# ABUNDANCE AND SUMMER OCCUPANCY OF ARCTIC FOX DENS IN NORTHERN YUKON TERRITORY 1984-1988

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March 1989

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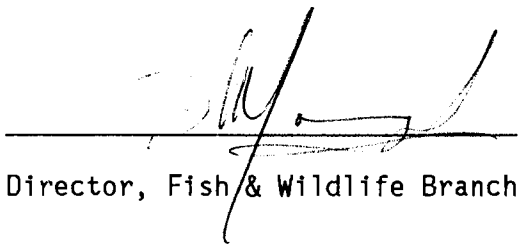

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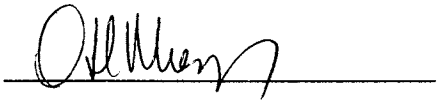

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**ACKNOWLEDGEMENTS**

The study was funded by the Northern Oil and Gas Action Program (NOGAP) (1984 and 1985) the Lands, Parks and Resources Branch, Yukon Department of Renewable Resources (1986 survey) and the Yukon Wildlife Management Program of the Inuvialuit Final Agreement (IFA) (1987 and 1988 surveys), with field support provided by Polar Continental Shelf Project (1987 and 1988). We thank Parks Canada and the Yukon Lands, Parks, and Resources Branch for allowing us to work in Northern Yukon National Park and Herschel Island Territorial Park respectively. Our gratitude is also expressed to H. Jessup, A. Bear, J. Snyder, and M. Waterreus for their assistance in the aerial surveys and to a number of other people who provided support in the field in various ways. They are, F. Mueller, D. Talarico, R. Ward, P. Lortie, C. Smith, C. Kennedy, K. McKenna, D. Murray, A. Hargrave, W. Nixon, J. Hunston, D. Ladret, and G. Baird. The cooperation of A. Kulas, R. Thomson, and H. Morrison of Department of National Defense, Ottawa and of Felec Services Inc., Winnipeg are greatly appreciated. Brian Dougherty of Kenn Borek Air, and Mike Korney and E. Neil of Associated Helicopters skillfully flew the helicopters. D. Milne typed the manuscript while D. Mossop critically read the manuscript.

**ABSTRACT**

Presented is an update of information collected during aerial surveys and monitoring flights of arctic fox (Alopex lagopus) dens on Herschel Island and the Yukon Coastal Plain, 1984-1988.

During a preliminary survey in 1984, 14 dens were identified on Herschel Island. Additional dens were found in subsequent years during monitoring flights and a complete survey. A total of 33 dens were known to exist on Herschel Island in 1988. It is considered unlikely that any dens remaining undetected are natal. During 1984-1987 two natal arctic fox dens were observed each year on Herschel Island, while one natal red fox den was observed in both 1984 and 1985. In 1988 seven arctic fox dens and one red fox den were identified as natal. A comparison of occupancy rates of dens by fox litters was complicated by the fact that dens located in earlier years were generally larger and therefore more likely to be natal. When occupancy rates are compared between 1986, 1987, and 1988, when the same dens were sampled, proportions of natal arctic fox dens were substantially higher in 1988 (18.8%) than in both 1986 (6.3%) and in 1987 (6.3%). A comparison of occupancy rates of arctic fox dens between all years during 1984-1988 was only done with dens known in 1984 and showed that the difference between those was not significant.

On the Yukon coastal Plain, 32 dens were identified during a preliminary survey in 1984, while an aerial stratified random block sampling census in 1987 yielded a total estimate of 50 dens ($\pm$ 13, P=0.90). It is considered unlikely that few, if any, natal dens have been missed on the Yukon Coastal Plain within

the study area. One natal arctic fox den was observed during each of 1985 and 1988, while red fox natal dens were observed 1985 (1), 1987 (1, probably), and 1988 (1). There was no significant difference in occupancy rates between years for arctic foxes or red foxes on the Yukon Coastal Plain. Twenty arctic fox pups are known to have been produced on Herschel Island in 1988; litter size varied from four to seven.

Herschel Island is shown to produce one of the highest numbers of natal dens per unit area reported, whereas the Yukon Coastal Plain produces the lowest number reported. Information currently available suggests that Herschel Island is the primary arctic fox producing area in Yukon Territory. The clumped distribution of the population's breeding component increases the vulnerability of the population as a whole to harvest and human disturbance.

## INTRODUCTION

Arctic foxes (Alopex lagopus) are dependent upon dens for rearing their young. Individual dens have been estimated to be active for up to 300 years, often being enlarged, with additional entrances in successive years, until they deteriorate through natural processes (Macpherson, 1969).

