2011 REPORT

ESTIMATION OF LEMMING ABUNDANCE AND DISTRIBUTION NEAR BARROW, ALASKA

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Executive Summary

The Alaska-breeding population of Steller's eiders (*Polysticta stelleri*) which are listed as threatened under the Endangered Species Act, nests primarily near Barrow, Alaska, where they breed only intermittently. Brown lemming (*Lemmus trimucronatus*) populations in the high arctic exhibit significant fluctuations in abundance that occur in roughly 3-4 year cycles. Reproductive effort and success of Steller's eiders appears to be correlated with years of peak lemming abundance and a better understanding and quantification of this relationship is a priority for Steller's eider conservation. The objectives of this research were:

- To understand spatial and temporal variation in lemming abundance near Barrow
- To explore the feasibility of employing live mark-recapture methods to obtain abundance estimates in Program MARK,
- To connect local students with biological research in the Barrow area.

Brown lemmings were marked and recaptured on twelve sampling plots near Barrow, during two 5-day occasions in June and August 2011. We detected and described spatial and temporal patterns of distribution for lemmings in the Barrow area. Capture data trends indicated an increase in brown lemmings over the summer. Abundance estimates per plot ranged from 0 to 21 individuals in June, and 6 to 74 individuals in August. Abundance averaged over all twelve plots increased from 7 individuals in June to 25 individuals in August. Density estimates, extrapolated for the entire Barrow study area, ranged from 224 lemmings/km^2 or 38,073 total lemmings in June to 860 lemmings/km^2 or 146,094 total lemmings in August.

This project also connected local youth with experiential learning in science and biology; a high priority for the U.S. Fish and Wildlife Service's (Service) work on the North Slope. Four local middle and high school students were hired to assist with all aspects of field work. Through their involvement, they learned about biology, the scientific method, sampling design, data recording, orienteering, animal handling, responsibility, and respect for nature. Besides providing experiential learning opportunities, this research was also shared with multiple local groups including science camps hosted by the Service and Ilisaġvik College.

Long-term monitoring of the lemming population near Barrow will be challenging due to its eruptive nature, however, the value of this research is in establishing a baseline for this keystone species, especially as the effects of climate change become more pronounced.

Introduction

The listed Alaska-breeding population of Steller's eiders (*Polysticta stelleri*) nests primarily near Barrow on the Arctic Coastal Plain, where they breed only intermittently (Quakenbush et al. 2004). Both reproductive effort and success of Steller's eiders appears to be correlated with years of peak lemming abundance (Quakenbush et al. 2004); however this relationship has not been successfully quantified. It is hypothesized that Steller's eiders and other avian species increase their reproductive effort in high lemming years because nests are less likely to fail as avian and mammalian predators focus on lemmings as alternate prey (Roselaar 1979, Summers 1986, Dhondt 1987, and Quakenbush et al. 2004).

Lemming populations, especially brown lemmings (*Lemmus trimucronatus*), in the high arctic exhibit significant fluctuations in abundance that occur in roughly 3-4 year cycles (Rausch 1950, Pitelka et al. 1955*a*, Pitelka et al. 1955*b*, Pitelka 1957, Thompson 1955, Pitelka 1973, Maclean et al. 1974, Batzli and Pitelka 1983, Stenseth and Ims 1993). Of the two species inhabiting the North Slope of Alaska, collared lemmings (*Dicrostonyx groenlandicus*) are usually less abundant than brown lemmings (Pitelka 1973). With the exception of peak years, when brown lemmings are ubiquitous in all habitat types, each species exhibits different habitat preferences. Collared lemmings tend to select drier habitat such as high center polygons where forbs and willows dicotyledons predominate (Pitelka 1973, MacLean et al. 1974, Batzli and Pitelka 1983 and 1993, Morris et al. 2000), while brown lemmings are characteristically more abundant in wetter habitat like low center polygons, troughs, and wet meadows where grasses and sedges thrive (Pitelka 1973, MacLean et al. 1974, Batzli and Pitelka 1983, Morris et al. 2000).

Both species remain active year round, building subnivean nests of dry grasses during winter (Pitelka 1957, Maclean et al. 1974, Stenseth and Ims 1993). This feature of their natural history combined with high reproductive potential (sexual maturity may be attained between 21 and 28 days after birth; Mullen 1968) provides the potential for eruptive population growth. Causes of the lemming cycle are poorly understood and the intensity and timing of cycles are not wholly predictable (Pitelka 1957, Mullen 1968, Krebs and Myers 1974, Andrews et al. 1975, Batzli and Pitelka 1983, Stenseth and Ims 1993). During years of peak abundance, lemmings are a significant food source for avian and mammalian predators including jaegers, weasels, and foxes (Pitelka et al. 1955*a*, Pitelka et al. 1955*b*, MacLean et al. 1974, Larter 1998, Quakenbush et al. 2004). Brown lemmings also comprise the majority of prey for nesting short-eared and snowy owls (Pitelka et al. 1955*a*, 1955*b*, Holt 2003, Holt 2004, Holt 2010). Peak lemming abundance typically occurs shortly after break-up (Rausch 1950, Thompson 1955, Andrews et al. 1975), and coincides with initiation of breeding by ground-nesting waterfowl, shorebirds, and birds of prey (Pitelka et al. 1955a, 1955b).

To date, indices of abundance, and minimum number known alive (MKNA) have been obtained for lemmings populations across the high arctic via snap trapping, hand catching, incidental counts, road mortality counts, winter nest counts, or by indirect comparison to predator abundance (Østbye et al. 1993, Pitelka et al. 1955, MacLean et al. 1974, Krebs et al. 2008). In addition, radio-collaring has been attempted to estimate home range size of free-ranging lemmings (Banks et al. 1975, Brooks 1993). However, these measurements provide little inference about the area to which abundance pertains because sampling designs were either not statistically robust or efforts were unevenly distributed or entirely opportunistic. Mark-recapture via live-trapping to estimate abundance and distribution of lemmings in the Barrow area had not been conducted before this study.

Several studies have employed removal by snap trapping to obtain an index of lemming abundance in Barrow and other Arctic locations (Batzli and Pitelka 1983, Framstad et al. 1993a, b, Framstad and Stenseth 1993, Holt 2003, 2004, and 2010, Larter 1998, Mullen 1968, Peterson and Holt 1999, Pitelka 1957 and 1973, Pitelka et al. 1955a and b, Pitelka and Batzli 1993, and Rausch 1950). Because lemmings are more likely to activate the treadle of a snap trap (which has no sides and may be approached from any direction), than deliberately enter the appropriate end of a live trap, this method may initially seem more effective than live trapping. In addition, lemmings are reported to respond poorly to bait (Framstad et al. 1993). However, live trapping using mark-recapture methods provides more statistically robust data, is minimally invasive, and is a well documented technique for estimating abundance of microtine species (Chao 1987, Hammond and Anthony 2006, Menkens and Anderson 1988, Otis et al. 1978, Seber 1986, White and Burnham 1999). Furthermore, inference from data collected by removal trapping of lemmings in the Barrow area may be limited as those study designs may have inadvertently selected for collared lemmings by placing trap lines in drier high-center polygon and mounded habitat (Peterson and Holt 1999, Holt 2003, 2004, and 2010). Another disadvantage of removal trapping is significantly higher rates of lethal non-target captures (Peterson and Holt 1999, Holt 2003, 2004, and 2010). For these reasons live trapping was selected as the capture technique for this research.

Although Pitelka (1973) suggested the extensive manpower requirements and logistical complexity associated with live mark-recapture work would preclude application of this method to obtain estimates of lemming abundance and density, recent advances in field equipment and methodology encourage application of this technique. There are multiple methods for live trapping microtine species and several have been used on lemmings, including hand-catching, pit fall traps, and box style traps (Sherman, Ugglan, and Longworth; Andrews et al. 1975, Banks et al. 1975, Jensen et a. 1993, Krebs 1964, Morris et al. 2000, Perham 2002, Thompson 1955). Although hand-catching may seem like a productive approach, this method is not statistically defensible due to inherent differences in observer abilities and lack of geographic scale sampled. Although pit fall traps are moderately successful, researchers documented increased trap-shyness following initial capture (Jensen et al. 1993). Such behavior modification in response to pit fall traps would be unsuitable for mark-recapture work. Furthermore, excavating cavities for pit fall traps would be impractical for trapping in early spring, as the soil active layer near Barrow remains frozen until later in summer (K. Ott, *personal observation*). For these reasons, we employed folding Sherman live traps (H.B. Sherman Traps Inc., Tallahassee, FL).

Numerous techniques exist for individually marking small mammals in the field, including indelible non-toxic inks or paints, toe clipping, ear tagging, and tagging with passive integrative transponders (PIT tags). Application of indelible non-toxic inks or paints is impractical in wet environments or on small mammals that groom fastidiously (K. Ott, *personal observation*). Toe clipping is highly invasive (Andrews et al. 1975) and does not provide a sufficiently unique mark when many animals are captured over a period of several days. Therefore we selected unique metal ear tags, made of a rust and corrosion resistant nickel-copper alloy, as our marking technique (National Band and Tag Co. Newport, KY). Ear tags have been used successfully to mark lemmings in at least two similar field studies; neither study documented interference with behavior, health, or social status of lemmings as a result of ear tag application (Jensen et al. 1993 and Morris et al. 2000). Although suitable for marking brown lemmings, ear tags are inappropriate for use on collared lemmings because this species lacks external ears. However, because collared lemmings are less numerous than brown lemmings we expect this limitation to be negligible in terms of data analysis. PIT tags represent another alternative, however this pilot study employed ear tags because their application requires minimal training, and had a lower probability of wounding or lethal injury to an animal. If applied correctly however, PIT tags may be less invasive and more permanent than ear tags. Therefore, reevaluating the use of PIT tags may be justified in the future.

Objectives

Given the ecological role of lemmings as a keystone species in the high arctic, long-term monitoring of their abundance and distribution is warranted. There is some question as to whether lemming populations in the Barrow area maintain cyclicity, or if fluctuations remain as intense as historical accounts suggest (Robert Suydam *personal communication*). If lemming populations no longer cycle on regular intervals or if the amplitude of cycles is less intense, this could have significant implications for the conservation of threatened Steller's eiders and impact the reproductive success of other ground nesting birds. Therefore this research had three principal objectives:

- To understand spatial and temporal variation in lemming abundance near Barrow in order to better quantify the relationship between lemming abundance and reproductive success of threatened Steller's eiders and other waterfowl.
- To explore the feasibility of employing live trapping with mark-recapture methods to obtain estimates of lemming abundance and density.
- Connect local students to scientists working in the Barrow area. Involving local students in this research will provide opportunities for them to develop scientific skills and a better understanding of the landscape and ecosystem in which they live. It may also foster an interest in biological science as a career path.

Methods

Study Area — The city of Barrow is located near the northern-most point of Alaska, bordered by the Chukchi Sea to the West and Beaufort Sea to the East at 71^{o} 18'N, 156^{o} 40' W. Habitat is predominantly coastal tundra and wetlands dominated by *Arctophila* spp. and *Carex* spp. Summers are cool and humid with 24 hours of daylight from mid-May to early August. For logistical reasons, our study area was located near Barrow, within 1 km of the road system (Figure 1). Land use permits for this research were obtained from Ukpeaġvik Inupiat Corporation. Once off the road system, all travel was on foot.

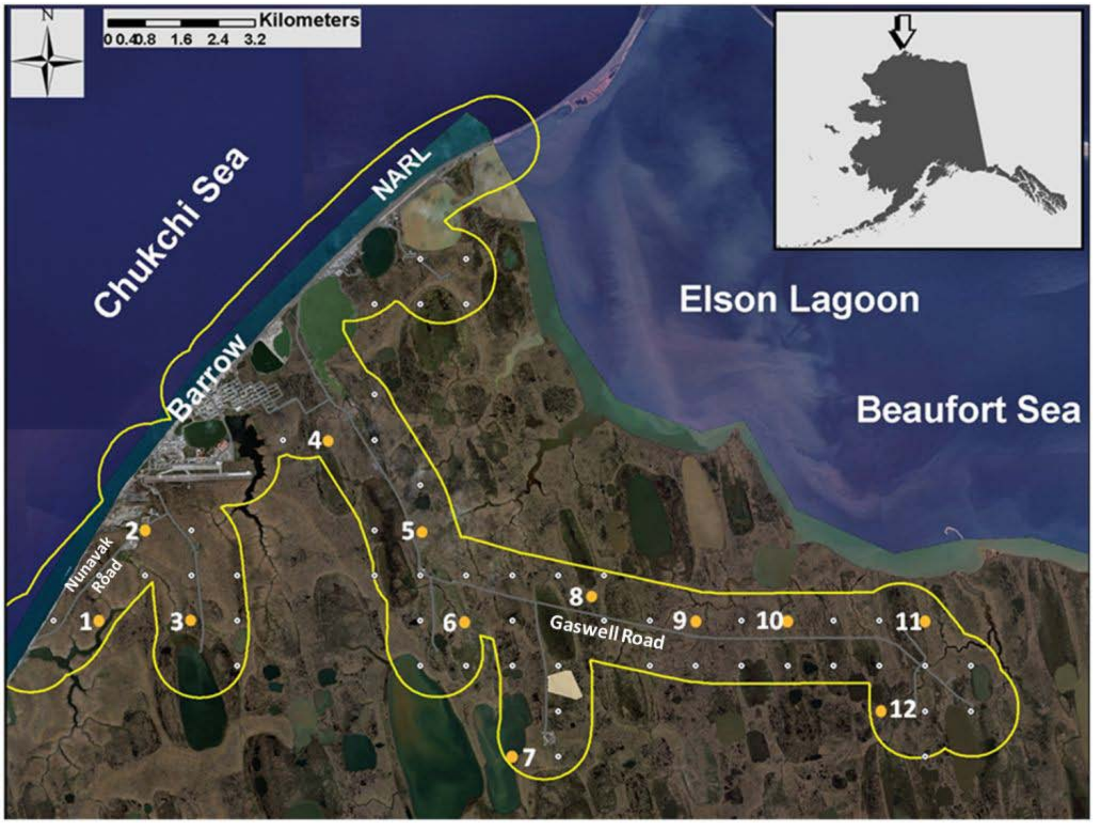

Figure 1. Map of study area adjacent to the road system near Barrow, Alaska 2011.

Sampling Design — Following microtine sampling protocols developed by Rexstad and others in Denali National Park and Preserve, Alaska (Furtsch and Rexstad 1993, Rexstad and Debevec 2004, Rexstad et al. 2005), we adopted a multistage sampling design. First a 1 km buffer was created around the road system near Barrow. The 1 km restriction ensured that sampling plots could be visited with required frequency while facilitating distribution of plots over the greatest possible area. The buffer was overlapped with a 1 km x 1 km grid to form a sampling frame composed of 1 km^2 cells. Cells were numbered sequentially starting from Nunavak Road at the western edge of the study area, continuing from northern Cake Eater Road, to the eastern end of Gaswell Road. We randomly selected the first cell, and then systematically selected every fourth cell in an ascending numerical order, until a total of 12 sampling cells were selected. This provided a relatively even distribution of cells across the study area. The centroid of each 1 km^2 cell became the vertex of a sampling chevron, and the orientation of the chevron was determined by a random compass bearing. A sampling chevron consisted of 40 traps spaced at 10 m intervals in the shape of a hollow “L” (Figure 2). This sampling design facilitated trap checks by a minimal crew of 2 while reducing the amount of back-tracking and overall trap check time. For example, team members would begin at either trap A1 or B1, and would walk down the red A line or black B line in tandem. When an animal was trapped, one crew member needed only walk approximately 20 m to assist with processing. Alternatively, if capture rates were high and walking between lines became tedious, both crew members could walk the same line together to complete the trap check.

