

THE HUNTING ECOLOGY OF ARCTIC FOXES (Alopex lagopus)  
NEAR CAPE CHURCHILL, MANITOBA

BY

JAMES BAHR

A Thesis Submitted to the Faculty of Graduate Studies  
in Partial Fulfillment of the Requirements  
for the Degree of

MASTER OF SCIENCE

Department of Zoology  
University of Manitoba  
Winnipeg, Manitoba

© September, 1989

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## The Hunting Ecology of Arctic Foxes (Alopex lagopus)

Near Cape Churchill, Manitoba

**Abstract:** Several aspects of arctic fox hunting ecology were studied during the summers of 1985 and 1986. Pup development was observed at one den during the summer of 1985.

Pup development was observed on an ad libitum basis. The pups' rapid behavioural maturation closely paralleled their rapid physical growth. As the pups matured, their responses to stimuli, their repertoire of behaviours and vocalizations, and their activity patterns changed. The pups expanded their repertoire of physical maneuvers as their strength and coordination increased. Physical and behavioural developments led to a maturation of predatory behaviours and skills of self preservation.

The hunting ecology and food habits of adult arctic foxes were studied by following male foxes on hunts. Foxes hunted along similar routes each day but did not hunt in the same area twice consecutively. Foxes covered the greatest proportion of their distance and made the greatest proportion of their kills in the habitat that probably harboured the highest prey densities. They used their entire home ranges in June and July even when most Canada geese (Branta canadensis) and snow geese (Chen caerulescens) were concentrated in specific areas after late June.

The foxes travelled at an average rate of 5.3 km/h and could cover 25 km or more during a day of hunting. When lemmings (Dicrostonyx groenlandicus) were abundant during 1985, the foxes averaged more attacks, kills and meals per time and per distance than in 1986 when lemmings were less abundant. Overall, the foxes were successful in 87% of capture attempts for lemmings, in 64% of attempts for defended goose nests and in all attempts on shorebird, duck, passerine and ptarmigan nests.

In 1985, lemmings accounted for the majority of the adult foxes' diet before goose hatch. Passerine clutches made up most of the remainder and the foxes rarely ate cached food during hunts. In 1986, shorebird eggs and eggs from caches accounted for the majority of the foxes' diet. After goose hatch in both years, goslings and adult geese became important food items but the foxes did not abandon the food sources they utilized before hatch.

## Acknowledgements

I wish to acknowledge the guidance and support of my advisors, Dr. R.R. Riewe, Dr. W.O. Pruitt and Dr. M. Shoemith. The Northern Studies Committee provided funding for this research, and the Wildlife Branch of the Manitoba Department of Natural Resources provided logistical support.

I wish to thank Dr. D. Rusch, Murray Gillespie, Dr. R.M. Evans, Dr. S. Sealy and Dr. R.A. MacArthur for their help and advice during this project, T. Sveinsson for translations, Colleen Nelson for identifying waterfowl feet, and Ernie Welburn and Mike Conrad for assistance in the field.

I also wish to thank Shawn and Donna Coughlin, Tom Laurion and Kathy Firchow, Dan Grout and Henry Bird for their friendship and happy memories.

Lastly, I would like to express my appreciation for my brother, Stephen, who tolerated me patiently when I commandeered his drafting equipment and who provided me with a seemingly endless supply of velum, for my sister, Valerie, who baked cookies and cakes with full knowledge that most of them would end up in my stomach but she baked them anyway, and for my parents, for whom no expression is adequate other than I love them.

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## INTRODUCTION

Arctic foxes (Alopex lagopus) are opportunistic predators and scavengers that will utilize any food source (Garrott and Eberhardt 1987). During the summer, their food habits reflect the availability of the prey species within their home ranges (Chesemore 1968, Fine 1980, Hersteinsson 1984) and their activity cycles and patterns of habitat use may be influenced by the activity patterns and locations of prey (Speller 1972, West and Rudd 1983).

Along the west coast of Hudson Bay near Cape Churchill, Manitoba, numerous sandy beach ridges provide abundant den habitat for arctic foxes. The adjoining peat lowlands strewn with lakes and ponds harbour a variety of prey: lemmings (Dicrostonyx groenlandicus), Canada geese (Branta canadensis), willow ptarmigan (Lagopus lagopus) and several species of shorebirds, eg. dunlin (Calidris alpina) and semipalmated sandpiper (Calidris pusilla), ducks, eg. oldsquaw (Clangula hyemalis) and ground-nesting passerines, eg. Lapland longspur (Calcarius lapponicus).