In northern Yukon Territory, aerial surveys to determine abundance and summer occupancy of arctic fox dens have been performed yearly from 1984-1988 (Smits and Jessup 1985; Slough and Ward 1987; Smits and Slough 1987). The purpose of these activities has been to collect baseline information necessary for the management of the species from both habitat management and population management perspectives. Additionally, this information was deemed to facilitate the development of non-consumptive uses of the arctic fox resource. This report presents progress to date on the abundance and breeding status of arctic fox dens on the Yukon Coastal Plain west of the Babbage and Crow Rivers, and on Herschel Island.

## STUDY AREA

The study area includes Herschel Island (101 $km^2$) and the Yukon Coastal Plain west of the Babbage and Crow Rivers (2,440 $km^2$) (Fig. 1). A description of the physiography, climate, and vegetation has been presented in Smits *et al.* (1988).

## METHODS

Dens in the study area have been identified using several methods. These include: a systematic transect census, July 1984; incidental observations during relocation flights, July 1985 (Smits and Jessup, 1985) and July 1986 (Slough and Ward, 1987); an aerial stratified random block sampling census, July 1987 (Smits and Slough, 1987), and observations incidental to field activities on the ground, July 1985, 1986, and 1987. Each July during 1984-1988 all known dens were ground checked for occupancy, with the exception of 1986 when no dens were checked on the Yukon Coastal Plain. During aerial searches, dens were relocated using their plotted locations on 1:250,000 (Yukon Coastal Plain) or 1:50,000 (Herschel Island) topographical maps. In 1988 aerial relocation of dens was greatly facilitated by aerial colour photographs of den sites which were taken during previous surveys. Dens were re-located from a Bell 206 Jet Ranger B helicopter by one or two observers. Dens located from the air were ground checked to determine their occupancy status by the presence of fox scats, tracks, prey remains, and /or the presence of foxes. Dens were classified as natal if juvenile foxes were sighted, if small tracks or faeces were present, or if the sound of characteristic juvenile barks were heard from within the den. In July 1988 juvenile foxes were live-trapped and ear-tagged at natal dens on Herschel Island. The purpose of this was to enable identification of foxes harvested in the arctic as part of an investigation to determine their seasonal distribution. These capture activities also allowed a more accurate estimate of litter size at natal dens. From three to six traps (Tomahawk single-door collapsible live traps, National Live Trap Co., Tomahawk, WI, USA, size 23 x 23 x 43 cm) were placed in front of burrow entrances of natal dens. Bait used was fish. Captured foxes were run into a sack, ear-tagged with numbered metal tags (style 1005 monel, size 1, National Band

and Tag Co., Newport KY, USA), sexed, weighed and released at the capture location.

## RESULTS AND DISCUSSION

### Den Abundance and Summer Occupancy

#### Herschel Island

Fourteen dens were identified during a systematic aerial transect survey by helicopter on Herschel Island in 1984 (Table 1; Table 2). Five additional dens were found in 1985 while checking previously identified dens for occupancy. In 1986 an intensive aerial transect survey by helicopter yielded an additional 17 dens while three dens collapsed between the summers of 1985 and 1986 (Slough and Ward, 1987). In both 1987 and 1988 only one previously unknown den was found suggesting that probably no dens remain undetected. A total of 33 dens were known to exist on Herschel Island in 1988. When we compare the size of dens found in a recent survey (1986) with the size of those found in earlier years (before 1986), dens detected in 1986 were significantly smaller than dens located before 1986 (Table 3). Since non-natal dens are also significantly smaller than natal dens (Table 4), this suggests that any dens remaining undetected are likely small and probably non-natal. Furthermore, since arctic foxes frequently use multiple dens simultaneously to raise their litter (Eberhardt et al, 1983), we consider it very unlikely that any litters or evidence thereof were (was) missed during the aerial surveys of 1986, 1987, and 1988.

During the years 1984 through 1987 two natal arctic fox dens were observed each year on Herschel Island, while one natal red fox den was observed in addition to this in both 1984 and 1985 (Table 2). By contrast, seven arctic fox dens and one red fox den were identified as natal in 1988.

A comparison of the proportion of natal dens between years has to take into account the type (size) of dens known in each year. To get a more realistic approach, we compared occupancy rates for the years 1986, 1987, and 1988 when the same dens were sampled (Table 5; Table 6), excluding no. 58 (collapsed after summer of 1987), and no. 91 (not known in 1986). The proportions of natal dens for this adjusted number (n = 32) of dens are 6.3% (n = 2), 6.3% (n = 2), and 18.8% (n = 6) for 1986, 1987, and 1988, respectively, for arctic fox and 3.1% (n = 1) for red fox in 1988 (Table 5). In 1988 den no. 47 and no. 61 were used by the same arctic fox litter. Additional simultaneous use of dens by other litters may have occurred and would have caused apparent occupancy rates to be greater than the actual rates. However, we consider this unlikely in view of the distance between natal dens (Figures 2a, 2b, 2c, 2d, and 2e). Eberhardt et al. (1983) report an average distance between natal and successive dens of 2.2 $\pm$ 0.7 km in northern Alaska. One den produced fox litters during three seasons, four dens during two seasons, nine dens during one season, while 23 dens did not produce fox litters during the period of study (Fig. 2).

