TECHNICAL REPORT

MONITORING LEMMING ABUNDANCE AND DISTRIBUTION NEAR BARROW, ALASKA, 2012

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U.S. Department of the Interior

January 2014

This report may be cited as follows:

Ott, K. O. and Currier, K. D. 2012. Monitoring lemming abundance and distribution near Barrow, Alaska, 2012. U.S. Fish & Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. Technical Report. 45 pp.

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 lemmings (*Lemmus trimucronatus*) are a keystone species in the high arctic and exhibit significant fluctuations in abundance approximately every 3-4 years. Reproductive effort and success of Steller's eiders and other birds appears to be correlated with years of peak lemming abundance. Given concerns over a lack of empirical data, possible shifts in the periodicity or amplitude of fluctuations, potential effects of climate change, and resulting implications for conservation of Steller's eiders and other birds, baseline monitoring of lemming abundance near Barrow began in 2011. Principal objectives of this research were:

1. Continue monitoring variation in brown lemming abundance near Barrow using mark-recapture at established research plots;
2. Connect local students to next-door science by recruiting high-school field assistants;
3. Estimate abundance of brown lemmings with capture data collected in June and August; and,
4. Compare trends in abundance over a single summer and between years to begin establishing a baseline and quantifying the relationship between lemming abundance and reproductive success of Steller's eiders and other waterfowl;

Brown lemmings were live-trapped using traditional mark-recapture techniques on twelve sampling plots near Barrow, during two 5-day trapping periods in June and August 2012. Capture data and modeling results indicated an increase in brown lemmings over the summer. Abundance estimates (N) ranged from 1 to 17 animals per plot in June, and 8 to 56 animals per plot in August. A five-fold increase in average abundance was recorded between June ($\bar{N} = 5 \pm 1.24$) and August ($\bar{N} = 29 \pm 4.02$) and density estimates, ranged from 5 to 65 lemmings/ha. Although trends in average abundance were very similar in 2011 and 2012, abundance varied across sampling plots and was not consistent between years. The first two years of this research are likely representative of moderate lemming abundance. Furthermore, 2011 and 2012 were both years of moderate nesting effort in Steller's eiders, with 27 and 19 documented nests, respectively.

This project fulfilled outreach and education objectives by increasing opportunities for local youth to connect with nature through next-door science. Three local students were hired in 2012 to assist with all aspects of field work. In addition, we maintain a commitment to conducting community presentations, to share preliminary results and announce future opportunities for local-hires.

Although the current body of work is limited to two consecutive years, this study has already begun to quantify the shifts in abundance that characterize lemming populations. Given the association between lemming abundance and reproductive effort of Steller's eiders and other ground-nesting birds, long-term monitoring of lemming fluctuations near Barrow is crucial to informing future management decisions for Steller's eiders. The value of this research will compound over time, and in the context of climate change, it represents an indispensable component of baseline monitoring in the arctic.

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ACKNOWLEDGEMENTS

This research would not have been possible without the support and encouragement of numerous people. We are grateful to E. Debevec, M. Flamme, C. Perham, E. Rexstad, D. Safine, and N. Stellrecht for guiding the study design. North Slope Borough biologists C. George, C. Hanns, and R. Suydam provided invaluable recommendations and the Arctic National Wildlife Refuge generously loaned their collection of Sherman live-traps. We offer sincere thanks to a dedicated and hard-working crew: M. Bartkovich, K. Currier, M. Davis, B. Shryock, and S. Torrence, and to C. Latty and J. Morton for sharing their own summer staff with this project. We also thank Barrow High School student technicians S. Ahsoak, K. Goodwin, and C. Wilson for their assistance and enthusiasm in the field. Considerable recognition is due to D. Safine and the 2012 Eider Project technicians and volunteers for providing tremendous logistical support to the lemming crew. We extend our sincere thanks to the community of Barrow and Ukpeaġvik Inupiat Corporation for allowing us to conduct this work on their land. The Barrow Arctic Science Consortium facilitated student hires, and we would like to thank the Bureau of Land Management and North Slope Borough School District for their continued support of our outreach and education efforts. A final and significant thanks is due to D. Safine and S. Torrence for greatly improving this report by advising the data analysis and reviewing previous drafts.

INTRODUCTION

Background

The U.S. Fish and Wildlife Service (Service) listed the Alaska-breeding population of Steller's eiders (*Polysticta stelleri*) as threatened on June 11, 1997 (62 FR 31748) due to a substantial contraction of the species' breeding range in Alaska and resulting vulnerability of the remaining Alaska-breeding population to extirpation (USFWS 1997). Currently, the Alaska-breeding population of Steller's eiders nests primarily near Barrow on the Arctic Coastal Plain (ACP), where they breed only intermittently (Quakenbush et al. 2004). Reproductive effort and nest success of Steller's eiders, and other ground-nesting species, are believed to increase in years of peak lemming abundance (Quakenbush et al. 2004); although this relationship has not been quantified. During years of peak abundance, lemmings are a significant food source for avian and mammalian predators including owls, jaegers, weasels, and foxes (Pitelka et al. 1955*a*, Pitelka et al. 1955*a* and 1955*b*, MacLean et al. 1974, Larter 1998, Quakenbush et al. 2004, and Holt 2003, 2004, and 2010). Steller's eiders and other ground-nesting birds may increase reproductive effort in peak lemming years, because the probability of nest predation may decline when predators can select for hyper-abundant lemmings (Roselaar 1979, Summers 1986, Dhondt 1987, and Quakenbush et al. 2004).

Of at least 10 extant species, only brown (*Lemmus trimucronatus*) and collared lemmings (*Dicrostonyx groenlandicus*) inhabit the ACP, where brown lemmings are a keystone species that undergoes dramatic fluctuations in abundance roughly every 3-4 years (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). Collared lemmings on the ACP are less common, and while their abundance may increase in years when brown lemmings are scarce, their populations do not experience the extreme interannual fluctuations that characterize brown lemmings (Pitelka 1973). Both species demonstrate mild habitat preferences, although brown lemmings may become ubiquitous across habitat types in peak years. Collared lemmings primarily occupy drier elevated sites (e.g., high-center polygons; Pitelka 1973, MacLean et al. 1974, Batzli and Pitelka 1983 and 1993, Morris et al. 2000), while brown lemmings prefer moist habitat dominated by grasses and sedges (e.g., low-center polygons, troughs, and wet meadows; Pitelka 1973, MacLean et al. 1974, Batzli and Pitelka 1983, Morris et al. 2000).

Lemmings do not hibernate, but build subnivean tunnels where they feed and reproduce throughout winter (Pitelka 1957, Maclean et al. 1974, Stenseth and Ims 1993). This aspect of their natural history combined with high reproductive potential (sexual maturity may be attained in as little as 21 days; Mullen 1968) likely contributes to eruptive population growth. In addition, other biotic and abiotic factors (e.g., demographics, resource availability, predator abundance, phenology, disease, weather, and other variability in weather) may propel fluctuations, although the influence of each component is difficult to isolate, and predicting shifts in abundance is problematic (Andrews et al. 1975, Batzli and Pitelka 1983, Chitty 1955 and 1967, Erlinge et al. 1983, Krebs and Myers 1974, Krebs 1993, Lidicker 1975 and 1985, Mullen 1968, Pitelka et al. 1955b and 1955b, Pitelka 1957 and 1973, Schultz 1964 and 1969, Stenseth 1980, Stenseth and Ims 1993). Nonetheless, traditional ecological knowledge and other observations were generally consistent with an approximate 3-4 year period between notable shifts in the Barrow area, and 2008 was the most recent year with remarkably high lemming abundance. However, uncertainty regarding the periodicity and amplitude of fluctuations has increased in recent years [Robert Suydam, North Slope Borough Department of Wildlife Management (NSB Wildlife), *personal communication*], and these concerns are heightened by the unknown effects of climate change. If fluctuations in lemming abundance are perturbed or the intensity of peak years has diminished, there could be significant impacts to conservation of Steller's eiders and other ground nesting birds.

