. Density of reindeer for stratum i: $\bar{X}_i = \frac{\sum_j x_{ij}}{\sum_j n_{ij}}$

2. Variance of Xi:

$$S^2(\bar{X}_i) = \frac{A_i - a_i}{A_i} \times \frac{m_i}{m_i - 1} \times \frac{1}{(\sum_j n_{ij})^2} \left[ \sum_j x_{ij}^2 + \left( \frac{\sum_j x_{ij}}{\sum_j n_{ij}} \right)^2 \sum_j n_{ij}^2 - 2 \left( \frac{\sum_j x_{ij}}{\sum_j n_{ij}} \right) \sum_j x_{ij} \cdot n_{ij} \right]$$

3. Standard error of $\bar{X}i$: $S(\bar{X}_i) = \sqrt{S^2(\bar{X}_i)}$

4. Total estimate for stratum i: $X_i = \frac{A_i}{a_i} \sum_j x_{ij}$

5. Standard error of Xi: $S(X_i) = \frac{A_i}{a_i} \sum_j n_{ij} S(\bar{X}_i)$

6. Total estimate for strata with reindeer: $X = \sum X_i$

7. Standard error for the total estimate for strata with reindeer:
$$S(X) = \sqrt{\sum_i S^2(X_i)}$$

Where: $x_{ij}$ = number of reindeer on transect j, stratum i.

$n_{ij}$ = area (length x width) of transect j; stratum i.

$A_i$ = total area of stratum i.

$a_i$ = total area surveyed in stratum i.

$m_i$ = number of transects in stratum i.

A ground crew attempted to classify individual animals by age and sex. However, the reindeer maintained dense group formations during various types of approach. Only reindeer on the exterior of the groups could be classified, thereby making the limited results unusable.

## RESULTS

The reindeer population of the Belcher Islands was estimated at 287 for 8-10 March 1982 (Table 1). A confidence interval for this estimate could not be determined because of the untransformable non-normal data distribution caused by the clumped distribution of the reindeer. At least 222 reindeer were observed during the survey. All reindeer within the census strips were probably detected, because their dark pelage was readily seen against the snow background. Two groups of 169 and 26 were observed on southwestern Flaherty Island, and two groups of 23 and 4 reindeer on Tukarak Island (Fig. 1). Only adult males were detected in the group of 26, and the group of 4 was composed of 2 adult females, a calf and a yearling. Only adult females, yearlings and calves were noted in the groups of 169 and 23; however, adult males may have gone undetected. Due to large group size and dense group formation, individual animals could not be classified by sex and age. No sign of reindeer was detected outside of southwestern Flaherty and Tukarak Islands.

Table 1. Numbers and densities of reindeer on the Belcher Islands, NWT from aerial surveys, 8-10 March 1982.

| Sampling Stratum (sampling proportion)[a] | Number of reindeer | | Number of reindeer per km$^2$[b] | | Estimated number of reindeer | |
|---|---|---|---|---|---|---|
| | Within 1.6-km transects | Outside 1.6-km transects | Mean | Standard error | Total | Standard error |
| 1. Split - Kugong (19.3%) | 0 | 0 | 0 | 0 | 0 | 0 |
| 2. Bakers' Dozen (74.6%) | 0 | 0 | 0 | 0 | 0 | 0 |
| 3. Wiegand (64.6%) | 0 | 0 | 0 | 0 | 0 | 0 |
| 4. Central Flaherty (24.5%) | 0 | 0 | 0 | 0 | 0 | 0 |
| 5. East Flaherty (42.6%) | 0 | 0 | 0 | 0 | 0 | 0 |
| 6. Tukarak (74.9%) | 23 | 4 | 0.08 | 0.04 | 30.7 | 15.4 |
| 7. Snape (64.5%) | 0 | 0 | 0 | 0 | 0 | 0 |
| 8. Southwest Flaherty (76.1%) | 195 | 0 | 0.47 | 0.20 | 256.4 | 108.8 |
| TOTALS (45.9%) | 218 | 4 | 0.17 | -- | 287.1 | 109.9 |

[a]See Fig. 1 for sampling strata. Sampling proportion is the proportion of the total land area surveyed.