Although den occupancy rates by arctic fox litters were obviously higher in 1988 relative to 1986 and 1987 (Table 6) it is less clear how the 1988 occupancy rate compares with those of 1984 and 1985 when far fewer dens were known. A realistic comparison would be to compare the occupancy rates of dens known in 1984 between the years 1984 through 1988 (Table 7; Table 8). Occupancy rates of arctic foxes were highest during 1988 and lowest in 1986; however, the difference in the occupancy rates between those years wasn't significant ($X^2$ = 2.59, d.f. = 4, p>0.50).

It is too early to know if 1988 is the 'high' year in what may be a cyclic variation in breeding by arctic foxes on Herschel Island. Our current knowledge of den abundance should provide a basis for accurate comparison of occupancy rates of dens by fox litters in future years.

**Yukon Coastal Plain**

Thirty-two dens were identified during a systematic (none) aerial transect survey by helicopter on the Yukon Coastal Plain in 1984 (Table 9; Table 10). Three additional dens were found in 1985 while checking previously identified dens for occupancy (Smits and Jessup, 1985). In 1987 an aerial stratified random block sampling census (Smits and Slough, 1987) yielded a total estimate of 50 dens ( $\pm$ 13, P=0.90; calculated as described in Smits and Slough, 1987). Two more dens were located in 1988 while intensively surveying an additional 12 sample blocks (unpubl. data). Although the probability of finding more dens was fairly high, we suspect that few, if any, natal dens on the Yukon Coastal Plain have been missed within the study area. However, the proportion of natal dens among any unobserved dens is likely lower than among the known dens as suggested by a comparison of the size of fox dens known previous to 1987 and those found during more intensive surveys in 1987 and 1988 (Table 11). No active natal dens of either red or arctic fox were observed on the Yukon Coastal Plain during the 1984 survey. One natal arctic fox den was observed during each of 1985 and 1988, while red fox natal dens were observed in 1985 (1), 1987 (1, probably), and 1988 (1). One den produced fox litters during two seasons, three dens produced fox litters once, while 47 dens did not produce fox litters during the period of study (Fig. 3). There was no significant difference in occupancy rates between years for arctic foxes or red foxes on the Yukon Coastal Plain. This holds for both when dens known in 1984 were

compared between years, and when dens known in 1987 (when many additional dens were located relative to 1984-1985) were compared between 1987 and 1988.

## Fox Productivity

Between 1984-1987 observations of pups at natal dens were sporadic and probably not representative of the total numbers of pups present at dens. Observed numbers of pups in arctic fox litters varied from 1 to 4 and in red fox litters from 2-5, during this period (Smits and Jessup, 1985; Slough and Ward, 1987). Capture-recapture and ear-tagging activities in 1988 greatly aided the accurate estimation of litter sizes at natal dens. A total of 20 arctic fox pups (10 female, 10 male) was captured at five dens on Herschel Island during this year (Table 12). Litter size varied from 4 to 7.

## GENERAL DISCUSSION

Assuming that Herschel Island and mainland arctic foxes belong to one population, the disproportionate increase in the number of natal arctic fox dens on Herschel Island relative to the Yukon Coastal Plain suggests that either arctic foxes prefer habitat on Herschel Island over that of the Yukon Coastal Plain for breeding purposes or that arctic foxes tend to breed in the area where they have been produced and that their survival is higher on Herschel Island (the former has been suggested by Eberhardt et al., 1983). This phenomenon raises questions about habitat quality (e.g. prey availability, predator abundance, den suitability) and seasonal distribution that can only be speculated on with the information currently available. In any event, it is clear that Herschel Island contains the most important segment of the arctic fox breeding range in Yukon Territory west of the Babbage and Crow Rivers. It is not yet known whether the number of natal arctic fox dens observed on Herschel Island in 1988 constitutes the maximum number sustainable. Studies of cyclic arctic fox populations have shown periodic highs and lows in the population to occur every three to four years (Braestrup, 1941; Shibanoff, 1951; Macpherson, 1969; Hersteinsson et al., 1989). Under a similar temporal cyclic regime, arctic foxes on Herschel Island should have reached their highest density of breeders in 1988 or possibly not until 1989.