The artic climate is currently warming at an accelerated pace (Moritz et al. 2002), and while global mean surface temperature has risen 0.4°C in the past 150 years, the arctic warming trend has increased by two to three times that amount (Post 2009). The arctic environment is characterized by cold temperatures and short growing seasons (Berteaux et al. 2004), although recent widespread shifts in vegetation, and annual declines in terrestrial snow cover in the Northern Hemisphere may be linked to arctic warming (Post 2009). Researchers speculate these vegetative shifts and reduced snow cover could contribute to a collapse of microtine populations, disrupting patterns of abundance and distribution, and altering trophic interactions of the arctic ecosystem (Levy 2008, Post 2009). Climate change could also impact lemmings by physically altering the subnivean environment that provides insulation, access to forage, and protection from predators (Kausrud et al. 2008). Researchers have noted a critical spring phase in which small mammals may be dramatically affected by heat loss, ice formation, and availability of food due to changes in relative humidity and hardness of snow cover (Kausrud et al. 2008, Levy 2008). As climate change progresses, increased warming and earlier break-up could exacerbate these impacts on over-wintering microtines, with subsequent cascading effects on other arctic species and ecosystem processes (Morell 2012). Therefore, establishment of integrated baseline monitoring is essential to understanding the advancing effects of climate change on the artic (Post 2009), and robust multi-year estimates of lemming abundance in the Barrow area are currently lacking.

Existing lemming data on the North Slope are limited to indices of abundance and minimum number known alive (MKNA) obtained through removal (snap) trapping, hand catching, incidental observations, road mortality counts, winter nest surveys, or indirect comparisons to predator abundance (Østbye et al. 1993, Pitelka et al. 1955, MacLean et al. 1974, Krebs et al. 2008). Radio-collaring has also been attempted to estimate home range size (Banks et al. 1975, Brooks 1993). However, these measures are less statistically robust because animals are captured or sighted only once and efforts are often unevenly distributed or entirely opportunistic. These methods also provide little inference about the area to which an abundance estimate pertains. Furthermore, removal data from the Barrow area may not be sufficiently informative due to potentially biased sampling of collared lemmings as a result of trap-line placement in drier high-center polygonal habitat (Peterson and Holt 1999, Holt 2003, 2004, and 2010). Removal studies are also associated with significantly higher rates of lethal by-catch (Peterson and Holt 1999, Holt 2003, 2004, and 2010).

Lemmings may be more likely to activate the treadle of a snap trap (which has no sides and may be approached from any direction), than deliberately enter a live trap. Furthermore, lemmings reportedly to respond poorly to bait (Framstad et al. 1993). For these reasons, most existing research on lemming population dynamics has relied on removal through snap trapping (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). In contrast, mark-recapture techniques are minimally invasive, produce more robust data, and are well supported 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).

Although mark-recapture requires extensive manpower and logistical complexity (Pitelka 1973), recent advances in equipment and methodology endorse application of this technique with lemmings. Methods used to live-capture lemmings have included 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). For our objectives, hand-catching is not appropriate due to inherent differences in observer abilities, lack of repetition, and geographic scale sampled. Pit fall traps would also be unsuitable for mark-recapture work because researchers have documented increased trap-shyness after the initial capture (Jensen et al. 1993). Furthermore, excavating cavities for pit fall traps would be impractical for early spring trapping near Barrow, as the soil active layer 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 toe clipping, indelible non-toxic inks or paints, passive integrative transponder tags (PIT tags), and ear tags. Toe clipping is highly invasive (Andrews et al. 1975) and does not provide a sufficiently unique mark when hundreds of animals are captured over a period of days. Furthermore, application of indelible ink or paint is impractical in wet environments or on small mammals that groom fastidiously (K. Ott, *personal observation*). PIT tags are a more permanent alternative, however their application requires experience and proficiency in small mammal handling, further training, and if conducted incorrectly, presents a higher probability of injury of death to the study animal. Therefore, we used corrosion resistant, laser etched metal ear tags (National Band and Tag Co. Newport, KY) because they are minimally invasive and require less training. Ear tags have been used to mark lemmings in at least two similar field studies; neither study documented behavioral interference, or reduced health or social status of lemmings as a result of ear tag application (Jensen et al. 1993 and Morris et al. 2000). Although collared lemmings lack external ears, and therefore cannot be tagged, we expect this limitation to be minor because collared lemmings are not known to experience dramatic shifts in abundance.

Objectives

Due to a lack of empirical data, concerns regarding possible shifts in the periodicity or amplitude of lemming fluctuations, potential effects of climate change, and the resulting implications for conservation of Steller's eiders and other birds, baseline monitoring of lemming abundance near Barrow began in 2011. Principal objectives of this research in were:

1. Continue monitoring variation in brown lemming abundance near Barrow using mark-recapture at established research plots;
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METHODS

Study area

Our study area is located near Barrow, Alaska within 1 kilometer (km) of the road system (Figure 1). Barrow is located near the northern-most point of continental North America, bordered by the Chukchi Sea to the west and Beaufort Sea to the east at 71° 18'N, 156° 40' W. Habitat is predominantly coastal tundra wetland dominated by *Arctophila* spp. and *Carex* spp. Summers are cool and humid with 24 hours of daylight from mid-May through early August. Appropriate land use permits were obtained from Ukpeaġvik Inupiat Corporation, and all off-road travel was on foot.