[b]Based on number of reindeer counted within 1.6-km transects.

## DISCUSSION

Within 4 years, the reindeer population on the Belcher Islands increased at least 3.7 times from 60 released in March 1978, to a minimum of 222 in March 1982. Based on the magnitude of the increase, calf production has been high. In May 1978, two months following the release, 22 calves were observed on the islands (Stephenson 1978). No other survey of productivity or frequency of calves has been conducted.

Parker (1981) studied reproductive characteristics of an expanding woodland caribou (R. t. caribou) population in northern Labrador in April 1980. Pregnancy rates for females 22, 34, and 46 months and older were 43, 90 and 95%, respectively in that population. It may be erroneous to extrapolate from that population to Belcher Islands reindeer because of subspecies and habitat differences. However, ignoring these problems, using the Labrador pregnancy rates, and assuming 100% survival and equal sex ratio among calves, the total population estimate would be 292 (Table 2); close to the 287 estimate obtained from our survey.

Leader-Williams (1980) studied the dynamics of three populations of Norwegian reindeer introduced to South Georgia in the south Atlantic. In these populations, the pregnancy rate for yearling and older females was approximately 90%. Leader-Williams did not note any pregnant calves as occurs in some Norwegian reindeer (Reimers 1972). The mortality rate of calves during their first year was about 15% in two of the South Georgia populations; and calf sex ratios were not significantly different from 50 to 50 (Leader-Williams 1980). Again, ignoring possible habitat differences and using the above rates and ratios, plus assuming 100% adult survival, the

Table 2. Possible age and sex of reindeer on the Belcher Islands, NWT from March 1978 to March 1982, based on pregnancy rates for female woodland caribou[a], no mortality and equal sex ratio among calves.

| Date | Number of females by age | | | | Number of Males by Age | | | | Total Number |
|---|---|---|---|---|---|---|---|---|---|
| | Calves | Yearlings | Two-Years Old | Three-Years and older | Calves | Yearlings | Two-Years Old | Three-Years and older | |
| March 1978 | ---- | ---- | ---- | 50 | ---- | ---- | ---- | 10 | 60 |
| March 1979 | 23.8 | ---- | ---- | 50 | 23.8 | ---- | ---- | 10 | 107.6 |
| March 1980 | 23.8 | 23.8 | ---- | 50 | 23.8 | 23.8 | ---- | 10 | 155.2 |
| March 1981 | 28.9 | 23.8 | 23.8 | 50 | 28.9 | 23.8 | 23.8 | 10 | 213.0 |
| March 1982 | 39.6 | 28.9 | 23.8 | 73.8 | 39.6 | 28.9 | 23.8 | 33.8 | 292.2 |

[a] Parker 1981

total population estimate for reindeer on the Belcher Islands would be 257 (Table 3).

Management Concerns and Strategy

The carrying capacity of the Belcher Islands has not been precisely established. Manning (1971) crudely estimated a maximum carrying capacity of 500 caribou, based on comparisons to estimates for Baffin Island and utilization of the entire land area of the Belchers. I suggest a maximum of 1,000 reindeer, which would yield a density of 1 reindeer per 2.8 $km^2$. Edmonds (1979) had insufficient data to estimate carrying capacity from vegetation studies. She suggested that winter range on the Belchers was fair to good when compared to other areas in the arctic. However, the best winter range on the Belchers covers only 8% of the land area.

Local residents have reported that large groups of reindeer have occupied southwestern Flaherty Island during winters from 1980 to 1985. Good winter range in this area is apparently very limited (Edmonds 1979). In the Mackenzie Delta area, NWT, most available forage was utilized in two winters of intensive grazing by reindeer on specific individual sites (Inglis 1975). Such repeated, intensive grazing by reindeer probably also occurs on the Belchers despite differences in habitat and herding practices by humans. The Belchers reindeer are wild, free-ranging animals.If Belchers reindeer do not disperse over a larger area in winter, carrying capacity may be further restricted by the effects of repeated utilization of vegetation in limited areas.