A striking phenomenon was the absence of an increase in red fox breeders relative to arctic fox breeders on Herschel Island . Whatever factors allowed the breeding component of the arctic fox population to increase are not being capitalized on by red foxes. A comparison of proportions of natal dens reported elsewhere suggests that a low proportion of dens on Herschel Island and Yukon Coastal Plain are used for breeding relative to other areas (Table

13). However, such a comparison may not be valid as it is not known if small dens (<5 burrows), unlikely to have been natal dens, have been included in the sample of other studies. A more relevant comparison would involve the number and size of litters produced per unit area, which is also a more appropriate and direct index of habitat productivity. When this index is computed for other areas (Table 13) Herschel Island is shown to produce one of the highest number of natal dens per unit area, whereas the Yukon Coastal Plain produces the lowest number reported.

Many dens that were non-natal during the period of study have been used by foxes in the recent past as evidenced by old sign of foxes at dens (i.e. scats, fur at burrow entrances). Such dens may have been occupied by pairs of foxes early in the breeding season whose litters subsequently failed (Macpherson, 1969) or foxes may have used the dens for shelter from inclement weather. Dens are reportedly frequently used for the latter purpose (Eberhardt et al. 1983).

Since arctic fox pups first emerge from the dens when they are 3-4 weeks old (Garrott et al., 1984), it is not possible to readily obtain information of litter size at birth from arctic foxes in the wild. Weaned litter size estimates on the other hand are more a function of early whelp mortality, which in turn is controlled by food availability, than of the initial size of litters (Macpherson, 1969). Our weaned litter estimates of 3-7 fall within the range reported by other workers (Macpherson, 1969; Østbye et al., 1978; Garrott and Eberhardt, 1987). However, weaned litter sizes have been reported to vary widely between years (Macpherson, 1969; Østbye et al., 1978). Consequently data from several years are required for a more relevant comparison of weaned litter sizes with other regions. Coastal arctic foxes have been reported to

have smaller litters varying less in size between years than inland foxes which has been suggested to be in accordance with a much greater need for fertility of the latter at certain times (i.e. coastal foxes' food resources are more predictable in time and space) (Braestrup, 1941).

No arctic fox dens have been located on the Yukon coastal Plain east of the Babbage and Crow Rivers (Ruttan, 1974; Smits and Jessup, 1985). However, the vegetation in that area is relatively dense and might obscure fox dens. Future survey activities in that area should improve our knowledge regarding distribution and abundance of fox dens and the productivity of foxes here. There are no records of arctic foxes breeding in Yukon Territory further inland than the Yukon Coastal Plain (D. Mossop, D. Russell; pers. comm.). Information currently available therefore suggests that Herschel Island is the primary arctic fox producing area in Yukon Territory. Indeed, all arctic fox litters located on the study area during July 1988 had been produced on Herschel Island. The total number of arctic fox breeders in Yukon Territory appears extremely low; the species may well be one of the rarest mammals breeding in the territory. The clumped distribution of the population's breeding component increases the vulnerability of the population as a whole to harvest and human disturbance.

Trapping at breeding dens during late winter, a practice commonly used as evidenced by the presence of toggles (to which traps are attached) at many dens in northern Yukon Territory (pers. observ.), may have a deleterious influence on the number of fox litters subsequently produced. With many breeding pairs of arctic foxes located in a small area as on Herschel Island it would be more cost/effort-effective for trappers to concentrate their operations in such an

area. This would increase the likelihood for these areas receiving a more consistent and intensive trapping pressure than areas where breeders are more widely dispersed. The potential impact of intensive trapping on Herschel Island as has occurred in the past (Smits and Jessup, 1985) cannot be estimated, but may be substantial (see Smirnov, 1968). Little is known of the effects of human disturbance on foxes at breeding dens other than that foxes may desert disturbed dens to occupy adjacent dens (Eberhardt et al., 1983; Anthony et al., 1985). Such behavior may conceivably result in increased mortality from predation, particularly when displacement from breeding dens occurs at a period during which fox whelps are young and presumably more vulnerable to predation. Disturbance at breeding dens may also have a negative effect on whelp survival through effects of displacement from favourable to less favourable habitat (e.g. lower prey abundance, higher predator abundance). The potential effects of displacement from breeding dens as suggested here are by necessity speculative as this aspect of the effects of human disturbance on arctic fox populations has not been studied.

Our yearly den monitoring has provided important clues as to the significance of certain areas and certain dens to produce arctic foxes. Conservation of arctic fox breeding habitat should be an important aspect of the management of the species. The absence over vast areas of breeding dens and the use of dens for hundreds of years attests to the importance of dens for arctic fox populations and indeed suggests that arctic fox populations may be limited by availability of suitable den sites. The results provide clear evidence of the relevance of replicate den surveys during several successive summers. Surveys during years with few natal dens would not have indicated the relative importance of Herschel Island as an arctic fox producer, nor would they have

highlighted certain dens as primary litter producers. The results also emphasize the significance of Herschel Island as a prime area for non-consumptive use potential of arctic fox. The projected increase of visitors to Herschel Island (D. Talarico, pers. comm.) will soon create a need to develop guidelines preventing human disturbance at den sites.