In the field, we navigated to the coordinates of each selected vertex using a GPS unit. Provided sufficient habitat was available for plot placement (e.g., no open water present in area), a random compass bearing was taken and 100 m was measured on that bearing between corners A1 and A11. A pin flag (removed at the end of the season) was placed every 10 m along this transect. The remainder of the chevron was laid in the same fashion, by navigating to each corner with the appropriate compass bearing and a meter tape. Once the full chevron was marked with flags, GPS coordinates were taken at each corner to assist with navigation to the plot on foggy days and facilitate locating plots in subsequent years. Traps were placed at each flagged location with the caveat that the trap could be placed anywhere within a 5 m radius of the flag. This allowed us to maximize the probability of capture by placing traps in established lemming runways or near burrow entrances whenever possible.

If we arrived at predetermined coordinates of a vertex and the habitat was unsuitable (e.g., wetland or large pond present) we chose a random compass bearing and moved 50 m in that direction, repeating the process as necessary, until sufficient space for a sampling plot was achieved. Additionally, if a chevron's placement was in close proximity to any known threatened eider or snowy owl nest we moved the plot (on a random bearing) a minimum of 500 m from the former and 200 m from the latter. We also made an effort to avoid sampling on any preexisting avian research plots or lemming traplines.

Similar to the timing of sampling occasions of Pitelka and Batzli (1993) this research involved two sampling occasions, during summer 2011 (June 12th -25th and August 7th-20th). The timing of the first occasion coincided as closely as possible with the end of break-up in order to sample the lemming population before the onset of increased predation from lack of snow cover. The second occasion provided information on lemming abundance prior to the onset of winter which may suggest a summer population trend when compared with June abundance estimates. Traps were deployed for a total of 5 nights with three daily trap checks (at 0600, 1300, and 2000) to minimize trapping mortality and maximize the number of effective trap nights. During the first week of each occasion, plots 1 through 6 were sampled. The four person crew was split into two teams of two people. Each crew was responsible for monitoring three plots during each check for the duration of the five day sampling period. See Table 1 for the detailed 2011 sampling schedule.

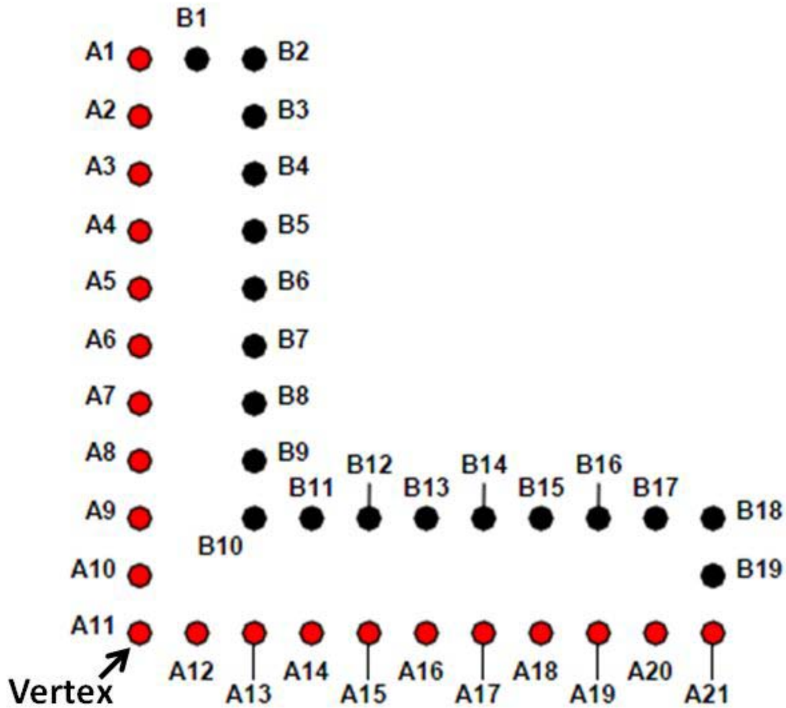

Figure 2. Live trapping Chevron (Rexstad and Debevec 2004).

Field Methods — On Sunday and Monday of week 1, six trapping chevrons were set in the field and traps were prepared with bait and bedding. Four plots were established on Sunday with the remaining two put out Monday morning. All traps remained closed until the simultaneous opening at 2000 Monday night (trap night 1). Crews could check plots in any order provided they maintained the same sequence after the first trap check. Trapping continued, with three daily checks, until 2000 Saturday, when traps were closed and collected. Beginning the following Sunday, sampling shifted to the remaining plots (7-12) following the same schedule.

Table 1: Schedule for 2011 field season for lemming abundance sampling near Barrow, Alaska.

Date	Time	Event
1-11 June		Check trap function, prepare bait, and bedding. Make trap covers, organize field equipment.
12 June	0800	Layout plots, set out traps: plots 1-4
13 June	0800	Layout plots, set out traps: plots 5-6
	2000	Open traps
14 June	0600, 1300, 2000	Trap check: plots 1-6
15 June	0600, 1300, 2000	Trap check: plots 1-6
16 June	0600, 1300, 2000	Trap check: plots 1-6
17 June	0600, 1300, 2000	Trap check: plots 1-6
18 June	0600, 1300, 2000	Trap check and collect traps: plots 1-6
19 June	0800	Layout plots, set out traps: plots 7-10
20 June	0800	Layout plots, set out traps: plots 11-12
	2000	Open traps
21 June	0600, 1300, 2000	Trap check: plots 7-12
22 June	0600, 1300, 2000	Trap check: plots 7-12
23 June	0600, 1300, 2000	Trap check: plots 7-12
24 June	0600, 1300, 2000	Trap check: plots 7-12
25 June	0600, 1300, 2000	Trap check and collect traps: plots 7-12
July		Clean and repair traps, repair trap covers
7 August	0800	Layout plots, set out traps: plots 1-4
8 August	0800	Layout plots, set out traps: plots 5-6
	2000	Open traps
9 August	0600, 1300, 2000	Trap check: plots 1-6
10 August	0600, 1300, 2000	Trap check: plots 1-6
11 August	0600, 1300, 2000	Trap check: plots 1-6
12 August	0600, 1300, 2000	Trap check: plots 1-6
13 August	0600, 1300, 2000	Trap check and collect traps: plots 1-6
14 August	0800	Layout plots, set out traps: plots 7-10
15 August	0800	Layout plots, set out traps: plots 11-12
	2000	Open traps
16 August	0600, 1300, 2000	Trap check: plots 7-12
17 August	0600, 1300, 2000	Trap check: plots 7-12
18 August	0600, 1300, 2000	Trap check: plots 7-12
19 August	0600, 1300, 2000	Trap check: plots 7-12
20 August	0600, 1300, 2000	Trap check and collect traps: plots 7-21
September		Clean and store traps and field equipment

We used 3” x 3.5” x 9” folding aluminum Sherman traps to live-capture lemmings. Each trap was covered with a 12” x 12” piece of waterproof roofing felt to protect it from the elements and because lemmings may be predisposed to seek cover (Craig George, North Slope Borough Department of Wildlife Management *personal communication*; Figure 3). Each cover was secured to the ground with two aluminum tent stakes. Where possible, traps were placed in established lemming runways to maximize the potential for capture (Rausch 1950, Perham 2002). Each trap was supplied with shredded sterile cotton nestlets (Ancare, Bellmore, NY) and a mixture of peanut butter and sunflower seeds as bait. Cotton nestlets were used in favor of synthetic nesting material because the latter may cause choking (Melanie Flamme NPS, *personal communication*). Although cotton loses its insulating properties when wet, nestlets were protected from moisture and precipitation by the waterproof roofing felt trap covers. Nesting material and bait were replenished as needed.

Figure 3. Folding aluminum 3”x 3.5” x 9” Sherman live trap with 12” x 12” waterproof roofing felt cover.

Upon encountering a closed trap, a gallon sized Ziploc® bag was secured over the door, the door was opened and the captured animal was gently tipped into the bag. Non-target animals were recorded and released immediately. Lemmings were identified to species and weighed with a Pesola 100 g spring scale while in the Ziploc bag. The weight of the bag and its contents were subtracted to obtain the animal’s body weight. If the animal was a new capture it was restrained and removed from the bag. We applied a numbered metal ear tag to the right ear. After tagging, the animal’s sex was determined and the animal was then released. Recaptured animals (those already marked with ear tags) were recorded, weighed, and released directly from the Ziploc bag. Total handling time for trapped lemmings did not exceed ten minutes. This project was consistent with the “Guidelines for the Capture, Handling, and Care of Mammals as Approved by the American Society of Mammalogists Animal Care and Use Committee” for live-trapping small mammals (ASM Guidelines, Sikes and Gannon 2011). In addition, all personnel handling lemmings wore light leather gloves. The gloves were thick enough to prevent penetration from bites but thin enough to ensure dexterity of the handler.

Bait Comparison — During the August trapping occasion we tested a novel bait delivery method. Recent research suggests several advantages to using bait wrapped in wax paper (similar to a "tootsie roll") in place of a traditional bait ball (Veselka and Collins 2011). To bait a trap with the novel bait, one end of the wrapper is pinched at the top of the back door in a Sherman trap, which leaves the bait hanging at the rear of the trap within reach of the target species. One advantage of this technique is that it removes the weight of the bait ball from the trigger plate, likely improving trap success and catch rate. Although bait preparation time increases, this method speeds setting, checking, and cleaning traps.

We selected two chevrons to test this new bait methodology. At these experimental plots every odd numbered trap was baited with a wrapped ball and even numbered traps were baited with a traditional bait ball. Traps were dedicated to either type of bait for the duration of the second occasion. Student technician Sam Ahsoak hypothesized that there would be no significant difference between capture success or trap failure rate and bait technique. We considered it a trap failure when there was evidence (e.g., scat, disturbed bedding, consumed bait) a lemming had been in the trap but the trap failed to trigger. Mr. Ahsoak will use the results of this experiment for his 2012 Barrow High School Science Fair project.

Data Analysis — Due to the short duration of each occasion (five days), abundance estimates were obtained for brown lemmings using the closed population models of Otis et al. 1978 in Program MARK under the log link function (Cooch and White 2001, Lukacs 2011, White and Burnham 1999). Closed population models assume (Otis et al. 1978):

1) The population is closed – there are no births, deaths, emigrations or immigrations for the duration of the study.
2) Marks are not lost.
3) Marks are read and recorded correctly.

Abundance estimates are possible only when marked individuals are recaptured (Rexstad and Debevec 2004, Debevec and Flamme 2007). In cases where there are no recaptures, estimated abundance is equal to the number of unique individuals captured (minimum number known to be alive or MNKA). It is important to note that MNKA is not an estimate of population size but rather an index of abundance.

Closed population data are incorporated into an input file of encounter histories, which consist of a contiguous series of "1"s and "0"s where 1 indicates an animal was captured (or recaptured) and 0 indicates an animal was not captured or recaptured (Cooch and White 2011). Due to the short time interval, closed population analyses do not estimate survival (which is assumed to be 1; White 1999). Rather, initial capture probability (p) and recapture probability (c) are estimated in addition to abundance (N; White 1999, Lukacs 2011). For this exploratory analysis, we considered models where initial capture probability and recapture probability either varied with time (t) or remained constant (.). It was necessary to constrain the last capture probability (p_5) in time dependent models (e.g., {N, p(t)c(.)} and {N, p(t)c(t)}) in order for MARK to reach numerical convergence. Therefore we set $p_5 = c_4$ when c varied with time, or $p_5 = c$ when c was constant. We also considered models where p and c varied with time or were constant, but also equal (=) to each other. For example, in model {N, p(t)=c(t)}, capture probability and recapture probability vary with time but are equal; so the capture probability for lemmings on plot 1 would be equal to recapture probability for animals on the same plot but different from animals on other plots. We considered all models with ΔAIC < 2 because these models have approximately equal weight in the data (Cooch and White 2011). We then selected the best fit model with the fewest parameters and greatest AIC_c weight, which is based on Akaike's information criterion (AIC, Akaike 1978), but includes refinements for small sample size (Cooch and White 2011).

Density estimation merits further exploration with Program Density (Efford 2004). For this report, a coarse estimate of brown lemming density as it relates to the greater Barrow study area (170 km^2) was based on average home range size of male and female lemmings (10,050 m^2, Banks et al. 1975). This translates to a home range (if assumed to be circular) with a radius of approximately 60 m. We made an assumption that the average lemming was captured near the center of its distribution. Therefore, we increased the perimeter of a sampling chevron by 60 m in all directions to obtain an approximation of the area to which each abundance estimate may pertain (0.03 km^2).

Results

Total Captures — Total captures for each species in summer 2011 are summarized in Table 2. Raw capture data for the June and August sampling occasions are presented in Appendices A and B respectively. We captured 488 brown lemmings representing 282 unique individuals, and 72 collared lemmings representing at least 20 individuals. Because collared lemmings could not be individually marked, only confirmed individuals (e.g., animals captured during the first trap check on the first day, or with differentiating characteristics such as sex or weight) could be considered unique. As a result, the number of individual collared lemmings was insufficient for incorporation into a mark-recapture analysis in Program MARK.

Table 2. Capture summaries for *Lemmus trimucronatus* and *Dicrostonyx groenlandicus* from sampling plots near Barrow, Alaska in June and August 2011.

Species	**Plot**	**Captures**	**Individuals**
Lemmus trimucronatus	1	8	4
	2	78	49
	3	57	31
	4	13	9
	5	10	6
	6	15	12
	7	13	4
	8	20	14
	9	58	35
	10	59	38
	11	147	72
	12	10	8
	Total	488	282
Dicrostonyx groenlandicus	1	49	8
	2	1	1
	3	10	5
	4	0	0
	5	0	0
	6	0	0
	7	7	2
	8	0	0
	9	0	0
	10	1	1
	11	0	0
	12	4	3
	Total	72	20

Body weight— In June, body weight of brown lemmings ranged from 39 g to 94 g with a mean weight of 65 g. By August, mean brown lemming weight decreased to 42 g and ranged between 7 g and 107 g. Average weight of collared lemmings also decreased from 58 g in June to 52 g in August. A summary of recorded body weights for each species is presented in Table 3.

Table 3. Summary of body weight (in grams) for brown (*Lemmus trimucronatus*) and collared lemmings (*Dicrostonyx groenlandicus*) captured near Barrow, Alaska in June and August 2011.

Occasion	Species	Min.	Max.	Mean	Std. Dev.
June	*Dicrostonyx groenlandicus*	17	92	58.37	18.45
June	*Lemmus trimucronatus*	39	94	64.89	12.40
August	*Dicrostonyx groenlandicus*	24	101	51.54	21.99
August	*Lemmus trimucronatus*	7	107	41.83	20.90

Species abundance — Brown lemmings were significantly more abundant than collared lemmings (Figure 4); though, collared lemmings were detected more often than expected, especially during the June occasion.