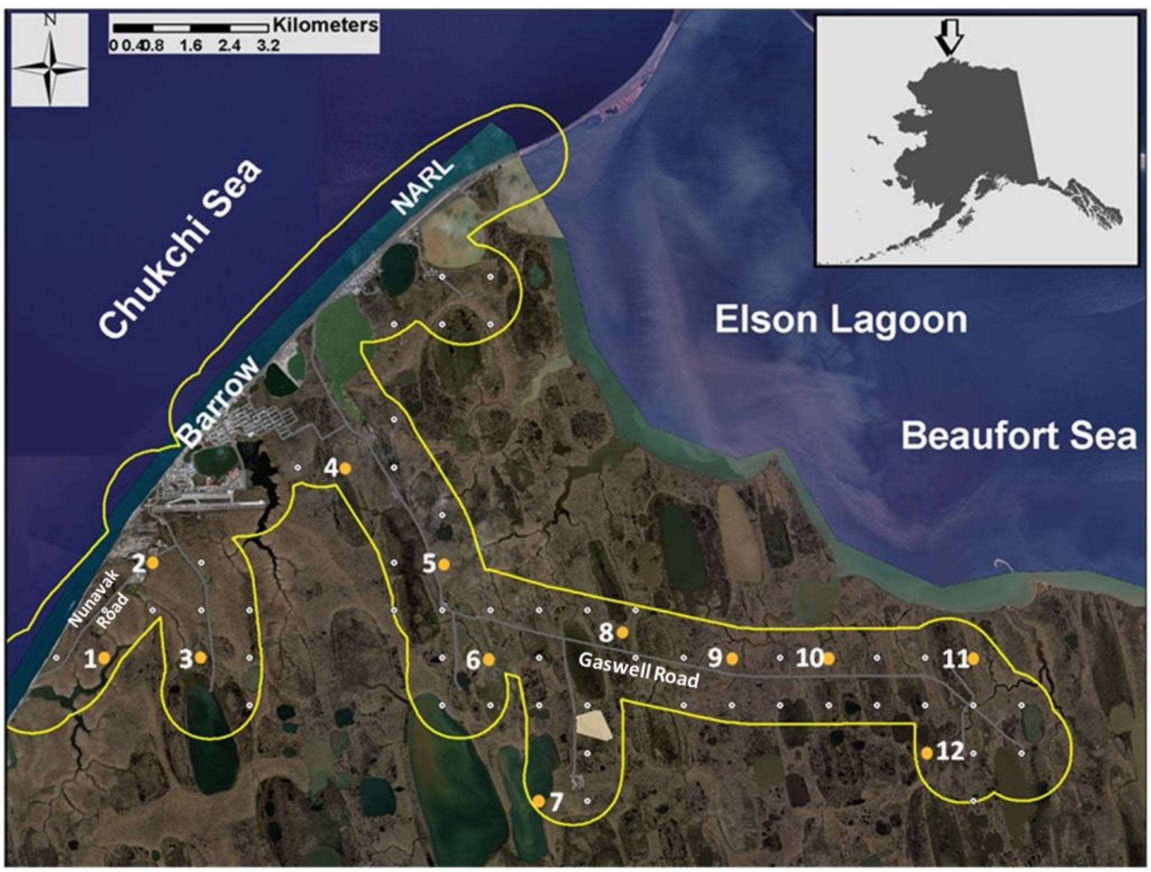


Figure 1. Location of the lemming monitoring study area near Barrow, Alaska. The yellow buffer represents the area within 1 km of the road to which the study area was limited. In 2011, 12 fixed sampling locations were selected for monitoring. These were maintained in 2012 with the exception of plot 8, which shifted 400 m to avoid a nesting spectacled eider.

Sampling design

Following sampling protocols developed by Rexstad and others for microtines 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 in 2011. Potential sampling locations were limited to within 1 km of the existing road system to ensure that plots could be visited with required frequency. A grid of 1 km^2 cells was overlain across the sampling area, and the center point of each cell represented a potential monitoring plot. Cells were numbered sequentially starting from Nunavak Road and continuing to eastern Gaswell Road. The first cell was selected at random, followed by systematic selection of every fourth cell to maximize spatial coverage and even distribution of sampling locations within the study area. The center point of each selected cell became the vertex of a sampling plot, and the orientation of each plot was determined by random compass bearing. Each sampling plot consisted of 40 traps at 10 meter (m) intervals in the shape of a 100 m x 100 m chevron (Figure 2). This design facilitated trap checks by a small crew while reducing the amount of back-tracking and overall trap-check time.

At sampling plots, trap stations were temporarily marked with numbered, orange pin flags and small wooden stakes were installed at plot corners to help define plot boundaries in future years. A Sherman trap was set at each station within a 5 m radius of the flag, with priority given to trap placement in an established runway or near a burrow entrance (Figure 3). This flexibility in trap placement was adopted to maximize capture probability (Rausch 1950, Perham 2002).

If a selected sampling location was in close proximity to any known threatened eider or snowy owl nest, the plot was shifted (on a random bearing) a minimum of 400 m from the former, and 200 m from the latter. For example, sampling plots selected in 2011 were maintained in 2012 with the exception of plot 8, which shifted 400 m to avoid a nesting spectacled eider. To further minimize impacts on other species or research projects, preexisting research plots and trap lines were avoided, and care was taken to minimize or avoid disturbance to other ground-nesting waterfowl and shorebirds.

Similar to other North Slope research (Pitelka and Batzli 1993), this study involved two summer sampling periods (early-June and mid-August). June sampling was timed to coincide with the end of break-up, to estimate post-winter abundance before the annual influx of migratory predators and lack of snow cover impact mortality rates. August sampling was timed to coincide with the onset of snow cover, to estimate late-summer abundance and provide a seasonal trend. Traps were deployed for 5 consecutive nights (occasions) at each plot, with three daily checks (0600, 1300, and 2000) to minimize trap mortality and maximize effective trap nights. During the first week of each sampling period, plots 1 through 6 were sampled by two 2-person crews. One crew was responsible for monitoring three plots during a single trap check, and crews often alternated between checking plots 1-3 and 4-6 over the five-day duration of the sampling period. See Table 1 for a detailed 2012 sampling schedule.

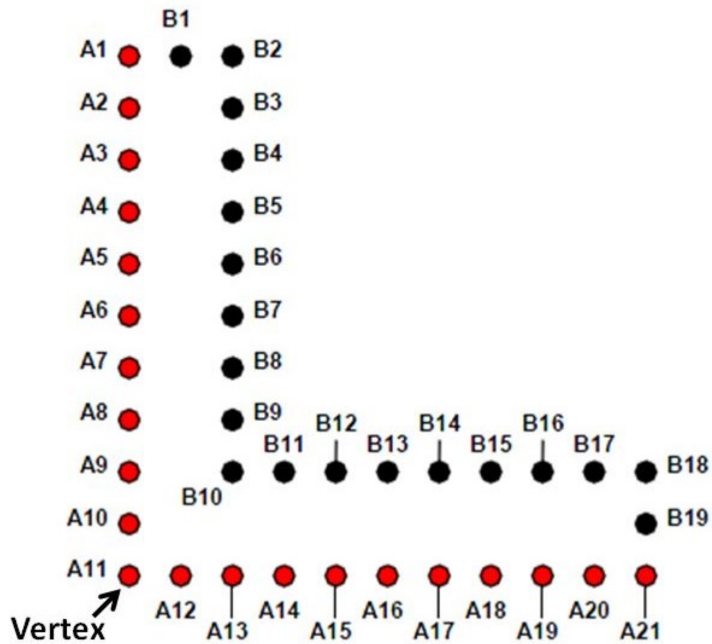


Figure 2. Plot design for live trapping small mammals developed by Rexstad and Debevec (2004). Plots consist of 40 Sherman traps at 10 m intervals in the shape of a 100 m x 100 m chevron.

Live trapping protocol

During the first two days of week 1, traps were prepared with bait and bedding and placed on plots 1-6. Traps remained closed until 2000 on the first trap night when they were simultaneously opened. Plots were monitored following the same sequence with three daily checks, until 2000 on the 5th trap night 5, when all traps were closed and collected. On the following day, sampling shifted to the remaining plots (7-12) and followed the same schedule.

Table 1. Field schedule for 2012 lemming monitoring near Barrow, Alaska.

Date	Time	Description
1-9 June		Inspect/repair traps and covers, prepare bait and bedding.
10 June	0800	Install plots 1-4
11 June	0800	Install plots 5-6
	2000	Open all traps
12 June	0600, 1300, 2000	Check traps on plots 1-6
13 June	0600, 1300, 2000	Check traps on plots 1-6
14 June	0600, 1300, 2000	Check traps on plots 1-6
15 June	0600, 1300, 2000	Check traps on plots 1-6
16 June	0600, 1300, 2000	Check traps on plots 1-6, remove all trapping equipment
17 June	0800	Install plots 7-10
18 June	0800	Install plots 11-12
	2000	Open all traps
19 June	0600, 1300, 2000	Check traps on plots 7-12
20 June	0600, 1300, 2000	Check traps on plots 7-12
21 June	0600, 1300, 2000	Check traps on plots 7-12
22 June	0600, 1300, 2000	Check traps on plots 7-12
23 June	0600, 1300, 2000	Check traps on plots 1-6, remove all trapping equipment
11 August	0800	Install plots 1-6
	2000	Open all traps
12 August	0600, 1300, 2000	Check traps on plots 1-6
13 August	0600, 1300, 2000	Check traps on plots 1-6
14 August	0600, 1300, 2000	Check traps on plots 1-6
15 August	0600, 1300, 2000	Check traps on plots 1-6
16 August	0600, 1300, 2000	Check traps on plots 1-6, remove all trapping equipment
17 August	0800	Install plots 7-10
18 August	0800	Install plots 11-12
	2000	Open traps
19 August	0600, 1300, 2000	Check traps on plots 7-12
20 August	0600, 1300, 2000	Check traps on plots 7-12
21 August	0600, 1300, 2000	Check traps on plots 7-12
22 August	0600, 1300, 2000	Check traps on plots 7-12
23 August	0600, 1300, 2000	Check traps on plots 1-6, remove all trapping equipment
24-25 August		Clean, repair, and store trapping equipment

We used 3” x 3.5” x 9” folding aluminum Sherman traps to live-capture lemmings. Each trap was protected from the elements by a waterproof roofing felt cover secured with two aluminum stakes (Figure 3). Because lemmings may be predisposed to seek shelter (Craig George, NSB Wildlife *personal communication*), trap covers might also improve capture success. Each trap was supplied with a calorie-rich bait mixture of peanut butter and sunflower seeds, as well as sterile cotton nestlets (Ancare, Bellmore, NY). Cotton nestlets were used in favor of synthetic bedding material because the latter may cause choking (Melanie Flamme, National Park Service, *personal communication*). Bait and nesting material were replenished as needed. The traditional bait-ball delivery method was adapted by wrapping bait in wax paper and suspending it from the rear door of the trap (Veselka and Collins 2011). Suspending the bait removed weight from the treadle which allowed finer tuning of the trigger mechanism, and likely improved trap success. This bait delivery technique also promotes a hygienic environment inside the trap, facilitates cleaning, and enables unsoiled materials to be reused.