We propose to continue the yearly monitoring of fox dens until a good understanding of year-to-year variability in productivity of arctic foxes in northern Yukon Territory has been gained. Since harvest levels of arctic fox in the area have been low in the recent past (N.W.T. Wildlife Service files), these surveys would provide information on abundance and productivity under relatively pristine conditions. As such, the effects of any future impact can be more clearly evaluated. We also propose to expand our survey efforts to the eastern Yukon Coastal Plain, an area of which little is known regarding arctic fox breeding density.

**Further activities proposed**

1) a survey of all known fox dens to determine their productivity on Herschel Island (on foot) and Yukon Coastal Plain (by helicopter), July 1989.
2) an aerial survey of part of the eastern Yukon Coastal Plain to determine den abundance and productivity, July 1989.
3) ear-tagging of foxes at breeding dens on Herschel Island, July 1989.

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Table 1. Numbers of natal fox dens identified on Herschel Island during 1984-1988.

| | Number of Dens | | |
|---|---|---|---|
| | | occupied by fox litter (%) | |
| Year | Identified | arctic fox | red fox |
| 1984 | 14 | 2 (14.3) | 1 (7.1) |
| 1985 | 19 | 2 (10.5) | 1 (5.3) |
| 1986 | 33 | 2 (6.1) | 0 (0.0) |
| 1987 | 34 | 2 (5.9) (?) | 0 (0.0) |
| 1988 | 33 | 7 (21.1) | 1 (3.0) |

Table 2. Breeding status* of fox dens identified on Herschel Island, 1984-1988.

| Den Identification Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1984 | 1985 | 1986 | | 1987 | | 1988 | |
| 37 - | 36 - | 36 - | 59 - | 36 - | 59 - | 36 - | 60 Naf |
| 39 - | 37 Naf | 37 Naf | 60 - | 37 - | 60 - | 37 Naf | 61 Naf+ |
| 40 - | 38 - | 38 - | 61 - | 38 - | 61 - | 38 Nrf | 62 - |
| 41 Nrf | 39 - | 39 - | 62 - | 39 - | 62 - | 39 - | 63 - |
| 42 - | 40- | 40 - | 63 - | 40 - | 63 - | 40 Naf | 64 - |
| 44 - | 41 Nrf | 41 - | 64 - | 41 - | 64 - | 41 - | 65 - |
| 45 - | 42** | 42 - | 65 - | 42 - | 65 - | 42 - | 66 - |
| 46 - | 43 | 44 - | 66 - | 44 - | 66 - | 44 Naf | 67 Naf |
| 47 - | 44 - | 45 - | 67 - | 45 - | 67 - | 45 - | 68 - |
| 48 Naf | 45 - | 46 - | 68 - | 46 - | 68 - | 46 - | 69 - |
| 50 - | 46 - | 47 - | 69 - | 47 - | 69 - | 47 Naf+ | 70 - |
| 51 - | 47 - | 48 - | 70 - | 48 - | 70 - | 48 - | 71 - |
| 52 - | 48 - | 50 - | 71 - | 50 Naf? | 71 - | 50 - | 72 - |
| 53 Naf | 49 ** | 51 - | 72 Naf | 51 - | 72 - | 51 - | 91 - |
| | 50 Naf | 52 - | | 52 - | 91 - | 52 - | |
| | 51 - | 53 - | | 53 Naf? | | 53 - | |
| | 52 - | 56 - | | 56 - | | 56 - | |
| | 53 - | 57 - | | 57 - | | 57 - | |
| | 54 ** | 58 - | | 58 ** | | 59 - | |
| Total: | | | | | | | |
| 14 | 19 | 33 | | 34 | | 33 | |
| Natal this year: | | | | | | | |
| 3 | 3 | 2 | | 2 | | 7 | |

* Naf: natal arctic fox den
Nrf: natal red fox den
- : non-natal
** : not functional in following year
+ : same litter

Table 3. A comparison of the size of a sample of fox dens on Herschel Island identified during a 1985 survey and a sample of those identified during a 1986 survey that were not observed in 1985. Natal dens during at least one year during 1984-1988 marked with 'n' ;with arctic fox unless otherwise stated.