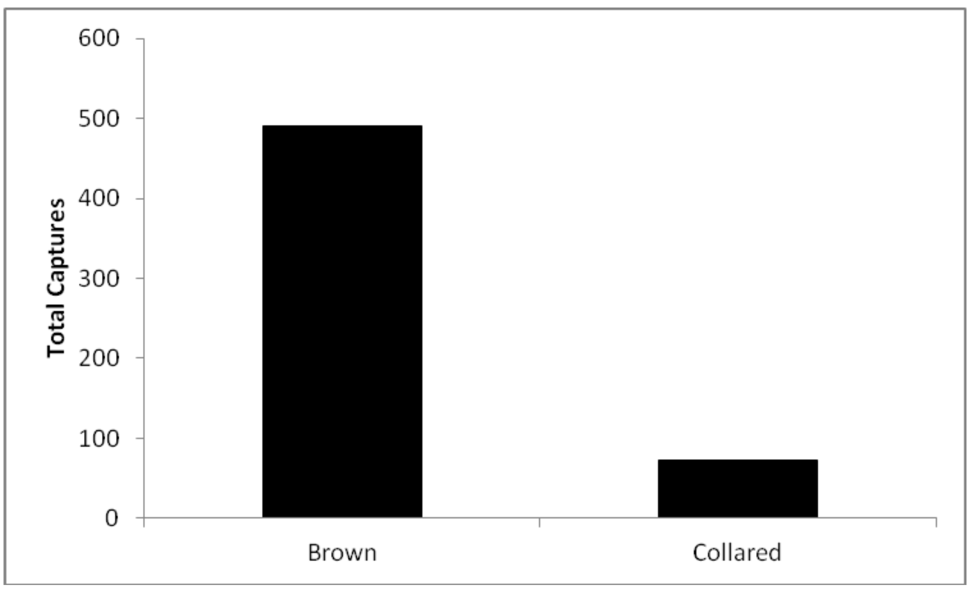

Figure 4. Total captures of brown and collared lemmings (pooled sampling occasions and plots) during summer 2011 near Barrow, Alaska.

Temporal variation — Brown and collared lemmings exhibited different trends in total captures during the summer of 2011. Brown lemmings were less common during the June occasion compared to August (Figure 5), while collared lemmings were captured more often in June than in August (Figure 6).

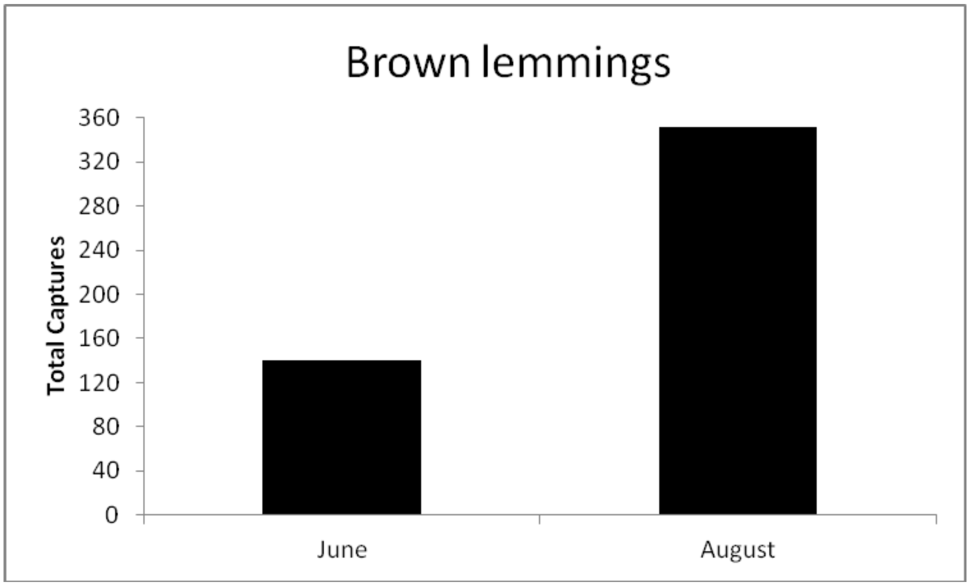

Figure 5. Total brown lemming captures (pooled sampling plots) for June and August 2011 near Barrow, Alaska.

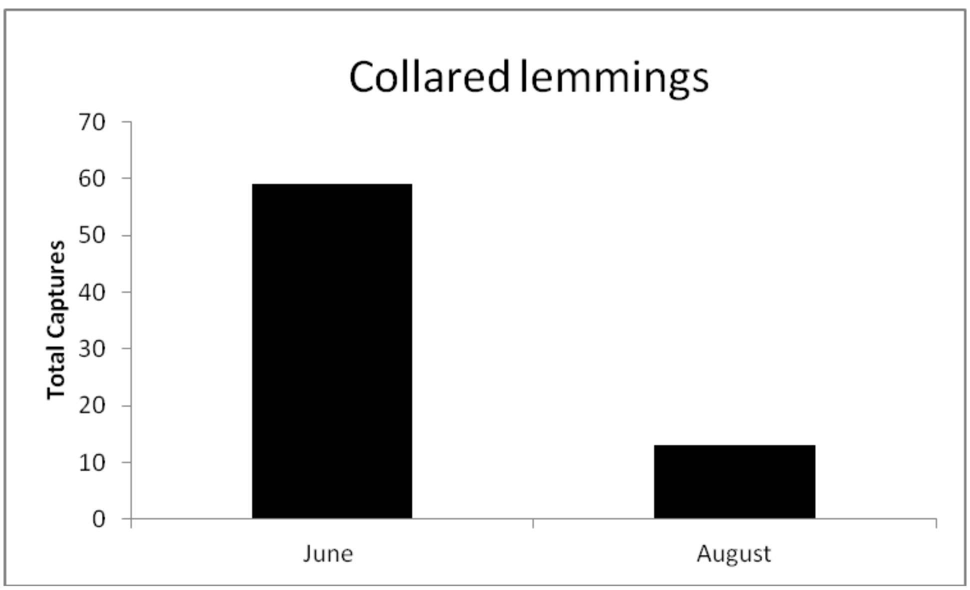

Figure 6. Total collared lemming captures (pooled sampling plots) in June and August 2011 near Barrow, Alaska.

As described by Henttonen and Kaikusalo in 1993, we also noted low numbers of lemming captures during the 1300 hour check for both occasions, although this pattern was more pronounced in June when day length was longer.

Spatial Variation — Lemming distribution across the Barrow study area varied by species. Although collared lemmings were encountered more often in June, the overall pattern of their distribution did not change between June and August. Collared lemmings were captured infrequently in the center of the study area and were caught more often on plots in the West and East of the study area (Plots 1, 10, and 12 respectively; Figure 7).

Figure 7. Spatial variation of total collared lemmings captured (*Dicrostonyx groenlandicus*) between sampling plots near Barrow, Alaska in June and August, 2011.

Similar to collared lemmings, brown lemmings were captured less frequently in the center of the study area than in the West and East. Plots 1, 7, and 12 were the only plots were collared lemmings were more common than brown lemmings (Figure 8).

Figure 8. Spatial variation of brown lemmings (*Lemmus trimucronatus*) between sampling plots near Barrow, Alaska in June and August, 2011.

Mortalities and by-catch — There were 15 mortalities, two during the first sampling occasion and 13 during the second occasion. Both mortalities during the June sampling occasion were collared lemmings. One was due to capture myopathy and the second was an incidental trap mortality. During the August sampling occasion all 13 mortalities were brown lemmings, and occurred over the duration of the two-week occasion. Five of the August mortalities could be attributed to capture stress, 5 were trap mortalities, and 3 were due to unknown causes (e.g., apparently healthy lemmings marked and released but later encountered dead within the boundaries of a sampling plot).

By-catch was extremely low. During the June occasion one Lapland longspur (*Calcarious lapponicus*) was caught and released unharmed. In August, one tundra shrew (*Sorex tundrensis*) was found dead in a trap. This is not unexpected as *Sorex* spp. have a high metabolism, insectivorous diet, and often die in live traps (Perham 2002, Rexstad and Debevec 2004, Stromgren 2008).

Bait comparison — The novel wrapped bait ball method was tested on plots 2 and 11. There were 48 and 110 total captures and 8 and 56 trap failures on these plots respectively. A chi-squared test of independence indicated a significant relationship between bait delivery method and incidence of trap failure on both plots. Furthermore, when compared to trap failure rates for two plots that exclusively employed bait balls (plots 3 and 10) but with similar capture rates to plot 2, there was a significant difference between bait delivery method and incidents of trap failure. This indicates a positive correlation between the wrapped bait methodology and improved capture success (results of χ^2 tests are summarized in Table 4).

Table 4. Chi-squared test of independence for relation between bait delivery method and trap failure rate for Sherman live traps deployed near Barrow, AK in summer 2011 (d.f. = 1).

Plot	χ^2	p-value	Relation
2	19.997	< 0.0005	Bait ball vs. wrapped ball within plot 2
11	5.29	< 0.025	Bait ball vs. wrapped ball within plot 11

Abundance estimates — Brown lemmings were not captured in Plots 1, 7, and 8 in June, therefore these plots were omitted from analysis in Program MARK. Based on AIC_c weights and ΔAIC_c values < 2, models {N, p(t)=c(t)} and {N, p(t)c(.)} were rated as the top models for the June dataset (Table 5). Although {N, p(t)c(.)} includes one less parameter, it also seems less biologically reasonable for initial capture probability to vary with time while recapture probability stays constant. Therefore we selected model {N, p(t)=c(t)}, where *p* and *c* are time dependent but equal, as the best candidate model for the June dataset.

Table 5. Results summary for model estimation in Program MARK for June closed population data.						
Model	AIC_c	ΔAIC_c	AIC_c Weight	Model Likelihood	No. Par.	Deviance
{N,p(t)=c(t)}	226.4499	0.0000	0.67954	1.0000	14	157.0940
{N,p(t)c(.)}	228.5422	2.0923	0.23872	0.3513	13	161.3738
{N,p(t)c(t)}	232.5469	6.0923	0.03223	0.0474	17	156.5415
{N,p(.)=c(.)}	232.8137	6.3638	0.02821	0.0415	10	172.1228
{N,p(.)c(.)}	233.7017	7.2518	0.01809	0.0266	11	170.8656
{N,p(.)c(t)}	237.1590	10.7091	0.00321	0.0047	14	167.8031

Abundance estimates for the June dataset are presented in Table 6. In instances where the number of individuals captured is less than 10 or there are few recaptures, the abundance estimate will be nearly identical to the number of unique individuals captured (Rexstad and Debevec 2004, Debevec 2005). This occurred on Plots 4, 5, 6, and 12 as indicated by very small standard errors and unrealistically narrow confidence intervals. Abundance averaged over all twelve plots in June (plots with no captures = 0) was 7 lemmings (SE = 2.02). Abundance ranged from 0 (no brown lemmings captured) to 21 lemmings on plot 11.

Table 6. Abundance estimates (N), standard error, and lower and upper 95% confidence intervals for brown lemmings (*Lemmus trimucronatus*) live-trapped near Barrow, Alaska between June 14th-25th, 2011

Plot	**N**	**SE**	**Lower CI**	**Upper CI**
1	—	—	—	—
2	15	1.84	13.40	22.35
3	12	1.60	10.22	18.42
4	3	0.02	3.00	3.01
5	1	0.00	1.00	1.00
6	3	0.02	3.00	3.01
7	—	—	—	—
8	—	—	—	—
9	8	1.32	7.08	14.60
10	8	1.32	7.08	14.60
11	21	2.22	18.76	28.99
12	2	0.00	2.00	2.00

Analysis of the August data suggested three time dependent models for consideration: {N, p(t)c(.)}, {N,p(t)=c(t)}, {N, p(t)c(t)} other based on AIC_c and ΔAIC_c values < 2 (Table 7). The top model included constant recapture probability, while *c* was time dependent and equal to *p* in the second weighted model. It seems more biologically reasonable that recapture probability would not be constant while initial capture probability varies with time. Additionally, both {N,p(t)=c(t)} and {N, p(t)c(t)} are fully time dependent and only differ in whether *p* equals *c* or *p* and *c* are different. Because *p* = *c* the former model includes fewer parameters and is a better fit. For these reasons, we selected model {N, p(t)=c(t)} as the most reasonable and parsimonious model for the August dataset.

Table 7. Results summary for model estimation in Program MARK for August closed population data.

Model	AIC_c	ΔAIC_c	AIC_c Weight	Model Likelihood	No. Par.	Deviance
{N,p(t)c(.)}	259.0663	0.0000	0.40521	1.0000	17	308.1804
{N,p(t)=c(t)}	259.3295	0.2632	0.35524	0.8767	17	308.4436
{N,p(t)c(t)}	260.7087	1.6424	0.17825	0.4399	20	303.5984
{N,p(.)=c(.)}	263.8132	4.7469	0.03775	0.0932	13	321.1701
{N,p(.)c(.)}	265.2809	6.2146	0.01812	0.0447	14	320.5831
{N,p(.)c(t)}	267.6944	8.6281	0.00542	0.0134	17	316.8085

Abundance averaged over all plots in August was 25 lemmings (SE = 6.31); more than three times the average abundance in June. Abundance ranged from 6 individuals on plot 7 to 74 individuals on plot 11. Abundance estimates for the August dataset are presented in Table 8.

Table 8. Abundance estimates (N), standard error, and lower and upper 95% confidence intervals for brown lemmings (*Lemmus trimucronatus*) live-trapped near Barrow, Alaska between August 9th-20th, 2011

Plot	**N**	**SE**	**Lower CI**	**Upper CI**
1	7	1.78	5.28	14.29
2	51	5.24	43.55	65.02
3	26	3.51	20.87	35.77
4	8	1.95	6.42	15.93
5	7	1.78	5.27	14.29
6	13	2.41	9.92	20.90
7	6	1.59	4.16	12.69
8	20	3.06	15.95	29.19
9	38	4.42	32.14	50.46
10	40	4.51	33.40	52.08
11	74	6.57	64.06	90.71
12	7	1.78	5.28	14.29

Density estimates — Average abundance of brown lemmings in June over 12 plots, was 6.45 lemmings/0.03 km^2. This extrapolates to an estimated 224 lemmings/km^2 or 38,073 total lemmings in the greater Barrow study area for June (170 km^2). By August, average lemming abundance more than tripled to 24.75 lemmings/0.03 km^2. This extrapolates to an estimated 860 lemmings/km^2 or 146,094 lemmings across the entire Barrow study area in August.

Discussion

The objectives of this study were achieved. This research has helped quantify and improve our understanding of spatial and temporal variations in lemming abundance near Barrow. In 1993, Krebs criticized the shortage of quantitative data, particularly via mark-recapture work, for lemming populations on the North Slope of Alaska. This research demonstrates that mark-recapture is a feasible method for estimating lemming abundance and density in the Barrow area.

Abundance estimates generated by Program MARK are reasonable and robust despite sparse data in a few instances. In June for example, plots 4, 5, 6, 10, and 12 yielded very few recaptures. This resulted in extremely low standard error values and unrealistically tight confidence intervals (Table 4), as MARK failed to locate estimates for some of the defined parameters. Abundance estimates (N) for these plots are essentially equal to the number of captures but seem reasonable given the scarcity of lemmings detected at these plots. Furthermore, absence of lemmings on certain plots represents valuable information with regard to variation in distribution, and these patterns (e.g. abundance in relation to habitat characteristics) warrant further investigation. As recaptures increase, standard error and confidence interval width decrease, and MARK's ability to generate abundance estimates improves dramatically as evidenced by estimates for plots 2, 3, 9, 10 and 11 in June and all plots in August (Tables 4 and 5, respectively). Further exploration of these data with Robust Design models (which treat each sampling occasion as a closed event but allow for an open population between occasions; Kendall 2011) may improve abundance estimates for the summer of 2011. Regardless, these data are informative, robust, and have the potential to be applied to other FWS research. For example, if compared to other indices, such as avian predator abundance during June breeding pair surveys, or distribution and success of nesting Steller's and spectacled eiders, these data may prove even more informative.