Figure 3. Trap placement in established lemming runway to maximize capture probability. The trap is protected by a waterproof cover secured with two aluminum stakes.

Upon encountering a closed trap, a 1-gallon Ziploc® bag was secured over the door, and the animal was gently tipped into the bag. Non-target species were recorded and immediately released. Lemmings were identified to species and weighed with a Pesola spring scales while in the Ziploc bag. The weight of the bag and its other contents (e.g., bedding) were subsequently subtracted to obtain individual body weight. If the lemming was not tagged, it was gently restrained and removed from the bag. A numbered metal ear tag was applied to the right ear, sex was determined, and the animal was released. Recaptured animals (those already marked) were recorded, weighed, and released directly from the capture bag. Total handling time for any animal did not exceed ten minutes. This project following accepted protocols for small mammal trapping in Alaska, and all work was conducted in full compliance 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 crew members handling lemmings wore light leather gloves for personal protection.

Data analysis

<u>Abundance estimates</u>
Due to the short, 5-day duration of sampling periods, lemming abundance estimates (N) were obtained 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), and June and August data were analyzed independently. Closed population models assume (1) there are no births, deaths, emigrations or immigration over the sampling period; (2) tags are not lost; and (3) tags are read and recorded correctly. Sufficient recaptures of marked individuals are required for accurate abundance estimates (Rexstad and Debevec 2004, Debevec and Flamme 2007), and in cases of very few recaptures, model outputs in Program MARK will mirror the number of individuals tagged, which equates to an index of abundance (i.e., MNKA).

Capture data are incorporated into an input file which consists of a binomial series, where “1” indicates detection (capture or recapture) and “0” indicates an animal was not encountered (Cooch and White 2011). Closed population models do not address survival, which is assumed to be 1 (White 1999), but instead estimate initial capture probability (p), recapture probability (c), and abundance (White 1999, Lukacs 2011). For exploratory analysis, we considered models where p and c either varied by occasion (time; t) or remained constant (.). In time-dependent models, it was necessary to constrain the last capture probability (p_5) in order for MARK to reach numerical convergence (e.g., {N, p(t)c(.)} and {N, p(t)c(t)}). Therefore, p_5 was set equal to c_4 when c varied with time, or $p_5 = c$ when c was constant. We also considered models with time dependent or constant capture probabilities that were equal. For example, p and c varied by occasion in model {N, p(t)=c(t)} but were also equal, i.e., probabilities of initial capture and recapture were identical on a given trap day but differed between days. We considered models where the difference in Akaike’s information criterion (ΔAIC; Akaike 1978) was < 2 because these models have approximately equal weight in the data (Cooch and White 2011). The best fit model was then identified based on the fewest number of parameters and greatest AIC_c weight: a refinement to Akaike’a criterion which includes bias adjustment for small sample size (Cooch and White 2011).

Density estimates

Capture data were arranged by Trap ID, and used to estimate density of brown lemmings with Program DENSITY under the model likelihood method of spatially explicit capture recapture (SECR; Efford 2004 and 2009). Maximum likelihood SECR provides well-defined density estimates by incorporating a spatial parameter in the modeling process. A digital representation of our chevron-shaped sampling plot (Figure 2) was created using figurative XY coordinates for each trap. Based on capture probabilities derived from Program MARK, this digital layout was assigned a 50 m buffer to the area of integration for likelihood-based models. The maximum likelihood SECR method was chosen over inverse prediction SECR or basic closed population estimates, to avoid substantial bias in abundance estimation, and account for the least "catchable" members in the population (Borchers and Efford 2008). Estimated home range size (i.e., root pooled spatial variance) derived by Program DENSITY was the square root of spatial variance in capture locations pooled over individuals (Efford 2004 and 2009).

RESULTS

Live trapping

Capture summary

Total captures for brown and collared lemmings in 2012 are summarized in Table 2, and raw capture data for both sampling periods are presented in Appendices A and B. Overall, there were 607 brown lemming captures, representing 328 individuals, and 71 collared lemmings representing at least 30 individuals. Because collared lemmings could not be tagged, only animals encountered for the first time on a given plot, or with differentiating characteristics (e.g., sex or weight), could be considered unique individuals. Because the number of individually identifiable collared lemmings was insufficient for mark-recapture analysis, 2012 abundance estimates pertain only to brown lemmings.

Table 2. Summary of total captures and unique individuals encountered for brown (*Lemmus trimucronatus*) and collared lemmings (*Dicrostonyx groenlandicus*) live-trapped in 2012 near Barrow, Alaska.

		June		August	
Species	**Plot**	**Captures**	**Individuals**	**Captures**	**Individuals**
Lemmus trimucronatus	1	1	1	9	6
	2	26	16	61	39
	3	7	6	37	21
	4	10	5	36	24
	5	10	5	32	19
	6	6	3	51	18
	7	35	7	17	9
	8	28	8	23	15
	9	4	2	71	41
	10	9	4	58	30
	11	5	2	33	24
	12	3	2	35	21
	Total	144	61	463	267
Dicrostonyx groenlandicus	1	14	3	5	4
	2	1	1	0	0
	3	6	3	2	1
	4	0	0	0	0
	5	0	0	0	0
	6	7	3	1	1
	7	19	5	6	1
	8	1	1	1	1
	9	1	1	0	0
	10	0	0	0	0
	11	2	1	1	1
	12	3	2	1	1
	Total	54	20	17	10

As in 2011, brown lemmings were captured more frequently than collared lemmings, and opposing captures trends were detected between June and August. Capture frequency of brown lemmings increased over the summer, while collared lemming captures decreased (Figure 4).

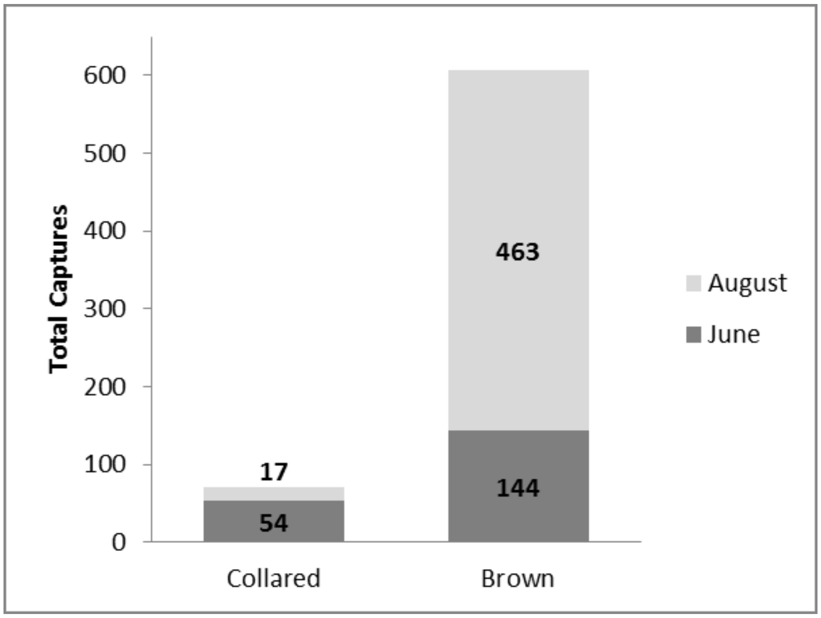


Figure 4. Comparison of total captures between June and August, 2012 for brown and collared lemmings live-trapped near Barrow, Alaska. Overall, there were 607 brown and 71 collared lemming captures.