Though lemming populations fluctuate between years, the variety of avian species contributes to a relatively stable supply of avian prey from year to year. Within years, the goose populations and distributions within the study area change from a scattered population of nesting Canada geese (Branta canadensis) (D. Rusch pers. comm.) before hatch to a more concentrated and larger population of both Canada geese and snow geese (Chen caerulescens) after hatch. As the Canada geese and goslings move to gosling-rearing areas along the sea coast, they are joined by several thousand snow geese and goslings from La Perouse Bay, about 8 km WNW of the study area.

The density of nesting Canada geese in the study area has been declining through the last two decades. Hypotheses concerning the effects of researcher disturbance and competition with increasing numbers of snow geese in the established brood-rearing areas are under consideration. Also, the impact of arctic foxes on the Canada goose population is unknown.

The objectives of this project were to:

- 1) examine the arctic foxes' hunting ecology and food habits.
- 2) estimate the foxes' impact on the local Canada goose population.
- 3) examine goose defenses to fox predation.
- 4) observe the growth and development of the fox pups.

## THE STUDY AREA

### Location

The study area is near Cape Churchill, Manitoba along the west coast of Hudson Bay, from 58°35'50" to 58°43'55" North Latitude and from 93°8'12" to 93°15'36" West Longitude. The UTM grid references for the four corners of the study area are 850950, 850100, 920950 and 920100. These boundaries encompass an area of about 105 sq.km of which roughly 19% are shallow lakes and ponds. There are 15 known arctic fox dens and one known red fox den in the study area (Fig. 1).

### Geology

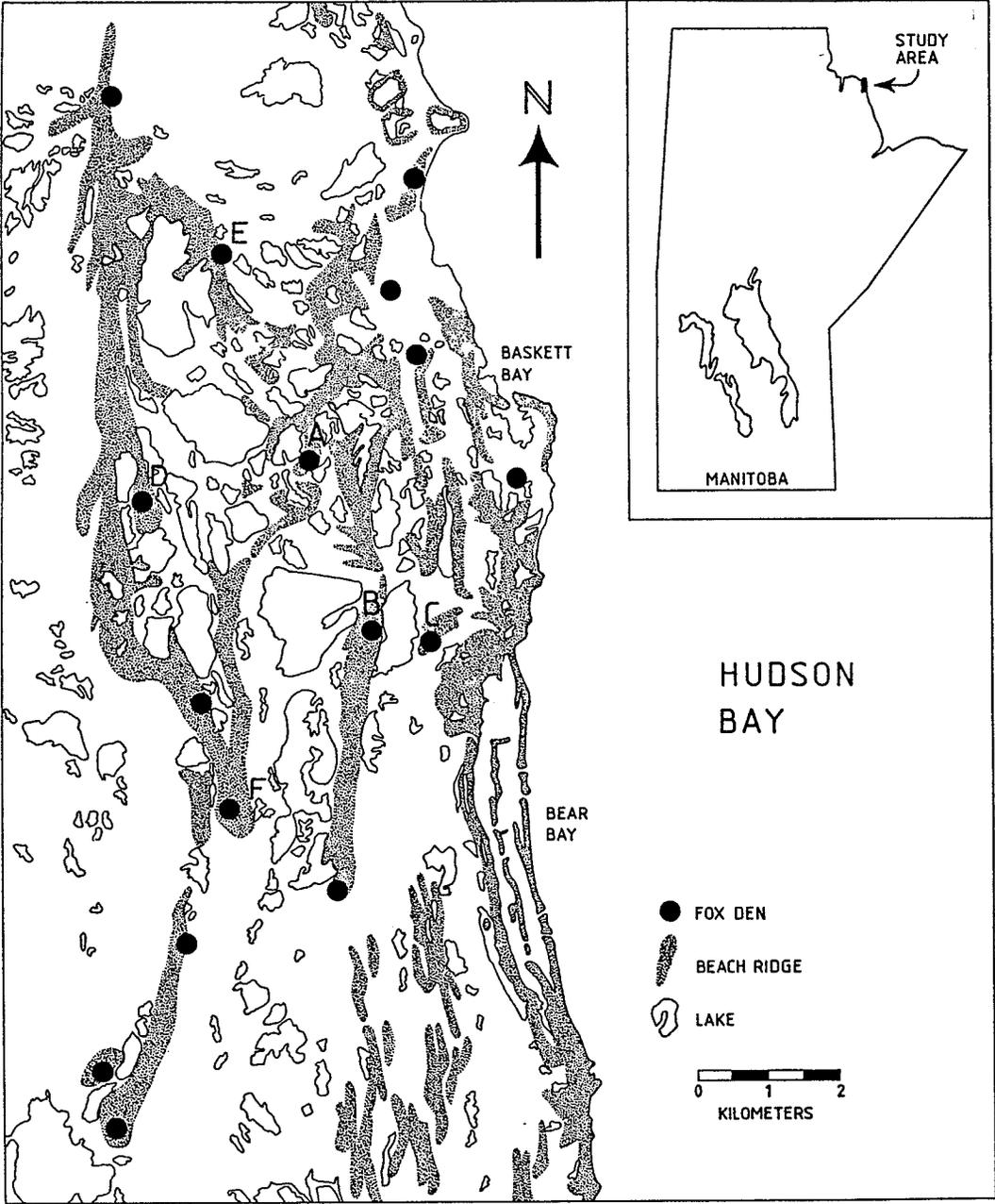
Precambrian age granite and gneiss of the Canadian Shield surround Hudson Bay. Along the southwestern coast of the Bay, including Cape Churchill, these Precambrian rocks are overlain by undeformed lower Palaeozoic age limestone and siltstone sediments of marine origin (Whitmore and Liberty 1968).