Another concern is winter icing and snow conditions which could exaggerate potential impacts of overutilized range. Winter icing and snow conditions were implicated in the extirpation of native caribou from the

Table 3. Possible age and sex of reindeer on the Belcher Islands, NWT from March 1978 to March 1982, based on pregnancy rates of females (90%), annual calf mortality (15%), and sex ratio of calves (1:1) for Norwegian reindeer introduced onto South Georgia[a], plus 100% adult survival.

| Date | Number of females by age | | | Number of Males by Age | | | Total Number |
|---|---|---|---|---|---|---|---|
| | Calves | Yearlings | Two-Years and older | Calves | Yearlings | Two-Years and older | |
| March 1978 | ---- | ---- | 50 | ---- | ---- | 10 | 60 |
| Summer 1978 | 22.5 | ---- | 50 | 22.5 | ---- | 10 | 105.0 |
| March 1979 | 19.1 | ---- | 50 | 19.1 | ---- | 10 | 98.2 |
| Summer 1979 | 22.5 | 19.1 | 50 | 22.5 | 19.1 | 10 | 143.2 |
| March 1980 | 19.1 | 19.1 | 50 | 19.1 | 19.1 | 10 | 136.4 |
| Summer 1980 | 31.1 | 19.1 | 69.1 | 31.1 | 19.1 | 29.1 | 198.6 |
| March 1981 | 26.4 | 19.1 | 69.1 | 26.4 | 19.1 | 29.1 | 189.2 |
| Summer 1981 | 39.7 | 26.4 | 88.2 | 39.7 | 26.4 | 48.2 | 268.6 |
| March 1982 | 33.7 | 26.4 | 88.2 | 33.7 | 26.4 | 48.2 | 256.6 |

[a]Leader - Williams 1980

Belchers during the late 1800s (Edmonds 1979). Peary caribou (R. t. pearyi) have sustained high mortality and low productivity due to snow cover and groundfast ice in late winter (Miller et al. 1977b). Vibe (1967) implicated fluctuations in Greenland reindeer (R. t. groenlandicus) with changes in winter weather conditions. In 1963-64, a reindeer population on St. Mathew Island in the Bering Sea declined from about 6,000 to less than 50 when reindeer in a poor nutritional state suffered a severe winter (Klein 1968). In 1963, the reindeer population on St. Mathew Island showed signs of deterioration through reduced calf survival, reduced adult body weight, and reduced proportions of calves and yearlings. Range vegetation was significantly altered after the population increased from 29 animals introduced in 1944. Klein (1968) concluded that range condition, complicated by climatic factors, was the dominant factor regulating the St. Mathew Island reindeer population.

Wolves and disease are two factors which may become management concerns in the Belchers in the future. In the winter 1983-84, a Sanikiluaq hunter harvested the first wolf seen on the Belcher Islands since 1932 (Sam Qavvik pers. comm.). Quite a few wolves were sighted, and sometimes trapped accidentally in fox traps, by local residents during 1920-26 and 1930-32. The wolf shot near Wiegand Island in February 1984 had seal fat in its feces and vomit. There was no indication of reindeer in its stomach. In terms of disease, Sanikiluaq hunters have reported symptoms in some reindeer which suggest foot rot. I saw no evidence of any disease among 15 harvested reindeer which were examined in January 1984.

To provide advice for harvesting, I have used a model based on the pregnancy rates, calf mortality rates and calf sex ratios found by Leader-

Williams in South Georgia reindeer (Table 4). The model assumes 100% adult survival, except for known numbers of harvested reindeer, and reindeer found dead by other causes. Only 4 reindeer have been found dead. One adult male was found dead from unknown causes in September 1979. Three adults have been found dead with antlers tangled in fencing material; one in fall 1981 and two in winter 1983-84.