<u>Body weight</u>

Mean body weight for brown lemmings decreased over the summer from 55 ± 9.6 g, to 35 ± 16.3 g in August. Descriptive statistics for collared lemmings could not be obtained due to the risk of pseudoreplication from repeated measurements on an unknown number of individuals.

<u>Non-target species and mortality</u>

Encounters with non-target species were extremely uncommon. There was no by-catch in June. In August, there was a single shrew (*Sorex* spp.) trap mortality. This is not unexpected as shrews are insectivorous, have a high metabolic rate, and often succumb in live traps due to a lack of suitable food (Perham 2002, Rexstad and Debevec 2004, Stromgren 2008). A second trapped shrew was lethargic but released alive in August.

Lemming mortality was also uncommon. Of nearly 700 total captures, there were 16 lemming mortalities; four in June and 12 in August. With the exception of one collared lemming in June, all mortalities were brown lemmings. During the August sampling period, most mortalities (10 of 12) occurred overnight between 2000 and 0600, despite bait and nesting material provided ad libitum. There was only one instance where a lemming was euthanized because could not be reasonably expected to recover.

Abundance

Although brown lemmings were detected on all plots in June, with 144 total captures, low recaptures produced a sparse dataset which resulted in model selection uncertainty. Based solely on AIC_c and ΔAIC_c values < 2, model {N, p(t)c(t)}, where *p* and *c* are time dependent and unequal, indicated the best-fit for the June dataset (Table 3). However, lack of recaptures in the input file confounded parameter estimation for all models, as evidenced by a discrepancy between the number of estimated versus actual parameters in a given model (Table 3). Therefore, because models {N,p(.)=c(.)} and {N,p(.)c(.)} successfully estimated the greatest percentage of parameters, we speculate they may fit the data more accurately. Because model {N,p(.)=c(.)} was also the most parsimonious, this model may best describe the June data although we acknowledge a degree of uncertainty regarding June model selection and abundance estimates.

Table 3. Summary of closed population model selection statistics generated by Program MARK with June 2012 capture data.

Model	AIC_c	ΔAIC_c	AIC_c Weight	Model Likelihood	Parameters Estimated	Parameters Actual	Deviance
{N,p(t)c(t)}	248.88	0.00	0.95893	1.0000	10	20	195.69
{N,p(t)=c(t)}	255.24	3.36	0.03996	0.0417	9	17	204.19
{N,p(t)c(.)}	263.74	14.86	0.00057	0.0006	12	17	206.22
{N,p(.)=c(.)}	264.20	15.32	0.00045	0.0005	7	13	217.39
{N,p(.)c(.)}	268.10	19.22	0.00006	0.0001	9	14	217.05
{N,p(.)c(t)}	270.79	21.91	0.00002	0.0000	12	17	213.27

June abundance estimates, based on model {N, p(.)=c(.)} are presented in Table 4. When fewer than 10 individuals are marked, or there are very few recaptures, Program MARK struggles to reach numerical convergence and model outputs closely mirror the number of individuals tagged (Rexstad and Debevec 2004, Debevec 2005). Extremely small standard errors (SE) and unrealistically narrow confidence intervals (CI) for abundance estimates on plots 1, 6, and 9-12 are likely artifacts of sparse recapture data (Table 4). Average brown lemming abudance in June was 5 (SE = 1.24), with a range of 1 to 17 animals (plots 1 and 2, respectively). Nearly identical encounter histories on plots 4 and 5 resulted in equal abundance estimates.

Table 4. June 2012 abundance estimates (N), standard errors (SE), and 95% confidence intervals (CI) for brown lemmings live-trapped near Barrow, Alaska.

Plot	N	SE	Lower CI	Upper CI
1	1	$6.26e^{-14}$	1.00	1.00
2	17	1.67	15.30	23.62
3	6	1.03	6.01	12.90
4	5	0.95	5.00	11.54
5	5	0.95	5.00	11.54
6	3	$3.01e^{-12}$	3.00	3.00
7	7	1.11	7.03	14.06
8	9	1.20	8.05	15.20
9	2	$6.16e^{-5}$	2.00	2.00
10	4	$1.73e^{-3}$	4.00	4.00
11	2	$7.31e^{-5}$	2.00	2.00
12	2	$2.92e^{-13}$	2.00	2.00

Analysis of August data was not hindered by low recaptures and Program MARK returned two models for consideration: {N, p(.)=c(.)} and {N,p(.)c(.)} (Table 5). Both models included constant capture and recapture probability, where *p* and *c* were unequal in the second ranked, less parsimonious candidate model: {N,p(.)c(.)}. Of both models with $\Delta AIC_c < 2$, model {N,p(.)=c(.)} was given the highest AIC_c ranking, and had the fewest number of parameters. Therefore, we selected candidate model {N, p(.)=c(.)}as the best-fit explaining the August dataset and abundance estimates based on this model are presented in Table 6. Again, very similar encounter histories produced identical esimates on two plots (3 and 12). Abundance ranged from 8 to 56 animals on plots 1 and 9 respectively, with an average of 29 (SE = 4.02) over all plots. This was more than five times the average abundance in June.

Table 5. Summary of closed population model selection statistics generated by Program MARK with August 2012 capture data.

Model	AIC_c	ΔAIC_c	AIC_c Weight	Model Likelihood	Parameters	Deviance
{N,p(.)=c(.)}	368.3352	0.0000	0.44654	1.0000	13	371.3829
{N,p(.)c(.)}	368.6804	0.3452	0.37575	0.8415	14	369.6841
{N,p(t)c(.)}	371.6800	3.3448	0.08386	0.1878	17	366.5326
{N,p(t)=c(t)}	372.0657	3.7305	0.06915	0.1549	17	366.9183
{N,p(.)c(t)}	374.7399	6.4047	0.01816	0.0407	17	369.5925
{N,p(t)c(t)}	376.7832	8.4480	0.00654	0.0146	20	365.4557

Table 6. August 2012 abundance estimates including SEs and 95% CIs for brown lemmings live-trapped near Barrow, Alaska.

Plot	N	SE	Lower CI	Upper CI
1	8	1.11	6.31	15.15
2	50	4.70	43.65	62.93
3	28	3.42	24.00	38.45
4	27	3.33	22.79	36.90
5	26	3.24	21.58	35.36
6	24	3.15	20.37	33.81
7	12	2.18	9.73	19.80
8	20	2.85	16.78	29.16
9	56	4.99	48.61	69.01
10	39	4.09	33.77	50.73
11	31	3.60	26.43	41.53
12	28	3.42	24.00	38.45

Density

As with abundance, June capture data were too sparse to derive accurate density estimates. Therefore estimates of brown lemming density in 2012 pertain only to the August dataset. Density ranged from 4.6 to 65.4 individuals/ha, with an average of 27.9 individuals/ha (SE = 5.4) over all plots (Table 7).

Table 7. Maximum likelihood density estimates (MLDens), including SEs, 95% CIs, and estimated home range size (RPSV) for brown lemmings live-trapped near Barrow, Alaska in August 2012.