During glaciation in the Pleistocene, the Laurentide ice sheet approximately centered on Hudson Bay and depressed the region under its weight. During deglaciation, Atlantic water penetrated into the Hudson Bay area and formed the Tyrrell Sea. Isostatic rebound of the land upon reduction of the ice load caused the Tyrrell Sea to recede, exposed a border of postglacial marine sediments 50-150 km wide, and formed countless beach ridges and strand lines around present day Hudson Bay (Lee 1968, Innes et al 1968).

### Physiography

The study area contains many north-south oriented sand or gravel beach ridges separated by peaty lowerlying areas strewn with shallow lakes and ponds.

Figure 1. The study area near Cape Churchill. Camp (Nestor 1) was about 250 m northwest of Den B. Dens A,B,D and F were the object of study in 1985 while dens A,C,D and E were the object of study in 1986. The main brood-rearing areas were at Bear Bay and Baskett Bay.



Drainage patterns are immature and drainage is poor. The permafrost is continuous and it lies from 30-50 cm below the surface in the low, wet tundra (Ritchie 1960). The permafrost lies farther below the surface under beach ridges, along rivers and in tidal areas along the coast (Johnson 1987).

About 10% of the study area is more than 15 m above sea level, while 60% is between 7.5 and 15 m, and 30% is below 7.5 m in elevation. The area of greatest elevation occurs as a continuous region from the west-central to the northwestern portions of the study area. The area of lowest elevation occurs as a strip along the Hudson Bay coast.

The eastern border of the study area is the shore of Hudson Bay, which consists of sand or gravel beaches with some scattered boulders, and extensive mud flats at low tide. The western border of the study area lies just inland of the western limit of the beach ridges. The physiographic features of the study area continue beyond the northern and southern borders of the area.

Permanent lakes are often surrounded by peat pressure ridges formed by the outward expansion of ice as the lake freezes in autumn. Lakeshores are irregular and they often exhibit several points as well as islands. A few raised peat polygons occur on the wet tundra.

### Climate

Hudson Bay has a strong climatic influence on the surrounding coastline. The cooling influence of the Bay delays the onset of spring and produces cool summer temperatures. Autumn temperatures are moderated though the influence is more evident east of the Bay due to the prevailing northwest winds during that season. Winters along the coast are generally colder than those in other areas at the same latitude. However, temperature extremes are infrequent compared to inland areas due

to heat transfer from the water to the air at ice leads and through the ice on the Bay (Thompson 1968, Savile 1968).

The Environment Canada weather station at the Churchill airport, about 50 km west of the study area, reports the following climate data:

The mean annual temperature is  $-7.2^{\circ}\text{C}$ . July is the warmest month (mean =  $11.8^{\circ}\text{C}$ ) and January is the coldest (mean =  $-27.3^{\circ}\text{C}$ ). The vegetative season extends from about the last week in June to mid-August, although frost can occur in any month (K. Johnson, pers. comm.).