| 1985 | | 1986 | |
|---|---|---|---|
| Den # | Number of Burrow Entrances | Den # | Number of Burrow Entrances |
| 37 n | 41 | 56 | 4 |
| 38 n (RF) | 10 | 57 | 2 |
| 39 | 18 | 58 | 1 |
| 40 n | 47 | 60 | 20 |
| 41 n (RF) | 5 | 62 | 2 |
| 42 n (RF) | 32 | 64 | 2 |
| 44 n | 7 | 65 | 3 |
| 45 | 16 | 66 | 8 |
| 47 n | 19 | 67 | 35 |
| 48 n | 29 | 68 | 3 |
| 50 n | 17 | 69 | 1 |
| 51 | 13 | 70 | 1 |
| 52 | 5 | 71 | 1 |
| 53 n | 32 | | |
| Mean | 20.8* | | 7.2* |
| S.D. | 13.4 | | 10.0 |

* Two-sample t-test, t = 2.65, d.f.=26 $p<0.001$

Table 4. A comparison of the size of fox dens on Herschel Island identified as natal dens at least once during 1984-1988, and those not found to be natal during this period.

| Natal Dens | | Non-natal Dens | |
|---|---|---|---|
| Den # | Number of Burrow Entrances | Den # | Number of Burrow Entrances |
| 48 | 29 | 39 | 18 |
| 53 | 32 | 45 | 16 |
| 37 | 41 | 49 | 3 |
| 40 | 47 | 52 | 5 |
| 41 | 5 | 51 | 13 |
| 42 | 32 | 56 | 4 |
| 50 | 17 | 57 | 2 |
| 53 | 32 | 58 | 1 |
| 38 | 10 | 62 | 2 |
| 44 | 7 | 64 | 2 |
| 47 | 19 | 65 | 3 |
| 60 | 20 | 66 | 8 |
| 67 | 35 | 68 | 3 |
| | | 69 | 1 |
| | | 70 | 1 |
| | | 71 | 1 |
| Mean | 25.1 | | 5.2* |
| S.D. | 12.9 | | 5.6 |

* Two-sample t-test, $t = 5.49$, d.f.= 27 $p<0.001$

Table 5. Number of fox dens* identified in 1986, 1987, and 1988 that were occupied by arctic fox litters on Herschel Island.

| Year | No. Examined | No. Containing Litters (%) |
|---|---|---|
| 1986 | 32 | 2 (6) |
| 1987 | 32 | 2 (6) |
| 1988 | 32 | 7 (22) |

* excluding den no.s 58 and 91.

Table 6. Breeding status* of fox dens on Herschel Island identified prior to 1986, during 1986-1988.

| Den# | 1986 | 1987 | 1988 | Den# | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|---|
| 36 | -- | -- | -- | 56 | -- | -- | -- |
| 37 | AF | -- | AF | 57 | -- | -- | -- |
| 38 | -- | -- | RF | 58 | -- | -- | -- |
| 39 | -- | -- | -- | 59 | -- | -- | -- |
| 40 | -- | -- | AF | 60 | -- | -- | AF |
| 41 | -- | -- | -- | 61 | -- | -- | AF |
| 42 | -- | -- | -- | 62 | -- | -- | -- |
| 44 | -- | -- | AF | 63 | -- | -- | -- |
| 45 | -- | -- | -- | 64 | -- | -- | -- |
| 46 | -- | -- | -- | 65 | -- | -- | -- |
| 47 | -- | -- | AF | 66 | -- | -- | -- |
| 48 | -- | -- | -- | 67 | -- | -- | AF |
| 50 | -- | AF? | -- | 68 | -- | -- | -- |
| 51 | -- | -- | -- | 69 | -- | -- | -- |
| 52 | -- | -- | -- | 70 | -- | -- | -- |
| 53 | -- | AF? | -- | 71 | -- | -- | -- |
| | | | | 72 | AF | -- | -- |

*
-- - non-natal
AF - natal arctic fox
RF - natal red fox

Table 7. Number of fox dens identified in 1984 that were occupied by arctic fox litters on Herschel Island, 1984-1988.

| Year | No. Examined | No. Containing Litters (%) | $\chi^2$ Contribution |
|---|---|---|---|
| 1984 | 14 | 2 (14) | 0.0216 |
| 1985 | 14 | 2 (14) | 0.0216 |
| 1986 | 14 | 1 ( 7) | 0.7765 |
| 1987 | 14 | 2 (14) | 0.0216 |
| 1988 | 14 | 4 (29) | 1.7473 |

Table 8. Breeding status* of fox dens identified on Herschel Island in 1984, during 1984-1988.