Plot	MLDens (idv/ha)	SE-MLDens	LCI-MLDens	UCI-MLDens	RPSV (m)
1	8.57	11.14	1.22	60.22	N/A
2	48.83	13.13	29.09	81.97	15.2
3	36.05	10.38	20.73	62.68	6.8
4	16.91	6.17	8.45	33.82	25.2
5	27.02	7.8	15.52	47.03	10.1
6	11.93	3.47	6.82	20.86	19
7	4.60	2.24	1.86	11.36	26
8	23.07	8.49	11.47	46.38	10.5
9	65.41	13.94	43.27	98.87	9.8
10	17.85	4.76	10.67	29.83	20.6
11	47.07	18.94	22.04	100.56	14.6
12	16.72	6.13	8.33	33.55	32.1

Maximum likelihood SECR in Program DENSITY generated the null model, g0(.)σ(.), as the best-fit model with a half normal detection function. Estimated home range size (i.e., root pooled spatial variance) was not derived for plot 1, due to meager August capture data at this location. Estimated home range size varied between 6.8 m (plot 3) to 32.1 m (plot 12). Plots with higher estimated lemming density tended to toward smaller home range sizes compared to those with lower density (Table 7). Confidence interval width was inversely correlated to both the number of individuals marked as well as the number of recaptures at a particular plot, although the latter relationship was more pronounced (Figure 5). For example, although the number of tags deployed on plots 5 and 6 were nearly identical, higher recapture rates on plot 6 produced a narrower 95% CI.

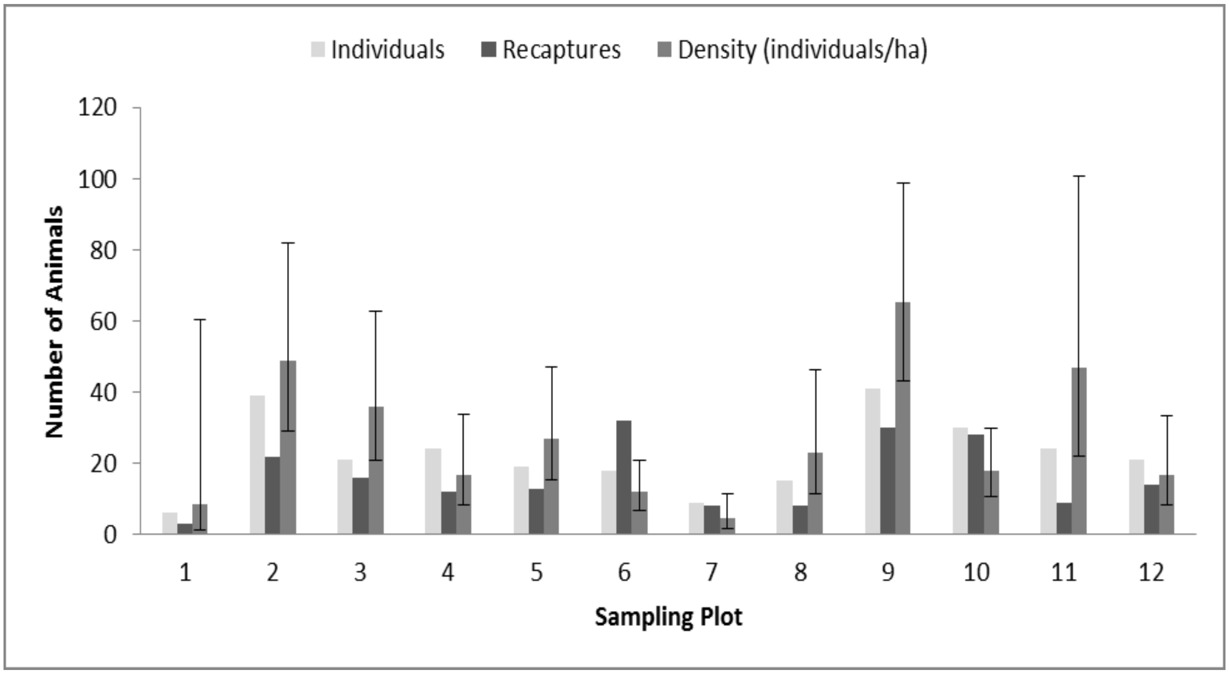
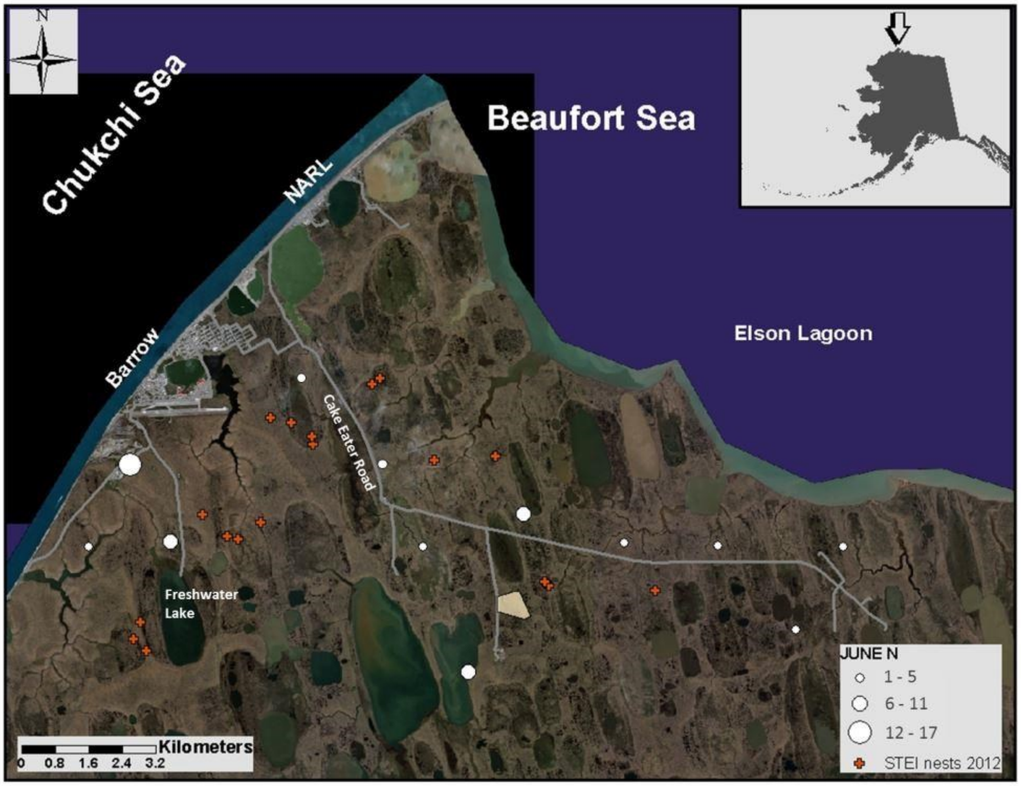


Figure 5. Estimated density (individuals/ha) of brown lemmings compared to the number of individuals and the number of recaptures per plot in August 2012 near Barrow, Alaska. Error bars represent 95% CIs of estimated density per plot.

Spatial variation

As in 2011, we detected variation in brown lemming abundance across the study area. Compared to the eastern plots, there was marginally greater abundance on the western plots in June (Figure 6A). The distribution of nesting Steller's eiders also varied across the eider survey area, with indistinct clusters near freshwater lake and Cake Eater Road (Figure 6A). Overall, while abundance continued to vary across plots, brown lemming abundance was greater in August, and there was a noticable increase on the eastern plots (Figure 6B).

(A)



(B)

Figure 6. Variation in brown lemming abundance across 12 plots near Barrow, Alaska in June (A) and August (B) 2012. Based on abundance estimates, plots were assigned a categorical range, denoted by size of the point identifying each plot in June and August. Orange crosses, indicate documented Steller's eider nest locations.