The mean annual precipitation is 40.6 cm. Most precipitation falls between July and September while the least falls between January and March. The mean annual rainfall is 23.3 cm with the most falling in August (mean = 6 cm). Fog occurs on average 7 days per month from May to August. The mean annual snowfall is 185.3 cm with the most falling in November (mean = 40 cm). The greatest cover thickness occurs in March (mean = 47 cm). The average duration of persistent snowcover is 211 days and extends from late October to late May.

Windspeed is fairly constant throughout the year but the average maximum occurs in November (mean = 25.6 km/h) and the average minimum occurs in July (mean = 19.3 km/h). The prevailing winds are northerly during the summer, westerly during the winter and northwesterly during the spring and autumn.

### Human Habitation

The prehistoric presence of aboriginal peoples along the Hudson Bay coast from Cape Churchill to Cape Tatnam has not been verified, probably due only to a lack of investigation (Trudeau 1968). Taylor (1968) speculates that Indian hunters were transient in this area. A Pre-Dorset archaeological site near Shamattawa, and several Pre-Dorset, Dorset and Thule sites north and west of Churchill (Riewe et al

1989) suggest that Eskimo peoples also travelled this stretch of coastline.

Nowadays, Inuit from Eskimo Point (Riewe et al 1989), Swampy Cree (Trudeau 1968) and citizens of Churchill visit this area to trap and to hunt.

Between 1944 and 1965 the Canadian and U.S. Armies conducted field exercises and equipment trials on Cape Churchill (Johnson 1987, M. Gillespie pers. comm.). Their vehicle tracks and refuse can still be seen on the beach ridges of the study area.

In the late 1960's, the Manitoba Dept. of Natural Resources established a permanent camp (UTM grid reference 890023) in the study area and began long-term research on Canada geese. The Canadian Wildlife Service also bases polar bear research from this camp. The camp (Nestor 1) is active from early June to early August or September, with up to ten people present at any time.

In 1972, Queen's University built a camp (Nestor 2) at La Perouse Bay for long-term snow goose research. This camp is active from late April to mid-August and holds up to 22 people.

During summer and autumn, numerous tourists visit Churchill and the Cape Churchill area to observe the local wildlife, especially birds and polar bears.