The success of this pilot season advocates for continued research in subsequent years, as the true value of this work will increase over time. Given the apparent close correlation to Steller's eider nesting effort, long-term monitoring of the lemming population near Barrow is warranted. In addition, only long term monitoring will allow statistical analysis of cycle periodicity (Pitelka and Batzli 1993). Over time, analysis of the lemming cycle may help inform management decisions for Steller's eiders, or at the very least, help predict the level of survey effort necessary to monitor nesting eiders. For example, summers preceding a peak year usually exhibit buildup or "pre-high" lemming numbers (Andrews et al. 1975). Based on the current data, the summer of 2011 may represent such a pre-high year. The summer of 2011 was a moderate effort nesting year for Steller's eiders with 27 documented nests. This may suggest the summer of 2012 will be a high nesting effort year for Steller's eiders and, based on this information, managers could adjust their field season hiring in response to expected levels of survey effort.

This project also serves as a vehicle to connect local youth with experiential learning in science and biology which is a high priority for the U.S. Fish and Wildlife Service's (Service) work on the North Slope. All four student assistants gained a better understanding of the importance of this keystone species and its relevance to migratory birds and the tundra ecosystem. Students assisted with all aspects of field work, including bait preparation, plot set up, trap checks, and lemming handling. Through their involvement, they learned about lemming biology, the scientific method, sampling design, data recording, orienteering, GPS and compass use, proper handling of captive animals, responsibility, and respect for nature. They were also encouraged to come up with their own biological questions which might be answered through application of the scientific method. In subsequent years for example, students might compare habitat characteristics to lemming abundance on different plots.

Besides providing experiential learning opportunities, this research was shared with multiple local groups. In July, the PI gave a presentation on lemming biology, including results of the first occasion, to 3rd-5th graders attending the Service Science camp at the Barrow FWS office. This presentation generated interest and inquiry from participants regarding the importance of this familiar yet uncharismatic animal. In August, the PI presented this work to a group of approximately 30 Barrow high school and Spanish foreign exchange students attending camp at Ilisaġvik College. Following this presentation, two exchange students shadowed the lemming crew in the field for two days, after which they were required to present their experiences and understanding of the study to their peers and mentors at Ilisaġvik College.

Successes of this pilot study notwithstanding, there were numerous challenges associated with this work, some of which may be unique to conducting microtine mark-recapture on the North Slope. For example, setting plots during the June occasion proved difficult because the active layer remained frozen just a few centimeters below the vegetation. This nearly precluded the use of pin flags to mark trap locations and tent stakes to secure trap covers. With persistence however, we found that pin flags could be forced into the active layer up to several centimeters and tent stakes could be embedded at an angle with a hammer. Care was taken not to bend the aluminum stakes, and although not flush with the tundra, they were secure enough that no trap covers were lost due to wind. By August, the active layer had thawed sufficiently and pin flags and stakes were embedded with ease. Although manageable, the frozen state of the active layer near Barrow in early summer should be taken into consideration when budgeting time for plot set up.

Mortalities occurred over the duration of the August occasion despite providing bait and bedding ad libitum. Because ambient temperatures were not significantly different between June and August, weather conditions alone cannot account for the increased incidence of mortality during the second occasion. One result of higher capture rates in August was a lengthening of the trap check interval. The average duration of a trap check doubled from 18 minutes in June to 36 minutes in August, with the longest trap check taking 3 hours and 45 minutes. Although every effort was made to work as efficiently as possible, increased time between trap checks at respective plots due to higher capture rates may have contributed to the increase in mortalities during the second occasion. Differences in mean body weight between June and August occasions may also partially explain the higher incidence of mortality in August. In June, the population is composed of adults recruited during the previous winter or summer, as juveniles of the year have yet to mature and leave maternal nests (Pitelka et al. 1955). Our data confirm a late summer pulse of juvenile brown lemmings based on mean August body weight of 41.8g compared to 64.9g in June. Likewise, mean body weight for mortalities in August was 29.7g. Smaller body size may translate into higher energetic requirements and increased thermoregulatory stress. Furthermore, smaller animals are difficult to handle, and mortality may occur from unintentional injury during restraint or stress as a result of gentler but increased handling time in an effort to avoid the former situation. Increasing the number of daily trap checks, recruiting additional crew members, and or designating a minimum tagging weight may significantly reduce mortalities in future years.

Surprisingly, twelve individuals marked in June were recaptured again in August. This indicates a degree of longevity both for lemmings and ear tags. However, ear tags are only semi-permanent and we documented at least two occasions where ear tags became detached. Given the potential for lost tags, it would be conceivable to mark a "new" individual more than once, leading to an overestimate of abundance. PIT tags are a more reliable and permanent alternative and, when conducted by experienced personnel, are less invasive than ear tags, and should be considered for future studies.

We concur with Pitelka (1973) that microtine mark-recapture studies are logistically complex and require a significant investment of manhours. Field work is strenuous and must occur on a regular interval in order to avoid trap mortalities and ensure data quality. Student technicians provided valuable assistance, however the added logistical complexity and temporal commitment of arranging transportation to and from the field added an additional level of difficulty. For example, during the June occasion students were encouraged to attend two of the three daily trap checks. All students elected to attend the 0600 and 1300 trap checks. However this resulted in several instances of students either missing the morning check entirely (and wasting valuable time as crew members attempted to locate/wake them) or staying up through the night before a 0600 check. Students were often lethargic and gained little from their experience in the field as a result of the later strategy. To address this problem during the August occasion, students were only required to attend the 1300 trap check. This resolved the issue because students convened early at the Eider House for lunch prior to going into the field. In subsequent years, limiting the number of student technicians to two instead of four would reduce logistical complexity and expenses. During the summer of 2011, four student technicians proved excessive for a small crew of adults with limited transportation.

This research does not explain or attempt to explain the driving factors of the lemming cycle. Although numerous studies have attempted to tease out the answer to this question; from predators, pathogens, parasites, resource availability, and social dynamics (Chitty 1955 and 1967, Pitelka 1955b, Pitelka et al. 1955b, 1964, Schultz 1964, 1969, Erlinge et al. 1983, Krebs 1993, Stenseth 1980, Stenseth and Ims 1993) the causes of the lemming cycle are likely multifactorial (Pitelka 1973, Lidicker 1975 and 1985), and thus intrinsically difficult to isolate. Long-term monitoring of the lemming population near Barrow will be challenging due to its eruptive nature, however, the value and impetus for this research is in establishing a baseline for this keystone species, especially as the effects of climate change become more pronounced.

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Appendix A. Live trapping results for brown (*Lemmus trimucronatus*) and collared lemmings (*Dicrostonyx groenlandicus*) including non-target species caught near Barrow, Alaska in June 2011. Fate is reported as new (N), recapture (R), or mortality (M). Unrecorded data are indicated by UNK.

Date	Visit	Temperature (°F)	Weather	Plot	Trap	Species	Fate	Tag	Sex	Weight (g)	Comments
14-Jun-11	600	32.0	overcast	2	A18	*Lemmus trimucronatus*	N	3	F	57	
14-Jun-11	600	32.0	overcast	2	A7	*Lemmus trimucronatus*	N	4	F	45	Lesion on right side of face, mature
14-Jun-11	600	32.0	overcast	2	B6	*Lemmus trimucronatus*	N	5	M	89	
14-Jun-11	600	32.0	overcast	2	B3	*Lemmus trimucronatus*	N	6	F	69	
14-Jun-11	600	32.0	partly cloudy	3	A16	*Lemmus trimucronatus*	N	501	M	39	
14-Jun-11	600	32.0	partly cloudy	3	B17	*Lemmus trimucronatus*	N	504	M	68	Tag in left ear
14-Jun-11	1300	35.6	partly cloudy	2	A7	*Lemmus trimucronatus*	UNK	4	F	UNK	
14-Jun-11	1300	35.6	partly cloudy	2	A14	*Lemmus trimucronatus*	N	24	M	UNK	Did not weigh
14-Jun-11	1300	35.6	partly cloudy	3	B15	*Lemmus trimucronatus*	R	504	M	UNK	
14-Jun-11	2000	37.0	partly cloudy	4	A7	*Lemmus trimucronatus*	N	64	M	66	Did not weigh
15-Jun-11	600	34.0	partly cloudy	2	B11	*Lemmus trimucronatus*	N	98	M	61	
15-Jun-11	600	34.0	partly cloudy	3	B17	*Lemmus trimucronatus*	N	100	F	74	
15-Jun-11	600	34.0	partly cloudy	2	B3	*Lemmus trimucronatus*	R	6	F	66	
15-Jun-11	1300	33.8	partly cloudy	2	B1	*Lemmus trimucronatus*	N	589	F	63	
15-Jun-11	2000	39.0	partly cloudy	2	B2	*Lemmus trimucronatus*	R	6	F	70	
16-Jun-11	600	39.9	partly cloudy	2	A8	*Lemmus trimucronatus*	N	522	UNK	74	Tag came out on release, tag on right ear
16-Jun-11	600	39.9	partly cloudy	2	B1	*Lemmus trimucronatus*	N	520	M	59	
16-Jun-11	600	39.9	partly cloudy	2	A7	*Lemmus trimucronatus*	R	4	F	53	
16-Jun-11	1300	39.9	partly cloudy	3	B17	*Lemmus trimucronatus*	N	529	M	60	
16-Jun-11	1300	39.9	partly cloudy	4	A4	*Lemmus trimucronatus*	N	583	M	47	
16-Jun-11	1300	39.9	partly cloudy	2	B12	*Lemmus trimucronatus*	R	24	M	69	
16-Jun-11	2000	46.0	partly cloudy	3	B15	*Lemmus trimucronatus*	N	505	M	78	Left ear tagged
16-Jun-11	2000	46.0	partly cloudy	2	B1	*Lemmus trimucronatus*	R	520	M	63	
17-Jun-11	600	39.9	partly cloudy	3	B19	*Lemmus trimucronatus*	N	540	M	71	
17-Jun-11	600	39.9	partly cloudy	5	A12	*Lemmus trimucronatus*	N	552	F	66	
17-Jun-11	600	39.9	overcast	2	B16	*Lemmus trimucronatus*	R	3	F	71	
17-Jun-11	600	39.9	overcast	2	A15	*Lemmus trimucronatus*	R	24	M	68	
17-Jun-11	600	39.9	overcast	2	A3	*Lemmus trimucronatus*	R	520	F	59	Left ear tagged

17-Jun-11	600	39.9	overcast	3	B15	*Lemmus trimucronatus*	R	525	M	60	
17-Jun-11	600	39.9	overcast	3	B17	*Lemmus trimucronatus*	R	505	M	61	
17-Jun-11	600	39.9	partly cloudy	4	A4	*Lemmus trimucronatus*	R	49	UNK	67	
17-Jun-11	600	39.9	partly cloudy	4	B6	*Lemmus trimucronatus*	R	583	M	55	
17-Jun-11	600	39.9	cloudy	2	B15	*Lemmus trimucronatus*	R	12	M	86	
17-Jun-11	1300	48.0	partly cloudy	3	B17	*Lemmus trimucronatus*	N	596	M	62	
17-Jun-11	1300	48.0	partly cloudy	3	B14	*Lemmus trimucronatus*	N	524	M	69	
17-Jun-11	1300	48.0	overcast	2	A3	*Lemmus trimucronatus*	R	520	M	61	
17-Jun-11	1300	48.0	overcast	3	A16	*Lemmus trimucronatus*	R	540	M	76	
17-Jun-11	1300	48.0	partly cloudy	4	B18	*Lemmus trimucronatus*	R	583	M	54	
17-Jun-11	1300	48.0	cloudy	5	A12	*Lemmus trimucronatus*	R	552	F	62	
17-Jun-11	2000	48.0	partly cloudy	2	A10	*Lemmus trimucronatus*	N	14	M	61	
17-Jun-11	2000	48.0	overcast	2	A18	*Lemmus trimucronatus*	R	3	F	67	
17-Jun-11	2000	48.0	overcast	2	B12	*Lemmus trimucronatus*	R	5	M	87	
17-Jun-11	2000	48.0	overcast	2	B1	*Lemmus trimucronatus*	R	520	F	66	
17-Jun-11	2000	48.0	overcast	3	B17	*Lemmus trimucronatus*	R	505	M	88	
17-Jun-11	2000	48.0	cloudy	4	B5	*Lemmus trimucronatus*	R	49	UNK	67	
18-Jun-11	600	37.9	partly cloudy	2	A7	*Lemmus trimucronatus*	N	584	M	69	
18-Jun-11	600	37.9	partly cloudy	3	B17	*Lemmus trimucronatus*	N	592	M	58	Bald spot on rump, tear on right ear, likely recap.
18-Jun-11	600	37.9	partly cloudy	6	A20	*Lemmus trimucronatus*	N	65	M	58	
18-Jun-11	600	37.9	partly cloudy	6	B11	*Lemmus trimucronatus*	N	75	M	57	
18-Jun-11	600	37.9	cloudy	2	A11	*Lemmus trimucronatus*	R	522	UNK	72	
18-Jun-11	600	37.9	cloudy	2	A3	*Lemmus trimucronatus*	R	520	M	62	
18-Jun-11	600	37.9	cloudy	3	B19	*Lemmus trimucronatus*	R	505	M	70	
18-Jun-11	600	37.9	partly cloudy	4	B17	*Lemmus trimucronatus*	R	583	M	56	
18-Jun-11	600	37.9	partly cloudy	5	A14	*Lemmus trimucronatus*	R	552	F	69	
18-Jun-11	1300	46.9	cloudy	2	B1	*Lemmus trimucronatus*	R	520	F	61	
18-Jun-11	1300	46.9	cloudy	3	B17	*Lemmus trimucronatus*	R	540	M	71	
18-Jun-11	1300	46.9	cloudy	6	B17	*Lemmus trimucronatus*	R	65	M	57	
18-Jun-11	2000	42.1	partly cloudy	2	B3	*Lemmus trimucronatus*	N	550	M	84	
18-Jun-11	2000	42.1	partly cloudy	6	A10	*Lemmus trimucronatus*	N	77	M	44	
18-Jun-11	2000	42.1	cloudy	2	A14	*Lemmus trimucronatus*	R	24	M	69	