DISCUSSION

Overall, 2012 was likely a moderate year of lemming abundance. While acknowledging the limitations of sparse data on some plots in June, Program MARK generated reasonable abundance estimates where the number of initial encounters and recaptures were sufficient. Given appreciably higher capture rates on most plots, compared to those where very few animals were encountered, we are confident the scant data accurately reflects an absence of lemmings rather than detection failure. Furthermore, the scarcity of lemmings on some plots provides contrast and illustrates the degree of spatial and temporal variability in lemming abundance near Barrow.

Over the summer of 2012, average abundance in August was approximately five times greater than in June. Qualitative observations also indicated an increase in abundance over summer. In August, more lemmings were observed during routine transits to sampling plots, and trap success may have improved because distinct runways and fresh sign were easier to identify than in June. We calculated a nearly identical trend in average abundance over the summer of 2011 (Figure 7), and both years saw moderate nesting effort in Steller's eiders, with 27 and 19 documented nests, respectively (Safine 2012 and 2013). This offers some substantiation of the correlation between lemming abundance and reproductive effort of Steller's eiders.

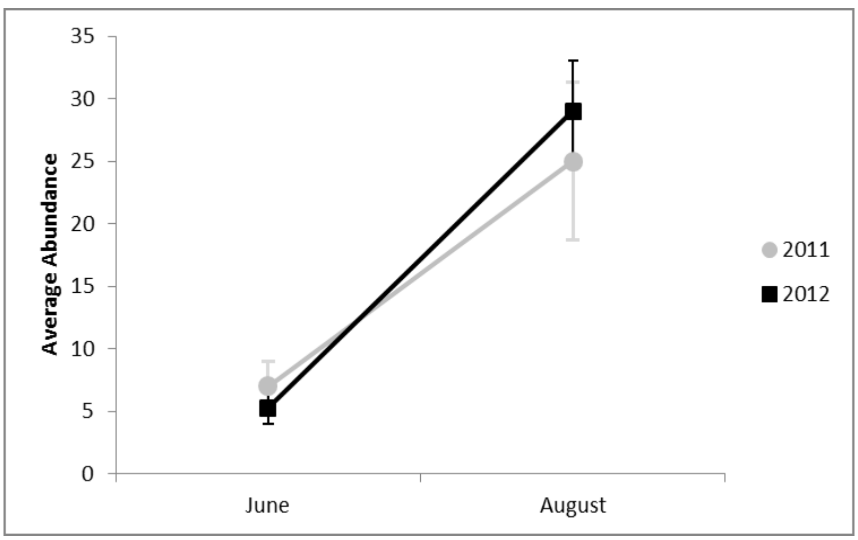


Figure 7. Average abundance, including SE, of brown lemmings between June and August of 2011 and 2012 near Barrow, Alaska.

Although overall trends were very similar in 2011 and 2012, abundance estimates fluctuated across sampling plots, between trap periods, and were not entirely consistent from 2011 to 2012 (Figure 8). While some plots returned similar estimates in June and August of both years (e.g., plot 2), abundance declined noticeably on plot 11 and increased on plot plot 12 (Figure 8).

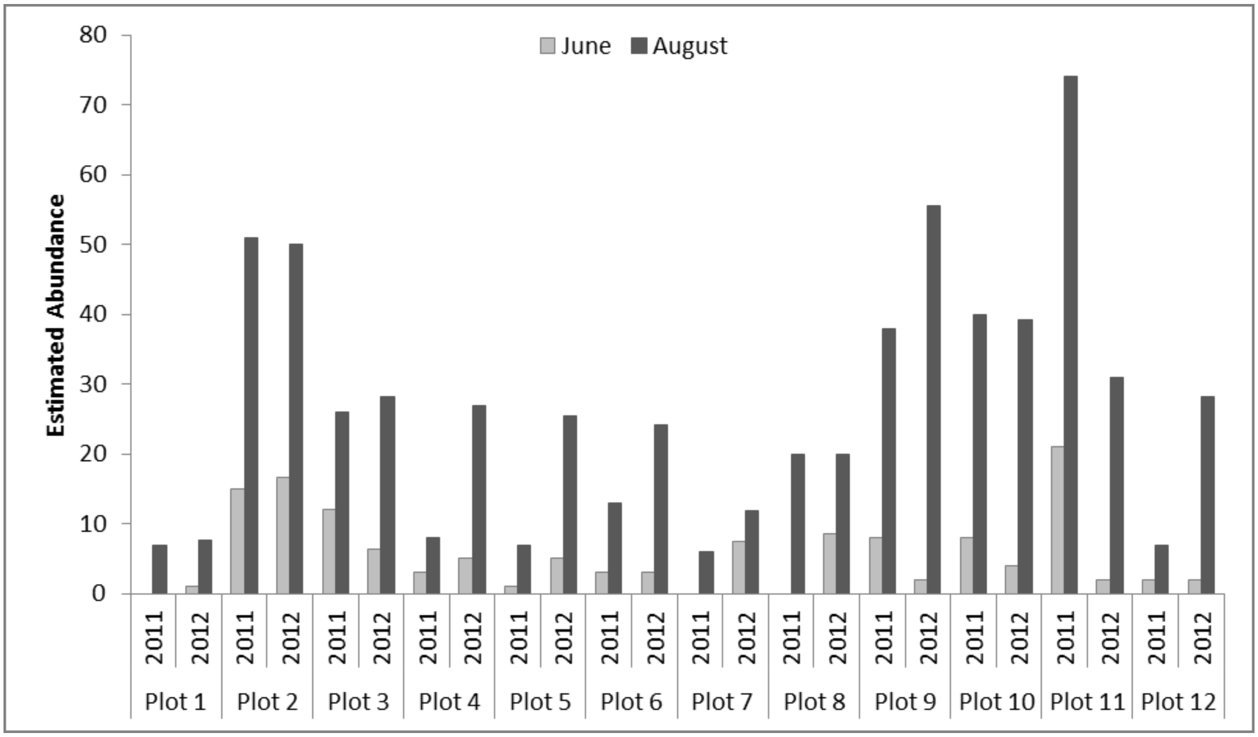


Figure 8. Brown lemming abundance estimated in June and August of 2011 and 2012, across 12 sampling plots near Barrow, Alaska.

Density of brown lemmings also varied by plot. In general, the estimated number of individuals per hectare was greater for datasets with more single-detection encounter histories. Although all density estimates seem reasonable, low recaptures on some plots produced broader confidence intervals (Figure 5). As with modeling abundance in Program MARK, encounter histories with more recaptures returned higher precision density estimates. These data suggest fluctuations in lemming abundance near Barrow are unpredictable at small temporal scales, and detecting trends or patterns, if they exist, will require continued monitoring.

This project fulfills Service outreach and education objectives by increasing opportunities for local youth to connect with nature through next-door science. Three local students were hired in 2012 to assist with all aspects of field work (Figure 9). Through hands-on involvement, students learned about the scientific method, sampling design, data recording, orienteering, and animal handling, in addition to the broader subjects of population dynamics and tundra ecology. Based on the data they collected, two students developed high school science fair projects.

Figure 9. Student technician Sam Ahsoak weighs a captive lemming (left), and Kevin Goodwin records data while Calvin Wilson reads the ear tag of a re-captured animal (right).

Ongoing outreach is integral to this project; to date, information on lemming biology as well as our preliminary results have been presented at an Ilisaġvik College summer camp, Service science camps, and the Service's Barrow Office Open House. In addition, interested members of the community, teachers, students, and other researchers have joined the lemming crew in the field to learn about the project. We maintain our commitment to sharing results through community presentations and recruiting local student hires.

In the course of this research, we have identified challenges that may be unique to live-trapping small mammals on the North Slope. For example, installing pin flags and trap-cover stakes in June required patience, and a hammer, because the soil active layer remains frozen until mid-summer. Although the soil thaws sufficiently by August, additional time should be budgeted for plot set-up in June.