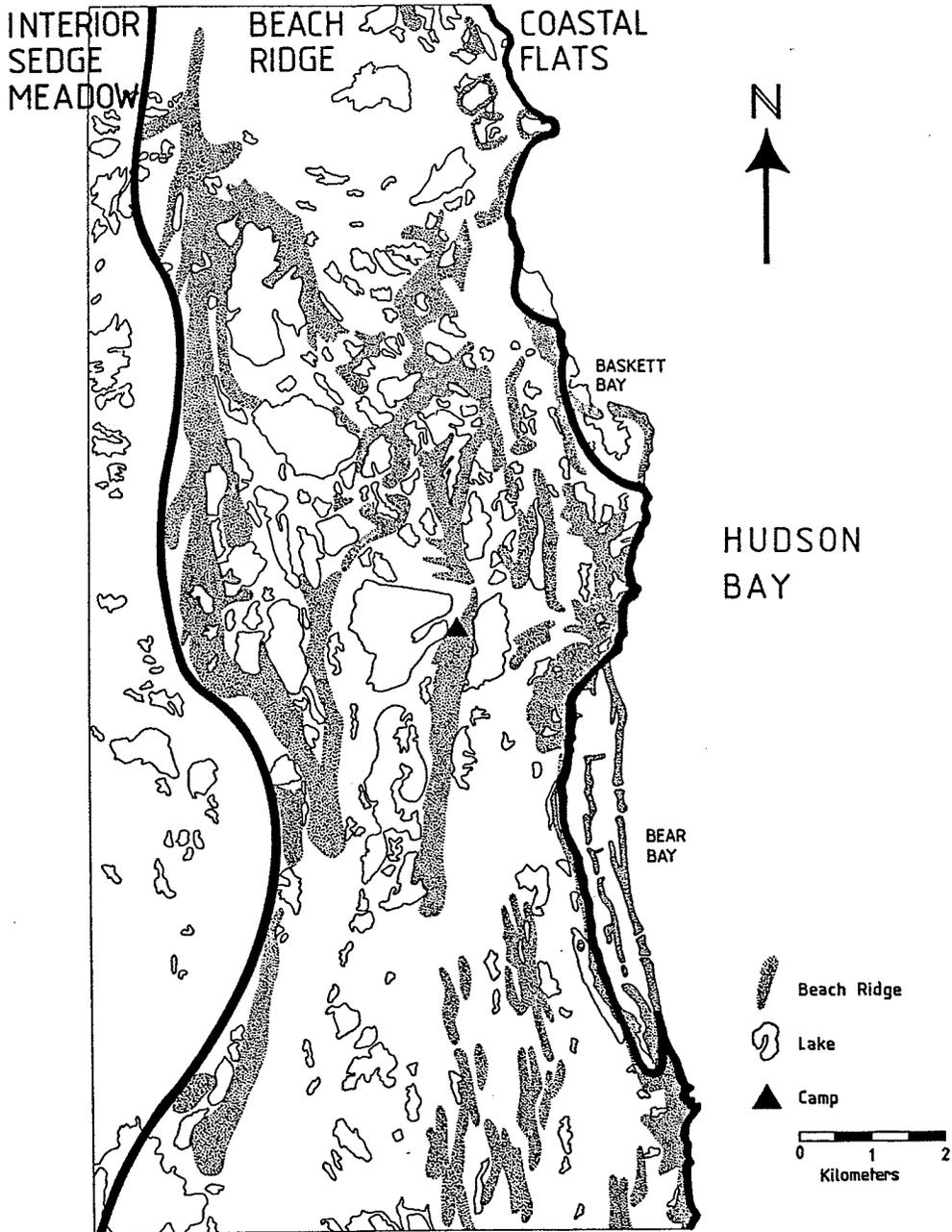
### Vegetation

Didiuk (1979), Johnson (1987) and Ritchie (1960) describe the habitats and vegetation of Cape Churchill. In the study area, the three physiographic regions (Fig.2) and some of their flora are:

#### 1) Coastal Flats

This area consists of coastal saline sedge and grass meadows that grade into tidally flooded mud, sand and boulders. In the study area, coastal beach ridges separate the meadows. To the south, however, the meadows form an almost continuous strip (average width = 0.5 km) along the coast to the mouth of the Broad River. The

Figure 2. The physiographic regions of the study area. The solid lines indicate the boundaries of the three regions (after Didiuk 1979).



soil in the meadows consists of a thin organic layer overlying marine alluvium (Didiuk 1979). Some typical plants of the saline meadows are (Johnson 1987, Didiuk 1979):

Triglochin maritima

Calamagrostis deschampsoides

Dupontia fisheri

Puccinellia phryganodes

Carex subspathecea

Ranunculus cymbalaria

## 2) Beach Ridge Area

This area is a mosaic of beach ridges, peat lowlands and lakes. A variety of plant communities exist and intergrade according largely to the moisture regime (Johnson 1987). The two major habitats in this area are:

a) Beach Ridges: These ridges are relic sand and gravel beaches left high and dry as isostatic rebound of the land (about 1 m/century) causes the Hudson Bay shoreline to recede (Johnson 1987, Lee 1968). The ridges have a xeric to well-drained moisture regime and have a deeper permafrost table than the adjoining peat lowlands (Johnson 1987). The vegetation on the ridges is a low-growing lichen-heath community. Typical plant species are (Johnson 1987):

Polygonum viviparum

Saxifraga oppositifolia

Dryas integrifolia

Hedysarum mackenzii

Shepherdia canadensis

Arctostaphylos alpina

Rhododendron lapponicum

Achillea nigrescens

Beach ridges along the coast have been exposed more recently than ridges farther inland and thus support a community of colonizing plants such as:

Trisetum spicatum

Elymus arenarius

Festuca brachyphylla

Potentilla pulchella

Potentilla multifida

Epilobium angustifolium

Androsace septentrionalis

Castilleja raupii

Matricaria ambigua

b) Peat Lowlands: In the low-lying areas surrounding the beach ridges, the marine alluvium is covered with a layer of peat (depth < 1 m). A high permafrost table and poor drainage cause the formation of treeless bogs strewn with lakes, ponds and areas of standing water. Distinct plant communities exist but they intergrade to form many intermediate types (Ritchie 1960, Speller 1972, Johnson 1987). Typical plant species in the peat lowlands are (Ritchie 1960, Johnson 1987):

Sphagnum sp.