18-Jun-11	2000	42.1	cloudy	3	B19	*Lemmus trimucronatus*	R	505	M	77	
18-Jun-11	2000	42.1	cloudy	3	B17	*Lemmus trimucronatus*	R	596	M	59	
21-Jun-11	600	34.0	partly cloudy	9	B9	*Lemmus trimucronatus*	N	11	M	69	Lesion on rear right thigh, on release immediately entered trap
21-Jun-11	600	34.0	partly cloudy	9	A20	*Lemmus trimucronatus*	N	25	M	68	
21-Jun-11	600	34.0	cloudy	10	A9	*Lemmus trimucronatus*	N	523	M	80	
21-Jun-11	600	34.0	cloudy	10	A3	*Lemmus trimucronatus*	N	586	M	67	Lesion on back
21-Jun-11	600	34.0	cloudy	10	A2	*Lemmus trimucronatus*	N	593	F	55	
21-Jun-11	600	34.0	cloudy	10	B4	*Lemmus trimucronatus*	N	588	M	74	Tag on left ear
21-Jun-11	600	34.0	cloudy	10	B15	*Lemmus trimucronatus*	N	566	M	72	
21-Jun-11	600	34.0	partly cloudy	11	B10	*Lemmus trimucronatus*	N	565	F	72	
21-Jun-11	600	34.0	partly cloudy	11	A13	*Lemmus trimucronatus*	N	527	M	80	
21-Jun-11	600	34.0	partly cloudy	11	A6	*Lemmus trimucronatus*	N	591	F	42	
21-Jun-11	600	34.0	partly cloudy	11	A9	*Lemmus trimucronatus*	N	506	F	50	
21-Jun-11	1300	39.0	partly cloudy	9	B7	*Lemmus trimucronatus*	R	11	UNK	69	
21-Jun-11	2000	36.0	overcast	11	B11	*Lemmus trimucronatus*	N	590	M	85	
21-Jun-11	2000	36.0	overcast/wind	9	B5	*Lemmus trimucronatus*	R	11	M	66	Windy, scale difficult to read
21-Jun-11	2000	36.0	overcast/wind	9	B14	*Lemmus trimucronatus*	R	25	M	66	
21-Jun-11	2000	36.0	overcast	10	A13	*Lemmus trimucronatus*	R	523	M	87	
22-Jun-11	600	34.0	fog	9	B6	*Lemmus trimucronatus*	N	526	F	72	
22-Jun-11	600	34.0	fog	9	A18	*Lemmus trimucronatus*	N	541	F	51	
22-Jun-11	600	34.0	fog/wind	10	B11	*Lemmus trimucronatus*	N	21	M	58	
22-Jun-11	600	34.0	fog	9	A4	*Lemmus trimucronatus*	R	11	UNK	UNK	
22-Jun-11	600	34.0	fog/wind	10	B16	*Lemmus trimucronatus*	R	566	M	77	
22-Jun-11	600	34.0	fog/wind	10	A16	*Lemmus trimucronatus*	R	523	M	91	
22-Jun-11	600	34.0	fog/wind	10	A02	*Lemmus trimucronatus*	R	593	UNK	52	
22-Jun-11	600	34.0	overcast/fog/wind	11	A11	*Lemmus trimucronatus*	R	590	M	79	
22-Jun-11	1300	39.9	cloudy	11	A21	*Lemmus trimucronatus*	N	521	M	78	
22-Jun-11	1300	39.9	cloudy	11	A13	*Lemmus trimucronatus*	N	551	F	UNK	Did not weigh
22-Jun-11	1300	39.9	cloudy	11	A6	*Lemmus trimucronatus*	N	515	F	48	
22-Jun-11	1300	39.9	cloudy	10	A8	*Lemmus trimucronatus*	R	21	UNK	58	
22-Jun-11	1300	39.9	cloudy	11	B10	*Lemmus trimucronatus*	R	590	UNK	79	
22-Jun-11	2000	37.9	fog	9	A4	*Lemmus trimucronatus*	R	11	M	74	

22-Jun-11	2000	37.9	fog	9	B6	*Lemmus trimucronatus*	R	526	UNK	70	
22-Jun-11	2000	37.9	fog/wind	11	B8	*Lemmus trimucronatus*	R	590	UNK	82	
23-Jun-11	600	33.1	fog	11	A21	*Lemmus trimucronatus*	N	539	F	44	Trap happy
23-Jun-11	600	33.1	fog/wind	9	B6	*Lemmus trimucronatus*	R	11	M	71	
23-Jun-11	600	33.1	fog	11	B11	*Lemmus trimucronatus*	R	565	F	50	
23-Jun-11	1300	33.8	overcast/fog/wind	11	B10	*Lemmus trimucronatus*	R	590	UNK	80	Escaped before weight
23-Jun-11	1300	33.8	overcast/fog/wind	11	A9	*Lemmus trimucronatus*	R	506	F	54	Tufted ears
23-Jun-11	2000	35.1	overcast/fog/wind	9	A19	*Lemmus trimucronatus*	N	97	M	75	
23-Jun-11	2000	35.1	fog/wind	11	A10	*Lemmus trimucronatus*	N	556	M	48	
23-Jun-11	2000	35.1	fog/wind	11	B10	*Lemmus trimucronatus*	N	558	F	74	
24-Jun-11	600	34.0	overcast/rain/wind	10	A9	*Lemmus trimucronatus*	N	16	M	85	Lesions on rump
24-Jun-11	600	34.0	overcast/rain/wind	11	B13	*Lemmus trimucronatus*	N	22	M	51	
24-Jun-11	600	34.0	overcast/rain/wind	11	A9	*Lemmus trimucronatus*	N	74	M	48	
24-Jun-11	600	34.0	overcast/wind	12	B12	*Lemmus trimucronatus*	N	96	F	43	
24-Jun-11	600	34.0	overcast/wind	9	B6	*Lemmus trimucronatus*	R	11	M	66	Obvious nipples, nursing?
24-Jun-11	600	34.0	overcast/wind	9	A17	*Lemmus trimucronatus*	R	25	UNK	70	Escaped before weight
24-Jun-11	600	34.0	overcast/rain/wind	11	B11	*Lemmus trimucronatus*	R	565	F	49	
24-Jun-11	1300	34.0	overcast/fog/wind	9	B6	*Lemmus trimucronatus*	R	11	M	69	Very lethargic
24-Jun-11	1300	34.0	overcast	11	A10	*Lemmus trimucronatus*	R	556	UNK	51	
24-Jun-11	1300	34.0	overcast	11	A21	*Lemmus trimucronatus*	R	539	UNK	42	
24-Jun-11	2000	36.0	overcast/fog/wind	11	B08	*Lemmus trimucronatus*	N	15	U	60	
24-Jun-11	2000	36.0	overcast	9	B6	*Lemmus trimucronatus*	R	11	UNK	64	
24-Jun-11	2000	36.0	overcast/fog/wind	11	B10	*Lemmus trimucronatus*	R	590	UNK	UNK	
25-Jun-11	600	39.0	overcast/fog/wind	9	A14	*Lemmus trimucronatus*	N	20	F	57	
25-Jun-11	600	39.0	fog	11	B5	*Lemmus trimucronatus*	N	530	F	52	
25-Jun-11	600	39.0	fog	11	A10	*Lemmus trimucronatus*	N	594	M	53	
25-Jun-11	600	39.0	fog	12	A15	*Lemmus trimucronatus*	N	555	M	60	
25-Jun-11	600	39.0	overcast/fog/wind	9	B6	*Lemmus trimucronatus*	R	11	M	63	
25-Jun-11	600	39.0	overcast/fog/wind	9	B16	*Lemmus trimucronatus*	R	25	UNK	63	
25-Jun-11	600	39.0	partly cloudy/wind	10	A18	*Lemmus trimucronatus*	R	523	UNK	93	
25-Jun-11	600	39.0	partly cloudy/wind	10	A9	*Lemmus trimucronatus*	R	21	UNK	52	
25-Jun-11	600	39.0	fog	11	B8	*Lemmus trimucronatus*	R	590	UNK	83	

25-Jun-11	600	39.0	fog	11	A9	*Lemmus trimucronatus*	R	506	UNK	58	
25-Jun-11	600	39.0	fog	11	B10	*Lemmus trimucronatus*	R	565	UNK	48	
25-Jun-11	600	39.0	fog	11	A21	*Lemmus trimucronatus*	R	539	UNK	50	
25-Jun-11	1300	45.0	cloudy/wind	11	B8	*Lemmus trimucronatus*	N	17	M	89	lemming in trap but trap not tripped
25-Jun-11	1300	45.0	cloudy	9	A17	*Lemmus trimucronatus*	R	97	UNK	UNK	
25-Jun-11	1300	45.0	cloudy	9	A14	*Lemmus trimucronatus*	R	25	UNK	66	
25-Jun-11	1300	45.0	cloudy	9	B6	*Lemmus trimucronatus*	R	11	UNK	60	
25-Jun-11	1300	45.0	cloudy/wind	11	A21	*Lemmus trimucronatus*	R	593	F	46	
25-Jun-11	1300	45.0	cloudy/wind	11	A10	*Lemmus trimucronatus*	R	22	UNK	57	Mature
25-Jun-11	1300	45.0	cloudy/wind	11	B10	*Lemmus trimucronatus*	R	565	M	47	
25-Jun-11	1300	45.0	cloudy/wind	11	A7	*Lemmus trimucronatus*	R	590	M	94	
25-Jun-11	1300	45.0	cloudy/wind	11	A6	*Lemmus trimucronatus*	R	515	UNK	55	
25-Jun-11	2000	36.0	overcast/fog/wind	9	A20	*Lemmus trimucronatus*	N	18	M	82	
25-Jun-11	2000	36.0	fog	11	A11	*Lemmus trimucronatus*	N	587	F	48	
25-Jun-11	2000	36.0	overcast/fog/wind	9	A14	*Lemmus trimucronatus*	R	97	UNK	70	
25-Jun-11	2000	36.0	fog	11	B8	*Lemmus trimucronatus*	R	590	UNK	72	
14-Jun-11	600	32.0	parly cloudy	3	A2	*Dicrostonyx groenlandicus*	M	502	F	38	Died while tagging
14-Jun-11	1300	35.6	parly cloudy	1	B19	*Dicrostonyx groenlandicus*	UNK	NA	M	39	
14-Jun-11	1300	35.6	parly cloudy	1	B6	*Dicrostonyx groenlandicus*	UNK	NA	M	79	
14-Jun-11	1300	35.6	parly cloudy	2	A13	*Dicrostonyx groenlandicus*	N	NA	F	37	
14-Jun-11	1300	35.6	parly cloudy	3	A4	*Dicrostonyx groenlandicus*	UNK	NA	M	62	
14-Jun-11	2000	37.0	parly cloudy	1	B15	*Dicrostonyx groenlandicus*	UNK	NA	F	55	
14-Jun-11	2000	37.0	parly cloudy	1	B6	*Dicrostonyx groenlandicus*	UNK	NA	F	88	
14-Jun-11	2000	37.0	parly cloudy	1	A5	*Dicrostonyx groenlandicus*	UNK	NA	F	48	
14-Jun-11	2000	37.0	parly cloudy	3	B1	*Dicrostonyx groenlandicus*	UNK	NA	F	55	
15-Jun-11	600	34.0	parly cloudy	1	A6	*Dicrostonyx groenlandicus*	UNK	NA	F	46	
15-Jun-11	600	34.0	parly cloudy	1	A5	*Dicrostonyx groenlandicus*	UNK	NA	F	56	
15-Jun-11	600	34.0	parly cloudy	1	B6	*Dicrostonyx groenlandicus*	UNK	NA	F	89	
15-Jun-11	600	34.0	overcast	3	B1	*Dicrostonyx groenlandicus*	M	NA	F	52	Trap mortality
15-Jun-11	1300	33.8	overcast	1	A13	*Dicrostonyx groenlandicus*	UNK	NA	M	71	
15-Jun-11	1300	33.8	overcast	1	A6	*Dicrostonyx groenlandicus*	UNK	NA	F	59	
15-Jun-11	1300	33.8	overcast	1	B6	*Dicrostonyx groenlandicus*	UNK	NA	M	89	Blood on bedding
15-Jun-11	2000	39.0	overcast	1	B18	*Dicrostonyx groenlandicus*	UNK	NA	F	39	

15-Jun-11	2000	39.0	overcast	1	B5	*Dicrostonyx groenlandicus*	UNK	NA	F	81	
16-Jun-11	600	39.9	parly cloudy	1	B9	*Dicrostonyx groenlandicus*	UNK	NA	M	84	
16-Jun-11	1300	39.9	partly cloudy	1	A18	*Dicrostonyx groenlandicus*	UNK	NA	M	36	
16-Jun-11	1300	39.9	partly cloudy	1	A15	*Dicrostonyx groenlandicus*	UNK	NA	F	90	
16-Jun-11	1300	39.9	partly cloudy	1	A6	*Dicrostonyx groenlandicus*	UNK	NA	F	61	
16-Jun-11	1300	39.9	cloudy	3	A14	*Dicrostonyx groenlandicus*	UNK	NA	F	88	
16-Jun-11	1300	39.9	cloudy	3	B4	*Dicrostonyx groenlandicus*	UNK	NA	F	74	
16-Jun-11	2000	46.0	cloudy	1	A15	*Dicrostonyx groenlandicus*	UNK	NA	F	49	
16-Jun-11	2000	46.0	cloudy	1	A13	*Dicrostonyx groenlandicus*	UNK	NA	M	84	
16-Jun-11	2000	46.0	cloudy	1	A4	*Dicrostonyx groenlandicus*	UNK	NA	F	53	
16-Jun-11	2000	46.0	cloudy	3	A12	*Dicrostonyx groenlandicus*	UNK	NA	F	92	
17-Jun-11	600	39.9	overcast/rain	1	A15	*Dicrostonyx groenlandicus*	UNK	NA	F	69	Lesion on heel, losing weight, trap happy, moved off grid ~300 m
17-Jun-11	600	39.9	overcast/rain	1	A4	*Dicrostonyx groenlandicus*	UNK	NA	F	70	
17-Jun-11	600	39.9	overcast/rain	1	A5	*Dicrostonyx groenlandicus*	UNK	NA	M	49	
17-Jun-11	1300	48.0	overcast	1	B18	*Dicrostonyx groenlandicus*	UNK	NA	M	41	
17-Jun-11	1300	48.0	overcast	1	A16	*Dicrostonyx groenlandicus*	UNK	NA	F	49	
17-Jun-11	1300	48.0	overcast	1	A15	*Dicrostonyx groenlandicus*	UNK	NA	M	41	
17-Jun-11	1300	48.0	overcast	1	A13	*Dicrostonyx groenlandicus*	UNK	NA	M	39	
17-Jun-11	1300	48.0	overcast	1	B9	*Dicrostonyx groenlandicus*	UNK	NA	M	74	
17-Jun-11	1300	48.0	overcast	1	A3	*Dicrostonyx groenlandicus*	UNK	NA	F	51	
17-Jun-11	2000	48.0	partly cloudy	1	B18	*Dicrostonyx groenlandicus*	UNK	NA	F	38	
17-Jun-11	2000	48.0	partly cloudy	1	A13	*Dicrostonyx groenlandicus*	UNK	NA	F	75	
17-Jun-11	2000	48.0	partly cloudy	1	A4	*Dicrostonyx groenlandicus*	UNK	NA	F	53	
17-Jun-11	2000	48.0	partly cloudy	3	B4	*Dicrostonyx groenlandicus*	UNK	NA	F	78	
18-Jun-11	600	37.9	partly cloudy	1	B18	*Dicrostonyx groenlandicus*	UNK	NA	F	37	
18-Jun-11	600	37.9	partly cloudy	1	A13	*Dicrostonyx groenlandicus*	UNK	NA	F	66	
18-Jun-11	600	37.9	partly cloudy	1	B7	*Dicrostonyx groenlandicus*	UNK	NA	UNK	17	
18-Jun-11	600	37.9	partly cloudy	1	A5	*Dicrostonyx groenlandicus*	UNK	NA	F	69	
18-Jun-11	1300	46.9	partly cloudy	1	A13	*Dicrostonyx groenlandicus*	UNK	NA	F	67	
18-Jun-11	1300	46.9	partly cloudy	1	A4	*Dicrostonyx groenlandicus*	UNK	NA	UNK	53	
18-Jun-11	2000	42.1	cloudy	1	B4	*Dicrostonyx groenlandicus*	UNK	NA	F	58	
18-Jun-11	2000	42.1	cloudy	1	A4	*Dicrostonyx groenlandicus*	UNK	NA	F	42	
18-Jun-11	2000	42.1	cloudy	1	A9	*Dicrostonyx groenlandicus*	UNK	NA	F	73	
21-Jun-11	1300	34.0	partly cloudy	7	B6	*Dicrostonyx groenlandicus*	N	NA	M	59	

22-Jun-11	2000	37.9	partly cloudy	7	A16	*Dicrostonyx groenlandicus*	N	NA	M	59	
22-Jun-11	2000	37.9	fog	10	B1	*Dicrostonyx groenlandicus*	N	NA	M	44	White stripe on forehead anterior to black dorsal stripe
22-Jun-11	2000	37.9	partly cloudy	7	B2	*Dicrostonyx groenlandicus*	UNK	NA	M	60	
23-Jun-11	1300	33.8	fog/wind	7	B6	*Dicrostonyx groenlandicus*	UNK	NA	M	72	
24-Jun-11	2000	36.0	overcast/fog/wind	12	A19	*Dicrostonyx groenlandicus*	N	NA	F	32	Distinct dorsal stripe
25-Jun-11	600	39.0	fog	12	A10	*Dicrostonyx groenlandicus*	N	NA	UNK	28	Escaped before sex
25-Jun-11	600	39.0	fog	12	A19	*Dicrostonyx groenlandicus*	N	NA	M	27	Small, juvenile?
25-Jun-11	1300	45.0	cloudy	7	A15	*Dicrostonyx groenlandicus*	UNK	NA	R	60	
25-Jun-11	600	39.0	overcast/fog/wind	9	A20	*Calcarious lapponicus*	N	NA	M	NA	Released unharmed

Appendix B. Live trapping results for brown (*Lemmus trimucronatus*) and collared lemmings (*Dicrostonyx groenlandicus*) including non-target species caught near Barrow, Alaska in August 2011. Fate is reported as new (N), recapture (R), or mortality (M). Unrecorded data are indicated by UNK.