| Den# | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|
| 37 | -- | AF | AF | -- | AF |
| 39 | -- | -- | -- | -- | -- |
| 40 | -- | -- | -- | -- | AF |
| 41 | RF | RF | -- | -- | -- |
| 42 | -- | -- | -- | -- | -- |
| 44 | -- | -- | -- | -- | AF |
| 45 | -- | -- | -- | -- | -- |
| 46 | -- | -- | -- | -- | -- |
| 47 | -- | -- | -- | -- | AF |
| 48 | AF | -- | -- | -- | -- |
| 50 | -- | AF | -- | AF? | -- |
| 51 | -- | -- | -- | -- | -- |
| 52 | -- | -- | -- | -- | -- |
| 53 | AF | -- | -- | AF? | -- |

* -- - non-natal
AF - natal arctic fox
RF - natal red fox

Table 9. Numbers and percentages of natal fox dens identified on Yukon coastal Plain, 1984-1988.

| | Number of dens | | |
|---|---|---|---|
| | | Occupied by fox litter (%) | |
| Year | identified | arctic fox litters | red fox litters |
| 1984 | 32 | 0 (0.0) | 0 (0.0) |
| 1985 | 35 | 1 (2.9) | 1 (2.9) |
| 1987 | 49 | 0 (0.0) | 1 (2.0) (?) |
| 1988 | 51 | 1 (2.0) | 1 (2.0) |

Table 10. Breeding status* of fox dens identified on Yukon Coastal Plain, during 1984, 1985, 1987, and 1988.

| Den Identification Number | | | |
|---|---|---|---|
| 1984 | 1985 | 1987 | 1988 |
| 1 - 28 - | 1 - 27 - | 1 - 27 - | 1 - 27 - |
| 2 - 29 - | 2 Nrf 28 - | 2 - 28 - | 2 Nrf 28 - |
| 4 - 30 - | 3 - 29 - | 3 - 29 - | 3 - 29 - |
| 6 - 31 - | 4 - 30 - | 4 - 30 - | 4 - 30 - |
| 7 - 33 - | 5 - 31 - | 5 - 31 - | 5 - 31 - |
| 8 - 34 - | 6 - 32 - | 6 - 32 - | 6 - 32 - |
| 9 - 55 - | 7 - 33 - | 7 - 33 - | 7 - 33 - |
| 10 - | 8 - 34 - | 8 - 34 - | 8 - 34 - |
| 11 - | 9 - 55 - | 9 - 55 - | 9 - 55 - |
| 12 - | 10 - | 10 - 74 - | 10 - 74 - |
| 13 - | 11 - | 11 - 75 Nrf? | 11 - 75 - |
| 14 - | 12 - | 12 - 76 - | 12 - 76 - |
| 15 - | 13 - | 13 - 77 - | 13 - 77 - |
| 16 - | 14 - | 14 - 78 - | 14 - 78 - |
| 17 - | 15 - | 15 - 79 - | 15 - 79 - |
| 18 - | 16 - | 16 - 80 - | 16 - 80 - |
| 19 - | 17 - | 17 - 81 - | 17 - 81 - |
| 20 - | 18 Naf | 18 - 82 - | 18 - 82 Naf |
| 21 - | 19 - | 19 - 83 - | 19 - 83 - |
| 22 - | 20 - | 20 - 85 - | 20 - 85 - |
| 23 - | 21 - | 21 - 86 - | 21- 86 - |
| 24 - | 22 - | 22 - 87 - | 22 - 87 - |
| 25 - | 23 - | 23 - 88 - | 23 - 88 - |
| 26 - | 24 - | 24 - | 24 - 100 - |
| 27 - | 25 - | 25 - | 25 - 101 - |
| | 26 - | 26 - | 26 - |
| Total: 32 | 35 | 49 | 51 |
| Natal this year: | | | |
| 0 | 2 | 1 | 2 |

* - - non-natal
Naf - natal arctic fox
Nrf - natal red fox

Table 11. A comparison of the size of a sample of fox dens on Yukon Coastal Plain identified during surveys in 1984 and 1985 and a sample of those identified during a survey in 1987 that were not observed in 1984 and 1985. Natal dens during at least one year during 1984-1988 marked with 'n' (AF - arctic fox; RF - red fox).

| 1984 + 1985 | | 1987 | |
|---|---|---|---|
| Den # | Number of Burrow Entrances | Den # | Number of Burrow Entrances |
| 2 n (RF) | 24 | 74 | 7 |
| 3 | 30 | 75 n (RF) | 3 |
| 5 | 13 | 76 | 3 |
| 7 | 14 | 77 | 1 |
| 8 | 9 | 78 | 3 |
| 9 | 19 | 79 | 20 |
| 10 | 24 | 80 | 3 |
| 12 | 27 | 82 n (AF) | 32 |
| 14 | 6 | 83 | 2 |
| 15 | 38 | 85 | 4 |
| 17 | 23 | 86 | 15 |
| 18 n (AF) | 8 | 87 | 6 |
| 20 | 14 | 88 | 20 |
| 21 | 4 | | |
| 22 | 6 | | |
| 23 | 22 | | |
| 24 | 30 | | |
| 25 | 18 | | |
| 26 | 14 | | |
| 27 | 17 | | |
| 28 | 18 | | |
| 29 | 15 | | |
| 30 | 21 | | |
| 31 | 30 | | |
| 32 | 20 | | |
| 33 | 8 | | |
| Mean | 18.2* | | 9.2* |
| S.D. | 8.7 | | 9.6 |