The assumptions of this model have not been verified with hard data. Adult mortality may increase, especially among the original 60 reindeer, in the next few years as the population ages. Productivity and calf survival have not been verified. Local hunters have suggested that calves may be pregnant and producing young at one year of age. Hunters have not reported any calf mortality on the islands, although this could go undetected due to consumption of carcasses by foxes and other scavengers. The current model and management scheme may not be applicable if the assumptions are inaccurate.

The residents of Sanikiluaq actually own the reindeer. Since the transplant in 1978, the Weasels HTA has sought advice about the harvest of their reindeer from the Department of Renewable Resources. Based on this advice, the reindeer were not harvested until January 1983 when they took six males and two females. In January 1984, the Weasels HTA approved a harvesting scheme whereby 50% of the estimated number of yearlings would be harvested annually. The harvesting scheme's objectives are: to allow the population to increase, to provide meat for the community, and to reduce the rate of population increase so that the population's condition and the range's carrying capacity may be determined before that capacity is surpassed.

Table 4. Modelling of the sex and age of reindeer on the Belcher Islands, NWT from March 1982 to March 1985, based on assumed pregnancy rates of females (90%), annual calf mortality (15%), sex ratio of calves (1:1), and 100% adult survival, except for adults known to have died.

| Date | Number of females by age | | | Number of Males by Age | | | Total Number |
|---|---|---|---|---|---|---|---|
| | Calves | Yearlings | Two-Years and older | Calves | Yearlings | Two-Years and older | |
| March 1982 | 33.7 | 26.4 | 88.2 | 33.7 | 26.4 | 46.2[a] | 254.6 |
| Summer 1982 | 51.6 | 33.7 | 114.6 | 51.6 | 33.7 | 72.6 | 357.8 |
| March 1983 | 43.9 | 33.7 | 112.6[b] | 43.9 | 32.7[b] | 67.6[b] | 334.4 |
| Summer 1983 | 65.8 | 43.9 | 146.3 | 65.8 | 43.9 | 100.3 | 466.0 |
| March 1984 | 55.9 | 42.9[c] | 124.3[c] | 55.9 | 41.9[c] | 91.3[c] | 412.2 |
| Summer 1984 | 75.2 | 55.9 | 167.2 | 75.2 | 55.9 | 133.2 | 562.6 |
| March 1985 | 63.9 | 55.9 | 142.2[d] | 63.9 | 55.9 | 108.2 | 490.0 |

[a] Less than Table 2 because: 1 found dead in September 1979, and 1 adult found dead in fall 1982 (assumed to be a male.)

[b] January 1983 harvest: 2 adult females, 1 yearling male, and 5 adult males.

[c] January and March 1984 harvests: 1 yearling female, 21 adult female, 2 yearling males, and 8 adult males. Also during winter 1983-84, 2 adults found dead -- assumed 1 adult male and 1 adult female.

[d] Assumes suggested harvest taken in winter 1984-85: 25 adult females and 25 adult males.

## RECOMMENDATIONS

If the reindeer population on the Belcher Islands is to be well-managed and to provide a sustainable yield, the following studies will have to be conducted:

1. Detailed range studies to determine carrying capacity and the impact of grazing on range condition;
2. Ground surveys during early summer and late winter to determine the age and sex composition of the population so as to estimate productivity and recruitment rates;
3. Monitoring of the physical, reproductive and disease status, and food habits of the population through measurements of, and specimen collections from, animals harvested by hunters;
4. Modelling of population growth using data from the above studies to recommend annual harvest yields; and
5. Aerial surveys every 5 years to estimate population size and distribution during late winter so as to verify the population modelling.

ACKNOWLEDGEMENTS

I gratefully acknowledge the field assistance of P. Kraft who acted as survey observer and L. Buckmaster, pilot, Landa Aviation. A. Ippak of the Weasels HTA acted as observer-navigator. P. Kilabuk led six members of the Weasels HTA in an attempt to classify the reindeer by sex and age. I also thank P. Kraft, R. Graf, and D. Heard for their comments on the manuscript.

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