Date	Visit	Temperature (°F)	Weather	Grid	Trap	Species	Fate	Tag	Sex	Weight (g)	Comments
9-Aug-11	600	42.1	partly cloudy/rain	2	B1	*Lemmus trimucronatus*	M	NA	M	31	
9-Aug-11	600	42.1	partly cloudy/rain	2	B6	*Lemmus trimucronatus*	N	73	F	44	
9-Aug-11	600	42.1	partly cloudy/rain	2	B17	*Lemmus trimucronatus*	N	95	M	UNK	
9-Aug-11	600	42.1	partly cloudy/rain	2	A11	*Lemmus trimucronatus*	N	51	M	27	
9-Aug-11	600	42.1	partly cloudy/rain	2	A10	*Lemmus trimucronatus*	N	72	F	61	
9-Aug-11	600	42.1	partly cloudy/rain	2	A9	*Lemmus trimucronatus*	N	60	M	18	Lethargic
9-Aug-11	600	42.1	partly cloudy/rain	2	A7	*Lemmus trimucronatus*	N	94	M	30	
9-Aug-11	600	42.1	partly cloudy/rain	2	A4	*Lemmus trimucronatus*	N	93	M	34	
9-Aug-11	600	42.1	partly cloudy/rain	2	A3	*Lemmus trimucronatus*	N	57	F	79	
9-Aug-11	600	42.1	partly cloudy/rain	2	B9	*Lemmus trimucronatus*	N	58	F	41	
9-Aug-11	1300	45.0	overcast/wind	2	B16	*Lemmus trimucronatus*	N	585	M	18	crooked tag
9-Aug-11	1300	45.0	overcast/wind	2	A17	*Lemmus trimucronatus*	R	95	M	30	
9-Aug-11	600	42.8	partly cloudy/wind	3	A21	*Lemmus trimucronatus*	N	NA	F	24	Lemming escaped during tagging
9-Aug-11	600	42.8	partly cloudy/wind	3	B16	*Lemmus trimucronatus*	N	528	F	76	Possibly pregnant
9-Aug-11	600	42.8	partly cloudy/wind	3	A6	*Lemmus trimucronatus*	N	529	F	73	
9-Aug-11	600	42.8	partly cloudy/wind	3	A16	*Lemmus trimucronatus*	R	505	M	79	
9-Aug-11	600	42.1	overcast	4	B16	*Lemmus trimucronatus*	N	559	M	21	
9-Aug-11	1300	45.0	overcast/wind	5	A12	*Lemmus trimucronatus*	N	71	M	26	
9-Aug-11	600	42.1	rain	6	A8	*Lemmus trimucronatus*	N	575	M	48	
9-Aug-11	600	42.1	rain	6	A2	*Lemmus trimucronatus*	N	576	M	56	
9-Aug-11	2000	45.0	overcast/wind	6	A18	*Lemmus trimucronatus*	N	531	M	81	
10-Aug-11	600	43.0	overcast	1	A11	*Lemmus trimucronatus*	N	577	M	56	
10-Aug-11	600	42.1	overcast	2	A19	*Lemmus trimucronatus*	N	571	M	31	
10-Aug-11	600	42.1	overcast	2	B15	*Lemmus trimucronatus*	N	570	M	22	
10-Aug-11	600	42.1	overcast	2	A17	*Lemmus trimucronatus*	N	519	M	27	
10-Aug-11	600	42.1	overcast	2	A9	*Lemmus trimucronatus*	N	532	M	16	
10-Aug-11	600	42.1	overcast	2	B9	*Lemmus trimucronatus*	N	533	F	75	
10-Aug-11	600	42.1	overcast	2	B1	*Lemmus trimucronatus*	N	534	M	75	
10-Aug-11	600	42.1	overcast	2	B5	*Lemmus trimucronatus*	N	535	F	52	
10-Aug-11	600	42.1	overcast	2	A8	*Lemmus trimucronatus*	R	584	F	67	

10-Aug-11	600	42.1	overcast	2	A7	*Lemmus trimucronatus*	R	4	F	58	
10-Aug-11	2000	42.1	overcast/wind	2	B14	*Lemmus trimucronatus*	N	554	M	24	
10-Aug-11	600	42.1	overcast/wind	3	A17	*Lemmus trimucronatus*	N	59	F	67	Black stripe posterior to forehead
10-Aug-11	600	42.1	overcast/wind	3	B1	*Lemmus trimucronatus*	N	52	F	72	
10-Aug-11	600	42.1	overcast/wind	3	A6	*Lemmus trimucronatus*	N	70	F	62	
10-Aug-11	600	42.1	overcast/wind	3	A11	*Lemmus trimucronatus*	R	529	M	72	
10-Aug-11	1300	42.1	overcast/wind	3	A8	*Lemmus trimucronatus*	N	28	F	75	
10-Aug-11	1300	42.1	overcast/wind	3	A11	*Lemmus trimucronatus*	N	80	M	70	
10-Aug-11	600	42.1	overcast/wind	4	A1	*Lemmus trimucronatus*	M	82	F	40	Capture myopathy, short handling time but dead on release
10-Aug-11	600	43.0	overcast/wind	5	B3	*Lemmus trimucronatus*	N	78	F	38	
10-Aug-11	2000	42.1	overcast/wind	6	A14	*Lemmus trimucronatus*	N	507	M	64	
11-Aug-11	600	39.9	overcast/wind	1	B14	*Lemmus trimucronatus*	N	91	F	61	
11-Aug-11	600	39.9	overcast/wind	2	A19	*Lemmus trimucronatus*	N	89	M	42	
11-Aug-11	600	39.9	overcast/wind	2	A17	*Lemmus trimucronatus*	N	88	M	43	
11-Aug-11	600	39.9	overcast/wind	2	A9	*Lemmus trimucronatus*	N	92	M	38	
11-Aug-11	600	39.9	overcast/wind	2	B3	*Lemmus trimucronatus*	N	29	M	36	
11-Aug-11	600	39.9	overcast/wind	2	B14	*Lemmus trimucronatus*	N	30	M	23	
11-Aug-11	600	39.9	overcast/wind	2	B15	*Lemmus trimucronatus*	N	87	M	18	
11-Aug-11	600	39.9	overcast/wind	2	B17	*Lemmus trimucronatus*	N	85	M	20	
11-Aug-11	600	39.9	overcast/wind	2	B18	*Lemmus trimucronatus*	N	69	M	15	tiny
11-Aug-11	600	39.9	overcast/wind	2	A11	*Lemmus trimucronatus*	R	51	NA	20	
11-Aug-11	600	39.9	overcast/wind	2	A3	*Lemmus trimucronatus*	R	534	NA	68	some blood, no obvious wound
11-Aug-11	600	39.9	overcast/wind	2	B13	*Lemmus trimucronatus*	R	519	NA	29	
11-Aug-11	600	39.0	overcast/wind	3	A21	*Lemmus trimucronatus*	N	84	M	UNK	
11-Aug-11	600	39.0	overcast/wind	3	A9	*Lemmus trimucronatus*	N	563	F	84	
11-Aug-11	600	39.0	overcast/wind	3	B6	*Lemmus trimucronatus*	N	572	M	26	
11-Aug-11	600	39.0	overcast/wind	3	B1	*Lemmus trimucronatus*	N	567	M	65	
11-Aug-11	600	39.0	overcast/wind	3	A11	*Lemmus trimucronatus*	R	80	NA	64	
11-Aug-11	600	39.0	overcast/wind	3	A13	*Lemmus trimucronatus*	R	529	NA	67	
11-Aug-11	600	39.0	overcast/wind	3	A17	*Lemmus trimucronatus*	R	528	NA	86	
11-Aug-11	600	39.0	overcast/wind	3	A19	*Lemmus trimucronatus*	R	505	NA	UNK	
11-Aug-11	1300	42.1	overcast/light wind	3	A6	*Lemmus trimucronatus*	R	529	F	62	
11-Aug-11	2000	43.0	overcast/wind	3	A2	*Lemmus trimucronatus*	R	529	NA	UNK	
11-Aug-11	600	39.0	overcast	4	B17	*Lemmus trimucronatus*	N	568	F	46	

11-Aug-11	600	39.9	overcast	5	B16	*Lemmus trimucronatus*	N	557	M	55	
11-Aug-11	600	39.9	overcast	5	B3	*Lemmus trimucronatus*	N	569	F	46	
11-Aug-11	600	39.9	overcast	6	A18	*Lemmus trimucronatus*	N	573	F	71	
11-Aug-11	600	39.9	overcast	6	A10	*Lemmus trimucronatus*	N	564	F	73	
11-Aug-11	600	39.9	overcast	6	B14	*Lemmus trimucronatus*	R	507	F	67	
12-Aug-11	600	39.2	overcast/very windy	1	A20	*Lemmus trimucronatus*	N	518	M	46	
12-Aug-11	2000	45.0	overcast/wind	1	B12	*Lemmus trimucronatus*	R	91	F	34	
12-Aug-11	600	39.9	overcast/very windy	2	B18	*Lemmus trimucronatus*	N	546	M	20	
12-Aug-11	600	39.9	overcast/very windy	2	B16	*Lemmus trimucronatus*	N	548	F	73	
12-Aug-11	600	39.9	overcast/very windy	2	B15	*Lemmus trimucronatus*	N	547	F	55	
12-Aug-11	600	39.9	overcast/very windy	2	B3	*Lemmus trimucronatus*	N	544	M	24	
12-Aug-11	600	39.9	overcast/very windy	2	A1	*Lemmus trimucronatus*	N	562	F	78	
12-Aug-11	600	39.9	overcast/very windy	2	B13	*Lemmus trimucronatus*	R	519	M	23	
12-Aug-11	600	39.9	overcast/very windy	2	A7	*Lemmus trimucronatus*	R	4	F	50	
12-Aug-11	600	39.9	overcast/very windy	2	A12	*Lemmus trimucronatus*	R	51	M	23	
12-Aug-11	600	39.9	overcast/very windy	3	A14	*Lemmus trimucronatus*	N	560	M	32	
12-Aug-11	600	39.9	overcast/very windy	3	A13	*Lemmus trimucronatus*	N	561	M	50	
12-Aug-11	600	39.9	overcast/very windy	3	A19	*Lemmus trimucronatus*	N	545	F	59	
12-Aug-11	600	39.9	overcast/very windy	3	A6	*Lemmus trimucronatus*	R	529	NA	61	
12-Aug-11	600	39.9	overcast/very windy	3	B8	*Lemmus trimucronatus*	R	70	F	58	
12-Aug-11	600	39.9	overcast/very windy	3	B15	*Lemmus trimucronatus*	R	525	F	62	
12-Aug-11	600	39.9	overcast/very windy	3	A17	*Lemmus trimucronatus*	R	59	F	66	
12-Aug-11	600	39.9	overcast/very windy	3	A20	*Lemmus trimucronatus*	R	505	M	74	
12-Aug-11	1300	42.1	overcast/wind	3	B15	*Lemmus trimucronatus*	R	525	NA	72	
12-Aug-11	2000	42.1	overcast/light wind	3	A19	*Lemmus trimucronatus*	M	59	F	70	Found dead ~1 m from trap
12-Aug-11	2000	42.1	overcast/light wind	3	B16	*Lemmus trimucronatus*	R	528	F	88	
12-Aug-11	600	39.2	overcast/wind	5	A19	*Lemmus trimucronatus*	N	83	F	UNK	
12-Aug-11	600	39.2	overcast/wind	5	A4	*Lemmus trimucronatus*	R	78	NA	34	
12-Aug-11	2000	45.0	overcast/wind	5	A4	*Lemmus trimucronatus*	R	78	NA	37	
12-Aug-11	600	39.2	overcast/wind/rain	6	B3	*Lemmus trimucronatus*	N	27	M	39	
12-Aug-11	2000	45.0	overcast/wind	6	A14	*Lemmus trimucronatus*	R	564	NA	77	
13-Aug-11	600	41.0	overcast/wind	1	A21	*Lemmus trimucronatus*	N	81	M	46	
13-Aug-11	600	41.0	overcast/wind	1	A20	*Lemmus trimucronatus*	N	53	M	34	
13-Aug-11	600	41.0	overcast/wind	1	B12	*Lemmus trimucronatus*	R	91	F	39	