*Two-sample t-test, $t = 2.95$, d.f. = 38, $p<0.01$

Table 12. Characteristics of arctic foxes captured on Herschel Island, July 1988.

| Fox ID# | Den# | Date Captured | Time Captured | Sex | Weight (g) | Ear Tag # | |
|---|---|---|---|---|---|---|---|
| | | | | | | Left | Right |
| 1 | 44 | 21 | 23:20 | F | 1580 | 190 | 8071 |
| 2 | 44 | 21 | 23:20 | F | 1670 | 184 | 192 |
| 3 | 44 | 22 | 18:30 | M | 1745 | 8052 | 8051 |
| 4 | 44 | 22 | 18:30 | M | 1670 | 8053 | 8054 |
| 5 | 44 | 22 | 18:30 | M | 1860 | 8056 | 8055 |
| 6 | 44 | 22 | 18:30 | M | 1780 | 8057 | 8058 |
| 7 | 44 | 22 | 18:30 | F | 1640 | 8060 | 8059 |
| 8 | 47 | 24 | 22:00 | M | 1520 | 8062 | 8061 |
| 9 | 47 | 24 | 22:00 | F | 1370 | 8064 | 8063 |
| 12 | 47 | 25 | 00:20 | F | 1300 | 8069 | 8070 |
| 10 | 61 | 24 | 23:00 | M | 1640 | 8065 | 8066 |
| 11 | 61 | 24 | 23:00 | M | 1440 | 8067 | 8068 |
| 13 | 61 | 25 | 01:00 | F | 1350 | A2653 | A2652 |
| 14 | 61 | 25 | 03:05 | F | 1360 | A2654 | A2655 |
| 15 | 61 | 25 | 05:30 | F | 1440 | A2657 | A2656 |
| 16 | 36 | 26 | 02:00 | F | 1950 | A2658 | A2659 |
| 17 | 67 | 26 | 17:30 | M | 1830 | A2661 | A2660 |
| 18 | 67 | 26 | 21:20 | M | 1740 | A2663 | A2662 |
| 19 | 67 | 26 | 21:20 | F | 1740 | A2665 | A2664 |
| 20 | 67 | 26 | 21:20 | M | 1940 | A2666 | A2667 |

Table 13. Crude density of natal dens and percentage natal dens reported for arctic fox den surveys.

| Location | Natal Dens Per 100 $km^2$ | % Natal Dens of all dens | Area ($km^2$) | Authority |
|---|---|---|---|---|
| U.S.S.R. | | 31 - 74 | | Shibanoff 1951 |
| Bol'shezemel'skaya tundra, U.S.S.R. | | 12 - 100 | | Tchirkova 1955 |
| Taimyr, U.S.S.R. | | 6 - 100 | | Sdobnikov 1960 |
| Bol'shezemel'skaya tundra, U.S.S.R. | | 3 | | Skrobov 1961 |
| Teshekpuk Lake area, Alaska | | 4 | | Chesemore 1969 |
| Aberdeen Lake area, N.W.T. | 0.33 - 1.38 | 12 - 50 | 4,947 | Macpherson 1969 |
| Whole tundra zone, U.S.S.R. | | 10 - 80 | | Bannikov 1970 |
| Keewatin district, N.W.T. | 0 - 1.74 | 0 - 43 | 518 | Speller 1972 |
| Northern Yukon Territory | | 4 | | Ruttan 1974 |
| Prudhoe Bay, Alaska | | 25 | | Underwood 1975 |
| Prudhoe Bay, Alaska | | 42 | | Fine 1980 |
| Prudhoe Bay, Alaska | 1.11 - 4.44 | 18 - 74 | 450 | Eberhardt et al., 1983 |
| Colville Delta, Alaska | 0.12 - 1.35 | 6 - 55 | 1,700 | Eberhardt et al., 1983 |
| Yukon-Kuskokwim Delta, Alaska | 0 - 8.33 | 0 - 7 | 37 | Anthony et al., 1985 |
| Hardangervidda, Norway | 0 - 1.65 | 0 - 3 | 182 | Østbye et al., 1978 |
| Herschel Island | 1.98 - 6.93 | 6 - 21 | 101 | This study |
| Yukon Coastal Plain | 0 - 0.04 | 0 - 2 | 2,449 | This study |