Carex aquatilis

Carex gynocrates

Carex rariflora

Saxifraga hirculus

Rubus chamaemorus

Andromeda polifolia

Kalmia polifolia

Ledum decumbens

Pedicularis sudetica

Pedicularis flammea

Bartsia alpina

Pinguicula vulgaris

Low, narrow peat ridges occur along the edges of many lakes and ponds in the peat lowlands. These ridges are better drained than the surrounding area. Some typical plant species found on the pressure ridges are (Johnson 1987):

Salix myrtilifolia

Salix lanata

Myrica gale

Betula glandulosa

Anemone richardsonii

Pyrola grandiflora

### 3) Interior Sedge Meadow

This area is a peat lowland to the west of the Beach Ridge Area. The Interior Sedge Meadow contains both lake systems and extensive peat bogs devoid of water bodies. There are few upland features (Didiuk 1979). In the study area, the plant species of the Interior Sedge Meadow are the same as those found in the peat lowlands, but farther inland, stunted Picea mariana occur (Ritchie 1960, Didiuk 1979).

## HUNTING ECOLOGY

### Methods and Materials

My original plan for data collection on this study was to observe hunting foxes from a stationary vantage point as Speller (1972) had done but the topography and vegetation of the study area allowed for only brief observations of foxes followed by long periods of scanning. I soon learned that I could follow male foxes on hunts and gather the desired data with no apparent disturbance to the foxes; therefore, I abandoned the original plan early in the 1985 field season.

I followed foxes on hunts during the summers of 1985 and 1986. In both years, data were gathered on the adult males of two dens. In 1986, I attempted to gather data on the male of a third den but that fox proved unsuitable after several unsuccessful attempts at habituation. Female foxes were not followed on hunts since they were always disturbed by my presence.

Hunts began when the fox left the den or when I contacted a fox in the field. Hunts ended when the fox returned to the den, took a nap or when I lost contact with the fox. During hunts I trailed from 70-120 m behind the fox though in 1986 I often exceeded these distances as I tried to take advantage of topographic features to minimize my disturbance of geese. Observations were made with the naked eye or with a 20X spotting scope mounted on a home-made rifle stock. During 1985, observations were concentrated on type of prey, capture success rate and the fate of captured items. In 1986 the same data were gathered with the addition of hunting routes and the time and distance between capture attempts. All observations were recorded in a note book in 1985 and on data sheets and 1:50,000 maps in 1986.

This method was not without drawbacks. The only reliable way to make contact with a fox was to wait at a den until the fox arrived then follow the fox as it

departed. Also, the frequency of lost contacts was high (66% overall). These constraints resulted in an inefficient use of field time that could have been eliminated with the use of mobile radio telemetry equipment. There were no funds for such equipment. In its absence, the method used was the only one feasible.

Besides following foxes on hunts in 1986, I observed a goose brood-rearing area from an observation tower in an attempt to gather data on the foxes' attack success rate on geese and goslings. The geese were extremely wary and mobile after hatch and such data were difficult to obtain on hunts since my presence was alarming to the geese. However, the few days spent in the tower were not productive so the procedure was abandoned.

### Results and Discussion

Table 1 and Figure 3 summarize the basic hunt observation data. In 1985 I stopped gathering hunt data after 1 July in part so that I could observe the pups' diet but also because my presence on hunts after goose hatch in late June would be disruptive to the foxes' efforts to capture geese. In 1986, hunt data after goose hatch were considered necessary so I observed hunts in July.

During June of 1985 the male foxes returned to their dens reliably during the day so I was able to observe many hunts during that month. In 1986, however, the male foxes were much less regular in their visits to their dens. There were many days when they did not return to the den at all during the daylight hours. The reasons for this were unclear. They may be related to a nocturnal activity pattern observed by Speller (1972) and Burgess (1984) where the adult fox rests somewhere other than the den (Burgess 1984). Garrott et al (1984) stated that adult foxes seldom visited the den during midday. The reasons may also be related to the bringing of food to the den. Macpherson (1969) and MacFarlane (1908) saw that arctic foxes cached large

Table 1. A summary of observation time and distance covered for hunts near Cape Churchill in 1985 and 1986.

	<u>1985</u>	<u>1986</u>
Observation period	5 June - 1 July	9 June - 24 July
Number of hunts observed	22	16
Average duration of hunts (min.)	77	67
Range of hunt duration (min.)	15-220	15-180
Total time of hunt observations (min.)	1690	1070
Average distance of hunts (m)		.5500
Range of hunt distance (m)		1000-11,100
Total distance of hunt observations (m)		88,050

Figure 3. Basic hunt observation data for hunts observed near Cape Churchill in 1985 and 1986. Distance data were not recorded in 1985.