13-Aug-11	600	41.0	overcast/wind	2	B7	*Lemmus trimucronatus*	N	62	F	UNK	
13-Aug-11	600	41.0	overcast/wind	2	A9	*Lemmus trimucronatus*	N	56	M	20	
13-Aug-11	600	41.0	overcast/wind	2	A11	*Lemmus trimucronatus*	N	54	M	28	
13-Aug-11	600	41.0	overcast/wind	2	B1	*Lemmus trimucronatus*	R	534	NA	60	Some blood in trap
13-Aug-11	600	41.0	overcast/wind	2	A7	*Lemmus trimucronatus*	R	4	NA	UNK	
13-Aug-11	600	41.0	overcast/wind	2	A17	*Lemmus trimucronatus*	R	519	NA	22	
13-Aug-11	600	41.0	overcast/wind	2	A19	*Lemmus trimucronatus*	R	89	NA	34	
13-Aug-11	600	42.1	overcast/wind	3	A21	*Lemmus trimucronatus*	N	63	F	73	Possibly pregnant
13-Aug-11	600	42.1	overcast/wind	3	B15	*Lemmus trimucronatus*	N	31	F	107	Possibly pregnant
13-Aug-11	600	42.1	overcast/wind	3	B16	*Lemmus trimucronatus*	R	525	NA	80	
13-Aug-11	600	42.1	overcast/wind	3	A10	*Lemmus trimucronatus*	R	563	F	50	
13-Aug-11	600	42.1	overcast/wind	3	A6	*Lemmus trimucronatus*	R	529	M	61	
13-Aug-11	1300	46.4	overcast/wind	3	A21	*Lemmus trimucronatus*	R	84	M	69	originally recorded M, recorded F on 8/13
13-Aug-11	1300	46.4	overcast/wind	3	A12	*Lemmus trimucronatus*	R	561	M	46	
13-Aug-11	2000	42.8	overcast/wind	3	A6	*Lemmus trimucronatus*	R	529	NA	74	
13-Aug-11	600	41.0	ocercast/fog/wind	4	A9	*Lemmus trimucronatus*	N	508	F	50	
13-Aug-11	600	41.0	ocercast/fog/wind	4	B1	*Lemmus trimucronatus*	N	536	F	45	
13-Aug-11	600	41.0	ocercast/fog/wind	4	B5	*Lemmus trimucronatus*	N	543	F	59	
13-Aug-11	200	44.1	overcast/wind/fog	6	A2	*Lemmus trimucronatus*	N	600	M	68	
13-Aug-11	1300	45.0	overcast/wind/fog	6	B3	*Lemmus trimucronatus*	N	55	F	75	
16-Aug-11	600	35.6	partly cloudy/wind	7	A1	*Lemmus trimucronatus*	N	32	F	56	Lethargic in hand
16-Aug-11	2000	39.9	overcast/wind	7	A1	*Lemmus trimucronatus*	N	36	M	39	
16-Aug-11	600	36.0	partly cloudy/wind	8	B8	*Lemmus trimucronatus*	N	67	F	70	left ear tag
16-Aug-11	600	36.0	partly cloudy/wind	8	A8	*Lemmus trimucronatus*	N	33	M	26	left ear tag
16-Aug-11	600	36.0	partly cloudy/wind	8	B2	*Lemmus trimucronatus*	N	49	M	16	very small, may not be a good tag
16-Aug-11	600	35.6	partly cloudy/wind	9	A10	*Lemmus trimucronatus*	N	48	M	24	not a great tag
16-Aug-11	600	35.6	partly cloudy/wind	9	A13	*Lemmus trimucronatus*	N	34	M	UNK	
16-Aug-11	600	35.6	partly cloudy/wind	9	B14	*Lemmus trimucronatus*	N	35	F	56	
16-Aug-11	1300	39.0	partly cloudy/wind	9	A13	*Lemmus trimucronatus*	N	514	M	23	
16-Aug-11	600	35.6	partly cloudy	10	A13	*Lemmus trimucronatus*	N	582	F	39	
16-Aug-11	600	35.6	partly cloudy	10	A14	*Lemmus trimucronatus*	N	509	F	39	
16-Aug-11	600	35.6	partly cloudy	10	B6	*Lemmus trimucronatus*	N	510	F	39	
16-Aug-11	600	35.6	partly cloudy	10	A3	*Lemmus trimucronatus*	N	511	M	57	
16-Aug-11	600	35.6	partly cloudy	10	A7	*Lemmus trimucronatus*	N	512	F	34	

16-Aug-11	600	35.6	partly cloudy	10	B14	*Lemmus trimucronatus*	N	513	M	52	
16-Aug-11	1300	39.9	partly cloudy/light wind	10	A13	*Lemmus trimucronatus*	N	651	M	27	
16-Aug-11	600	35.6	overcast	11	A7	*Lemmus trimucronatus*	M	NA	F	25	
16-Aug-11	600	35.6	overcast	11	B1	*Lemmus trimucronatus*	N	542	M	22	
16-Aug-11	600	35.6	overcast	11	B4	*Lemmus trimucronatus*	N	538	F	38	
16-Aug-11	600	35.6	overcast	11	B5	*Lemmus trimucronatus*	N	537	M	19	
16-Aug-11	600	35.6	overcast	11	B7	*Lemmus trimucronatus*	N	517	F	21	
16-Aug-11	600	35.6	overcast	11	B11	*Lemmus trimucronatus*	N	599	F	20	
16-Aug-11	600	35.6	overcast	11	B14	*Lemmus trimucronatus*	N	598	M	18	
16-Aug-11	600	35.6	overcast	11	B19	*Lemmus trimucronatus*	N	597	M	17	
16-Aug-11	600	35.6	overcast	11	A21	*Lemmus trimucronatus*	N	579	F	31	
16-Aug-11	600	35.6	overcast	11	A15	*Lemmus trimucronatus*	N	580	M	24	
16-Aug-11	600	35.6	overcast	11	A13	*Lemmus trimucronatus*	N	578	F	17	
16-Aug-11	600	35.6	overcast	11	B13	*Lemmus trimucronatus*	R	565	F	64	
16-Aug-11	2000	39.9	overcast/light wind	11	B15	*Lemmus trimucronatus*	N	652	F	37	
16-Aug-11	2000	39.9	overcast/light wind	11	A7	*Lemmus trimucronatus*	N	653	F	76	
16-Aug-11	2000	39.9	overcast/light wind	11	B4	*Lemmus trimucronatus*	R	538	F	44	
16-Aug-11	600	35.6	partly cloudy	12	A10	*Lemmus trimucronatus*	N	581	M	71	
17-Aug-11	600	37.0	overcast	8	B4	*Lemmus trimucronatus*	N	654	M	24	
17-Aug-11	600	37.0	overcast	8	B2	*Lemmus trimucronatus*	R	49	M	10	
17-Aug-11	600	37.0	overcast	8	A7	*Lemmus trimucronatus*	R	67	F	70	
17-Aug-11	600	37.0	overcast	9	A5	*Lemmus trimucronatus*	N	655	M	19	
17-Aug-11	600	37.0	overcast	9	A11	*Lemmus trimucronatus*	N	656	M	28	
17-Aug-11	600	37.0	overcast	9	A19	*Lemmus trimucronatus*	N	657	M	25	
17-Aug-11	600	37.0	overcast	9	A20	*Lemmus trimucronatus*	N	658	M	28	
17-Aug-11	1300	41.0	overcast	9	B17	*Lemmus trimucronatus*	N	39	F	32	Very docile
17-Aug-11	1300	41.0	overcast	9	A19	*Lemmus trimucronatus*	N	47	M	31	
17-Aug-11	2000	39.0	overcast	9	A18	*Lemmus trimucronatus*	R	20	F	66	
17-Aug-11	600	37.9	overcast	10	A2	*Lemmus trimucronatus*	N	659	M	24	
17-Aug-11	600	37.9	overcast	10	A3	*Lemmus trimucronatus*	N	675	UNK	UNK	
17-Aug-11	600	37.9	overcast	10	A7	*Lemmus trimucronatus*	N	674	F	42	
17-Aug-11	600	37.9	overcast	10	B6	*Lemmus trimucronatus*	N	673	F	64	
17-Aug-11	1300	42.1	overcast	10	B12	*Lemmus trimucronatus*	N	667	M	84	
17-Aug-11	600	37.0	overcast/wind	11	B16	*Lemmus trimucronatus*	N	46	M	68	

17-Aug-11	600	37.0	overcast/wind	11	A15	*Lemmus trimucronatus*	N	44	M	18	Not the best tag
17-Aug-11	600	37.0	overcast/wind	11	A10	*Lemmus trimucronatus*	N	43	M	UNK	Not the best tag
17-Aug-11	600	37.0	overcast/wind	11	A12	*Lemmus trimucronatus*	N	41	M	20	
17-Aug-11	600	37.0	overcast/wind	11	A1	*Lemmus trimucronatus*	N	42	F	66	Possibly pregnant
17-Aug-11	600	37.0	overcast/wind	11	A9	*Lemmus trimucronatus*	N	40	M	23	
17-Aug-11	600	37.0	overcast/wind	11	A19	*Lemmus trimucronatus*	R	597	NA	22	
17-Aug-11	600	37.0	overcast/wind	11	B3	*Lemmus trimucronatus*	R	542	NA	22	
17-Aug-11	1300	39.9	overcast	11	B19	*Lemmus trimucronatus*	N	672	M	17	
17-Aug-11	1300	39.9	overcast	11	B5	*Lemmus trimucronatus*	N	671	M	18	very lethargic
17-Aug-11	1300	39.9	overcast	11	A12	*Lemmus trimucronatus*	N	670	M	20	
17-Aug-11	1300	39.9	overcast	11	A5	*Lemmus trimucronatus*	R	653	F	72	
17-Aug-11	2000	39.0	overcast	11	B19	*Lemmus trimucronatus*	N	37	M	28	
17-Aug-11	2000	39.0	overcast	11	A15	*Lemmus trimucronatus*	N	101	M	19	
17-Aug-11	2000	39.0	overcast	11	A7	*Lemmus trimucronatus*	N	38	M	23	
17-Aug-11	2000	39.0	overcast	11	B6	*Lemmus trimucronatus*	N	120	F	82	Pregnant?
17-Aug-11	2000	39.0	overcast	11	B3	*Lemmus trimucronatus*	N	118	M	23	
17-Aug-11	2000	39.0	overcast	11	A13	*Lemmus trimucronatus*	R	578	NA	26	
17-Aug-11	2000	39.0	overcast	11	A9	*Lemmus trimucronatus*	R	40	NA	25	
17-Aug-11	2000	39.0	overcast	11	B4	*Lemmus trimucronatus*	R	538	NA	48	Trap failed to fire but lemming in trap with door open
17-Aug-11	600	37.9	overcast/wind	12	B12	*Lemmus trimucronatus*	R	581	NA	68	
18-Aug-11	600	37.0	overcast/fog	7	B2	*Lemmus trimucronatus*	R	32	NA	57	
18-Aug-11	1300	39.0	overcast	7	A2	*Lemmus trimucronatus*	N	628	M	24	
18-Aug-11	1300	39.0	overcast	7	B2	*Lemmus trimucronatus*	R	36	NA	35	
18-Aug-11	2000	39.0	overcast	7	A2	*Lemmus trimucronatus*	R	36	NA	38	
18-Aug-11	600	37.0	overcast/fog	8	B1	*Lemmus trimucronatus*	N	115	F	64	
18-Aug-11	600	37.0	overcast/fog	8	A8	*Lemmus trimucronatus*	R	33	NA	22	
18-Aug-11	1300	39.0	overcast	8	A8	*Lemmus trimucronatus*	N	665	M	23	
18-Aug-11	600	37.0	overcast/fog	9	Near A5	*Lemmus trimucronatus*	M	655	NA	UNK	mortality found near A5
18-Aug-11	600	37.0	overcast/fog	9	B3	*Lemmus trimucronatus*	N	117	M	48	
18-Aug-11	600	37.0	overcast/fog	9	B7	*Lemmus trimucronatus*	N	116	F	23	
18-Aug-11	600	37.0	overcast/fog	9	A12	*Lemmus trimucronatus*	N	119	F	20	
18-Aug-11	600	37.0	overcast/fog	9	A9	*Lemmus trimucronatus*	R	121	M	23	
18-Aug-11	600	37.0	overcast/fog	9	B14	*Lemmus trimucronatus*	R	35	NA	56	
18-Aug-11	600	37.0	overcast/fog	9	A17	*Lemmus trimucronatus*	R	21	NA	75	

18-Aug-11	1300	39.0	overcast	9	A8	*Lemmus trimucronatus*	N	650	F	57	Tag on left ear, small tear on right ear, recap?
18-Aug-11	1300	39.0	overcast	9	A7	*Lemmus trimucronatus*	N	649	F	27	
18-Aug-11	1300	39.0	overcast	9	B9	*Lemmus trimucronatus*	N	648	M	72	Possibly tagged previously, notch in right ear
18-Aug-11	2000	37.4	overcast	9	B15	*Lemmus trimucronatus*	N	102	F	27	
18-Aug-11	2000	37.4	overcast	9	B5	*Lemmus trimucronatus*	N	104	M	26	bald spot
18-Aug-11	600	37.9	overcast/fog	10	A18	*Lemmus trimucronatus*	N	NA	UNK	32	Not tagged, lemming escaped
18-Aug-11	600	37.9	overcast/fog	10	B4	*Lemmus trimucronatus*	N	122	F	50	
18-Aug-11	600	37.9	overcast/fog	10	B10	*Lemmus trimucronatus*	N	103	F	71	
18-Aug-11	600	37.9	overcast/fog	10	B6	*Lemmus trimucronatus*	R	511	NA	62	
18-Aug-11	600	37.9	overcast/fog	10	A7	*Lemmus trimucronatus*	R	674	NA	41	
18-Aug-11	1300	39.9	overcast	10	B19	*Lemmus trimucronatus*	N	630	F	44	
18-Aug-11	1300	39.9	overcast	10	B4	*Lemmus trimucronatus*	R	511	M	58	
18-Aug-11	1300	39.9	overcast	10	A13	*Lemmus trimucronatus*	R	651	NA	25	
18-Aug-11	2000	37.4	overcast	10	B14	*Lemmus trimucronatus*	N	105	M	29	
18-Aug-11	2000	37.4	overcast	10	B6	*Lemmus trimucronatus*	R	673	F	73	possibly pregnant
18-Aug-11	600	37.0	overcast/fog	11	B10	*Lemmus trimucronatus*	M	662	M	15	died during handling
18-Aug-11	600	37.0	overcast/fog	11	B5	*Lemmus trimucronatus*	M	671	NA	UNK	Found dead outside trap B5
18-Aug-11	600	37.0	overcast/fog	11	A19	*Lemmus trimucronatus*	N	664	M	23	
18-Aug-11	600	37.0	overcast/fog	11	A13	*Lemmus trimucronatus*	N	663	F	22	
18-Aug-11	600	37.0	overcast/fog	11	A9	*Lemmus trimucronatus*	N	661	M	18	
18-Aug-11	600	37.0	overcast/fog	11	B15	*Lemmus trimucronatus*	N	700	UNK	7	
18-Aug-11	600	37.0	overcast/fog	11	B1	*Lemmus trimucronatus*	N	626	F	31	
18-Aug-11	600	37.0	overcast/fog	11	A21	*Lemmus trimucronatus*	R	579	F	40	
18-Aug-11	600	37.0	overcast/fog	11	B17	*Lemmus trimucronatus*	R	46	M	65	
18-Aug-11	600	37.0	overcast/fog	11	A5	*Lemmus trimucronatus*	R	538	F	40	
18-Aug-11	600	37.0	overcast/fog	11	B19	*Lemmus trimucronatus*	R	672	M	19	
18-Aug-11	600	37.0	overcast/fog	11	A12	*Lemmus trimucronatus*	R	41	NA	20	
18-Aug-11	600	37.0	overcast/fog	11	B16	*Lemmus trimucronatus*	R	597	NA	22	
18-Aug-11	600	37.0	overcast/fog	11	A7	*Lemmus trimucronatus*	R	17	NA	UNK	Large lemming
18-Aug-11	1300	39.0	overcast	11	A1	*Lemmus trimucronatus*	M	NA	M	15	Trap mortality
18-Aug-11	1300	39.0	overcast	11	B13	*Lemmus trimucronatus*	N	114	M	25	
18-Aug-11	1300	39.0	overcast	11	A13	*Lemmus trimucronatus*	N	113	M	26	
18-Aug-11	1300	39.0	overcast	11	A5	*Lemmus trimucronatus*	N	112	M	27	Tear in right ear
18-Aug-11	1300	39.0	overcast	11	A4	*Lemmus trimucronatus*	N	61	M	22	

18-Aug-11	1300	39.0	overcast	11	A6	*Lemmus trimucronatus*	R	653	NA	77	Originally recorded as tag 635
18-Aug-11	1300	39.0	overcast	11	B4	*Lemmus trimucronatus*	R	538	F	33	
18-Aug-11	2000	39.0	overcast	11	B12	*Lemmus trimucronatus*	N	625	NA	30	
18-Aug-11	2000	39.0	overcast	11	A3	*Lemmus trimucronatus*	N	622	M	24	
18-Aug-11	2000	39.0	overcast	11	B15	*Lemmus trimucronatus*	R	46	NA	69	
18-Aug-11	2000	39.0	overcast	11	B4	*Lemmus trimucronatus*	R	538	NA	43	
18-Aug-11	2000	39.0	overcast	11	A7	*Lemmus trimucronatus*	R	38	NA	12	unsure of weight
18-Aug-11	2000	39.0	overcast	11	A12	*Lemmus trimucronatus*	R	506	NA	53	
18-Aug-11	2000	39.0	overcast	11	A13	*Lemmus trimucronatus*	R	670	NA	23	
18-Aug-11	2000	39.0	overcast	11	A4	*Lemmus trimucronatus*	R	653	NA	75	
18-Aug-11	2000	39.0	overcast	11	A6	*Lemmus trimucronatus*	R	17	NA	83	
18-Aug-11	600	37.9	overcast/fog	12	A14	*Lemmus trimucronatus*	N	627	M	24	
18-Aug-11	2000	37.4	overcast	12	A12	*Lemmus trimucronatus*	N	655	M	31	
19-Aug-11	600	34.0	overcast/fog	7	A1	*Lemmus trimucronatus*	R	32	NA	63	
19-Aug-11	600	34.0	overcast/fog	7	A2	*Lemmus trimucronatus*	R	36	NA	38	
19-Aug-11	2000	37.0	overcast/wind	7	B2	*Lemmus trimucronatus*	R	36	NA	37	originally recorded as tag 38
19-Aug-11	600	34.0	overcat/fog/light wind	8	B12	*Lemmus trimucronatus*	N	631	F	50	
19-Aug-11	600	34.0	overcat/fog/light wind	8	A8	*Lemmus trimucronatus*	N	632	M	20	
19-Aug-11	600	34.0	overcat/fog/light wind	8	A10	*Lemmus trimucronatus*	N	633	M	33	
19-Aug-11	600	34.0	overcat/fog/light wind	8	A11	*Lemmus trimucronatus*	N	634	M	26	
19-Aug-11	600	34.0	overcat/fog/light wind	8	B3	*Lemmus trimucronatus*	N	635	M	21	
19-Aug-11	600	34.0	overcat/fog/light wind	8	B8	*Lemmus trimucronatus*	N	636	M	43	
19-Aug-11	600	34.0	overcat/fog/light wind	8	B4	*Lemmus trimucronatus*	R	654	NA	24	
19-Aug-11	2000	37.0	overcast/wind	8	B2	*Lemmus trimucronatus*	N	619	F	19	
19-Aug-11	600	35.6	overcast	9	B5	*Lemmus trimucronatus*	M	NA	M	22	
19-Aug-11	600	35.6	overcast	9	B8	*Lemmus trimucronatus*	N	637	F	56	
19-Aug-11	600	35.6	overcast	9	B15	*Lemmus trimucronatus*	N	638	F	30	
19-Aug-11	600	35.6	overcast	9	A14	*Lemmus trimucronatus*	R	514	NA	29	
19-Aug-11	600	35.6	overcast	9	A17	*Lemmus trimucronatus*	R	20	NA	61	
19-Aug-11	2000	37.4	overcast/wind	9	A8	*Lemmus trimucronatus*	N	679	M	18	
19-Aug-11	600	35.1	overcast/light wind	10	B14	*Lemmus trimucronatus*	M	NA	M	44	Trap mortality
19-Aug-11	600	35.1	overcast/light wind	10	B18	*Lemmus trimucronatus*	N	640	F	64	
19-Aug-11	600	35.1	overcast/light wind	10	B17	*Lemmus trimucronatus*	N	641	F	26	
19-Aug-11	600	35.1	overcast/light wind	10	B12	*Lemmus trimucronatus*	N	639	UNK	13	

19-Aug-11	600	35.1	overcast/light wind	10	A18	*Lemmus trimucronatus*	N	643	M	28	
19-Aug-11	600	35.1	overcast/light wind	10	A14	*Lemmus trimucronatus*	N	642	M	31	
19-Aug-11	600	35.1	overcast/light wind	10	B6	*Lemmus trimucronatus*	N	644	M	29	
19-Aug-11	600	35.1	overcast/light wind	10	A8	*Lemmus trimucronatus*	N	645	F	63	
19-Aug-11	600	35.1	overcast/light wind	10	B4	*Lemmus trimucronatus*	N	647	F	53	
19-Aug-11	600	35.1	overcast/light wind	10	A1	*Lemmus trimucronatus*	N	601	F	71	
19-Aug-11	600	35.1	overcast/light wind	10	A2	*Lemmus trimucronatus*	R	512	NA	44	
19-Aug-11	600	35.1	overcast/light wind	10	A10	*Lemmus trimucronatus*	R	103	NA	67	
19-Aug-11	1300	39.9	overcast/wind	10	B17	*Lemmus trimucronatus*	N	149	F	25	
19-Aug-11	2000	37.4	overcast/wind	10	A4	*Lemmus trimucronatus*	R	675	NA	28	
19-Aug-11	600	34.0	overcast/fog	11	A21	*Lemmus trimucronatus*	N	106	M	27	
19-Aug-11	600	34.0	overcast/fog	11	A13	*Lemmus trimucronatus*	N	110	M	25	
19-Aug-11	600	34.0	overcast/fog	11	A11	*Lemmus trimucronatus*	N	109	NA	24	escaped before sex
19-Aug-11	600	34.0	overcast/fog	11	A15	*Lemmus trimucronatus*	N	111	M	24	
19-Aug-11	600	34.0	overcast/fog	11	B2	*Lemmus trimucronatus*	N	108	M	37	
19-Aug-11	600	34.0	overcast/fog	11	B12	*Lemmus trimucronatus*	N	107	M	UNK	
19-Aug-11	600	34.0	overcast/fog	11	B17	*Lemmus trimucronatus*	N	126	M	25	
19-Aug-11	600	34.0	overcast/fog	11	A19	*Lemmus trimucronatus*	R	597	NA	22	
19-Aug-11	600	34.0	overcast/fog	11	A12	*Lemmus trimucronatus*	R	670	NA	23	
19-Aug-11	600	34.0	overcast/fog	11	A9	*Lemmus trimucronatus*	R	661	NA	20	
19-Aug-11	600	34.0	overcast/fog	11	A8	*Lemmus trimucronatus*	R	653	NA	72	Wet fur
19-Aug-11	600	34.0	overcast/fog	11	A7	*Lemmus trimucronatus*	R	17	M	UNK	Recap from June occasion
19-Aug-11	600	34.0	overcast/fog	11	A4	*Lemmus trimucronatus*	R	61	NA	23	
19-Aug-11	600	34.0	overcast/fog	11	A1	*Lemmus trimucronatus*	R	626	NA	38	Dead pinky, born in trap
19-Aug-11	600	34.0	overcast/fog	11	B1	*Lemmus trimucronatus*	R	120	NA	94	
19-Aug-11	600	34.0	overcast/fog	11	B4	*Lemmus trimucronatus*	R	538	NA	42	
19-Aug-11	600	34.0	overcast/fog	11	B3	*Lemmus trimucronatus*	R	118	NA	24	
19-Aug-11	600	34.0	overcast/fog	11	B9	*Lemmus trimucronatus*	R	565	NA	62	
19-Aug-11	1300	37.9	overcast	11	B9	*Lemmus trimucronatus*	R	59	NA	23	
19-Aug-11	1300	37.9	overcast	11	A7	*Lemmus trimucronatus*	R	38	NA	19	
19-Aug-11	1300	37.9	overcast	11	B4	*Lemmus trimucronatus*	R	538	NA	UNK	
19-Aug-11	1300	37.9	overcast	11	A12	*Lemmus trimucronatus*	R	670	NA	UNK	
19-Aug-11	1300	37.9	overcast	11	B13	*Lemmus trimucronatus*	R	46	NA	UNK	
19-Aug-11	1300	37.9	overcast	11	A20	*Lemmus trimucronatus*	R	579	NA	UNK	

19-Aug-11	2000	37.0	partly cloudy/wind	11	A6	*Lemmus trimucronatus*	N	148	F	28	
19-Aug-11	2000	37.0	partly cloudy/wind	11	A8	*Lemmus trimucronatus*	R	17	NA	81	
19-Aug-11	600	35.1	overcast/wind	12	A14	*Lemmus trimucronatus*	R	96	NA	65	
19-Aug-11	1300	37.9	overcast	12	A12	*Lemmus trimucronatus*	N	602	F	24	
20-Aug-11	600	37.0	overcast/wind	7	A3	*Lemmus trimucronatus*	R	36	NA	38	
20-Aug-11	600	37.0	overcast/wind	7	B18	*Lemmus trimucronatus*	N	138	M	27	
20-Aug-11	1300	39.9	overcast/wind	7	A1	*Lemmus trimucronatus*	R	36	NA	40	hard to read tag
20-Aug-11	2000	39.0	overcast/wind/rain	7	A1	*Lemmus trimucronatus*	R	36	NA	42	
20-Aug-11	600	37.0	overcast/wind	8	B2	*Lemmus trimucronatus*	N	132	M	22	
20-Aug-11	600	37.0	overcast/wind	8	A8	*Lemmus trimucronatus*	R	140 / 67	F	54	tag pulled out of ear, originally 67
20-Aug-11	600	37.0	overcast/wind	8	B4	*Lemmus trimucronatus*	R	654	M	25	
20-Aug-11	600	39.0	overcast/wind	9	B12	*Lemmus trimucronatus*	N	136	M	25	
20-Aug-11	600	39.0	overcast/wind	9	B10	*Lemmus trimucronatus*	N	144	M	27	
20-Aug-11	600	39.0	overcast/wind	9	A6	*Lemmus trimucronatus*	R	650	NA	61	
20-Aug-11	600	39.0	overcast/wind	9	A14	*Lemmus trimucronatus*	R	514	NA	23	
20-Aug-11	1300	39.9	overcast/wind/rain	9	A10	*Lemmus trimucronatus*	M	121	NA	21	
20-Aug-11	2000	39.2	overcast/wind	9	B10	*Lemmus trimucronatus*	N	142	F	49	
20-Aug-11	600	39.0	overcast/wind	10	A13	*Lemmus trimucronatus*	M	651	NA	24	
20-Aug-11	600	39.0	overcast/wind	10	A10	*Lemmus trimucronatus*	N	146	M	30	
20-Aug-11	600	39.0	overcast/wind	10	A7	*Lemmus trimucronatus*	R	674	F	41	
20-Aug-11	600	39.0	overcast/wind	10	B10	*Lemmus trimucronatus*	R	103	F	61	
20-Aug-11	600	39.0	overcast/wind	10	B4	*Lemmus trimucronatus*	R	647	NA	NA	
20-Aug-11	1300	39.9	overcast/wind/light rain	10	A1	*Lemmus trimucronatus*	M	NA	M	20	
20-Aug-11	2000	39.0	overcast/wind/fog/rain	10	B16	*Lemmus trimucronatus*	N	611	M	21	
20-Aug-11	2000	39.0	overcast/wind/fog/rain	10	B4	*Lemmus trimucronatus*	R	647	NA	47	
20-Aug-11	2000	39.0	overcast/wind/fog/rain	10	B17	*Lemmus trimucronatus*	R	639	NA	20	
20-Aug-11	600	37.0	overcast/very windy	11	B16	*Lemmus trimucronatus*	N	612	F	42	
20-Aug-11	600	37.0	overcast/very windy	11	B12	*Lemmus trimucronatus*	N	677	F	23	
20-Aug-11	600	37.0	overcast/very windy	11	B19	*Lemmus trimucronatus*	R	37	NA	22	
20-Aug-11	600	37.0	overcast/very windy	11	B17	*Lemmus trimucronatus*	R	597	FNA	25	
20-Aug-11	600	37.0	overcast/very windy	11	B13	*Lemmus trimucronatus*	R	46	NA	32	
20-Aug-11	600	37.0	overcast/very windy	11	A8	*Lemmus trimucronatus*	R	17	NA	77	
20-Aug-11	600	37.0	overcast/very windy	11	A12	*Lemmus trimucronatus*	R	670	NA	24	
20-Aug-11	600	37.0	overcast/very windy	11	B9	*Lemmus trimucronatus*	R	565	NA	61	

20-Aug-11	600	37.0	overcast/very windy	11	B4	*Lemmus trimucronatus*	R	622	NA	NA	
20-Aug-11	600	37.0	overcast/very windy	11	B3	*Lemmus trimucronatus*	R	120	NA	84	
20-Aug-11	600	37.0	overcast/very windy	11	B2	*Lemmus trimucronatus*	R	108	NA	22	
20-Aug-11	600	37.0	overcast/very windy	11	A1	*Lemmus trimucronatus*	R	626	NA	40	
20-Aug-11	600	37.0	overcast/very windy	11	A2	*Lemmus trimucronatus*	R	38	NA	34	
20-Aug-11	1300	39.9	overcast/wind	11	A13	*Lemmus trimucronatus*	R	663	NA	27	
20-Aug-11	1300	39.9	overcast/wind	11	A7	*Lemmus trimucronatus*	R	38	NA	22	
20-Aug-11	1300	39.9	overcast/wind	11	A4	*Lemmus trimucronatus*	R	61	NA	20	
20-Aug-11	2000	39.0	overcast/wind/rain	11	B12	*Lemmus trimucronatus*	N	614	M	19	
20-Aug-11	2000	39.0	overcast/wind/rain	11	A4	*Lemmus trimucronatus*	R	61	NA	21	
20-Aug-11	2000	39.0	overcast/wind/rain	11	B8	*Lemmus trimucronatus*	R	17	NA	80	
20-Aug-11	600	39.0	overcast/wind	12	A14	*Lemmus trimucronatus*	R	96	NA	57	
20-Aug-11	1300	39.9	overcast/wind	12	B6	*Lemmus trimucronatus*	N	130	M	30	
9-Aug-11	600	42.1	partly cloudy/wind	1	A20	*Dicrostonyx groenlandicus*	N	NA	M	36	
9-Aug-11	600	42.1	partly cloudy/wind	1	B12	*Dicrostonyx groenlandicus*	N	NA	M	59	
9-Aug-11	2000	45.0	overcast/wind	1	A15	*Dicrostonyx groenlandicus*	N	NA	M	66	
10-Aug-11	600	43.0	overcast	1	Unknown	*Dicrostonyx groenlandicus*	N	NA	F	39	
10-Aug-11	600	43.0	overcast	1	B12	*Dicrostonyx groenlandicus*	R	NA	F	57	
10-Aug-11	2000	42.1	overcast/wind	1	A13	*Dicrostonyx groenlandicus*	N	NA	F	43	
11-Aug-11	600	39.9	overcast/wind	1	A13	*Dicrostonyx groenlandicus*	N	NA	F	101	
13-Aug-11	1300	45.0	overcast/wind/fog	1	B16	*Dicrostonyx groenlandicus*	N	NA	F	44	
13-Aug-11	600	42.1	overcast/wind	3	B12	*Dicrostonyx groenlandicus*	N	NA	F	85	
13-Aug-11	1300	46.4	overcast/wind	3	A18	*Dicrostonyx groenlandicus*	N	NA	F	33	
17-Aug-11	2000	39.0	overcast	7	B18	*Dicrostonyx groenlandicus*	N	NA	F	24	
18-Aug-11	2000	39.0	overcast	7	A16	*Dicrostonyx groenlandicus*	N	NA	F	34	
20-Aug-11	600	39.0	overcast/wind	12	B17	*Dicrostonyx groenlandicus*	N	NA	NA	49	
16-Aug-11	2000	39.9	overcast/wind	8	A12	*Sorex tundrensis*	M	NA	F	UNK	Trap mortality