Although mortalities were generally uncommon, there were occasional mortalities during August despite supplying bait and bedding ad libitum. Because ambient temperatures were not significantly different between trapping periods, it is unlikely that weather conditions were exclusively responsible for increased mortality in August. One artifact of higher August capture rates was increased handling time, and subsequent lengthening of the trap check interval. Although crews worked effectively to expedite the capture process, greater trap check intervals may have contributed to some mortality. Differences in mean body mass over the summer could have also affected mortality in August. In early summer, lemming populations may be largely composed of adults recruited during the previous year, while juveniles of the year remain in maternal nests (Pitelka et al. 1955). By August, these animals have likely entered the population in addition to the young of summer litters. Based on a comparison of mean body weight between June and August (55 and 35 g, respectively), the data support a potential late summer pulse of juvenile brown lemmings. In addition, individuals of small body size may be more susceptible to thermoregulatory stress and mean body weight for mortalities in August was 24 g. Smaller animals are also more difficult to handle, and mortality could conceivably result from unintentional injury or from stress associated with gentler but increased handling time. Recruiting additional crew members to accelerate trap check rounds, or designating a minimum tagging weight may reduce mortalities in future years.

At least two lemmings marked in June were recaptured in August. While this indicates some longevity for ear tags, we also recorded two instances where tags became detached. Although we believe tag loss was rare in this study, it would be conceivable to mark an animal that lost its tag more than once, and if this was more common than perceived, it could lead to overestimates of abundance. As an alternative, PIT tags should be considered for future years because they may be more permanent and less invasive when implanted by trained personnel. PIT tags would also permit marking and potential modeling of collared lemming abundance.

The paucity of empirical abundance data for lemming populations on the North Slope of Alaska has been identified as an important information gap (Krebs 1993). Although the current body of work is limited to two consecutive years, this study has already begun to quantify the shifts in abundance that characterize some lemming populations. This research also demonstrates mark-recapture is effective for estimating lemming abundance and density. Given the association between lemming abundance and reproductive effort of Steller's eiders and other ground-nesting birds, and the uncertain effects of climate change on this relationship, long-term monitoring of the lemming population near Barrow is warranted. Furthermore, the value of this work is compounded each year, and only long-term monitoring will permit meaningful statistical analysis of the periodicity of fluctuations (Pitelka and Batzli 1993). Over time, continued analysis of lemming fluctuations near Barrow may inform management decisions for Steller's eiders, and at the very least these data constitute an indispensable component of current baseline monitoring efforts in the Artic.

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Appendix A. Encounter data for brown (*Lemmus trimucronatus*) and collared lemmings (*Dicrostonyx groenlandicus*) live-trapped near Barrow, Alaska in June 2012. Fate was recorded as new (N), recapture (R), or mortality (M). Missing data are identified by UNK.

Date	Visit	Temperature (°F)	Weather	Plot	Trap	Species	Weight (g)	Fate	Tag	Sex	Comments
12-Jun-12	6:00	28.4	Fog	4	A12	*Lemmus trimucronatus*	41	N	1049	M	
12-Jun-12	6:00	28.4	Fog/Wind	6	B2	*Lemmus trimucronatus*	50	N	1050	M	
12-Jun-12	6:00	28.4	Fog	4	B7	*Lemmus trimucronatus*	59	N	1100	M	
12-Jun-12	6:00	28.4	Fog	2	A8	*Lemmus trimucronatus*	57	N	1201	F	
12-Jun-12	6:00	28.4	Fog	3	A4	*Lemmus trimucronatus*	55	N	1202	F	
12-Jun-12	13:00	33.7	Overcast/Wind	2	A1	*Lemmus trimucronatus*	69	N	1073	M	
12-Jun-12	20:00	33.8	Partly cloudy/Fog	2	A14	*Lemmus trimucronatus*	35	M	UNK	M	Consumed no bait, bedding saturated in urine (dehydration?), animal in rigor, lesion on left forepaw.
13-Jun-12	6:00	30.0	Fog/Wind	2	A14	*Lemmus trimucronatus*	36	N	1023	M	
13-Jun-12	6:00	30.0	Fog/Wind	2	A16	*Lemmus trimucronatus*	56	N	1024	M	
13-Jun-12	6:00	30.0	Fog	5	B17	*Lemmus trimucronatus*	56	N	1203	M	Tagged left ear
13-Jun-12	6:00	30.0	Fog	5	B12	*Lemmus trimucronatus*	53	N	1204	M	
13-Jun-12	13:00	40.0	Clear/Wind	2	B9	*Lemmus trimucronatus*	36	N	1022	M	
13-Jun-12	13:00	40.0	Partly cloudy	5	B6	*Lemmus trimucronatus*	38	N	1205	M	
13-Jun-12	13:00	40.0	Partly cloudy	3	A14	*Lemmus trimucronatus*	70	N	1206	M	
13-Jun-12	13:00	40.0	Partly cloudy	3	A13	*Lemmus trimucronatus*	41	N	1207	M	
13-Jun-12	13:00	40.0	Clear	6	B2	*Lemmus trimucronatus*	52	R	1050	M	
13-Jun-12	13:00	40.0	Clear/Wind	2	A8	*Lemmus trimucronatus*	59	R	1201	M	
14-Jun-12	6:00	35.1	Clear/wind	5	A15	*Lemmus trimucronatus*	47	N	1048	M	
14-Jun-12	6:00	35.1	Clear	2	B14	*Lemmus trimucronatus*	62	N	1208	M	
14-Jun-12	13:00	44.1	Clear	5	B12	*Lemmus trimucronatus*	43	R	1048	M	Fresh lesion behind left ear
14-Jun-12	20:00	42.0	Clear/Wind	4	B1	*Lemmus trimucronatus*	50	N	1021	F	
14-Jun-12	20:00	42.0	Clear	2	A17	*Lemmus trimucronatus*	58	N	1209	F	
14-Jun-12	20:00	42.0	Clear	2	A15	*Lemmus trimucronatus*	55	R	1024	M	
15-Jun-12	6:00	35.6	Clear/Wind	2	A15	*Lemmus trimucronatus*	54	N	1019	F	
15-Jun-12	6:00	35.6	Clear/Wind	1	A11	*Lemmus trimucronatus*	46	N	1029	F	
15-Jun-12	6:00	35.6	Clear	5	B4	*Lemmus trimucronatus*	41	N	1210	M	
15-Jun-12	6:00	35.6	Clear	4	A15	*Lemmus trimucronatus*	65	N	1211	M	
15-Jun-12	6:00	35.6	Clear	6	B3	*Lemmus trimucronatus*	51	R	1050	M	

15-Jun-12	13:00	53.2	Clear	2	B17	*Lemmus trimucronatus*	57	N	1212	F	
15-Jun-12	13:00	53.2	Clear	2	A8	*Lemmus trimucronatus*	56	N	1213	M	
15-Jun-12	13:00	53.2	Clear	2	A14	*Lemmus trimucronatus*	52	R	1024	M	
15-Jun-12	13:00	53.2	Clear/Wind	5	B7	*Lemmus trimucronatus*	45	R	1048	M	
15-Jun-12	13:00	53.2	Clear	4	A1	*Lemmus trimucronatus*	41	R	1049	M	
15-Jun-12	20:00	46.8	Clear/Wind	2	A18	*Lemmus trimucronatus*	45	N	1001	M	
15-Jun-12	20:00	46.8	Clear	6	A14	*Lemmus trimucronatus*	44	N	1219	M	
15-Jun-12	20:00	46.8	Clear	4	A11	*Lemmus trimucronatus*	52	N	1224	M	
16-Jun-12	6:00	35.1	Clear/Wind	2	B4	*Lemmus trimucronatus*	58	M	UNK	F	Stiff, near death, euthanized
16-Jun-12	6:00	35.1	Partly cloudy/Wind	6	A14	*Lemmus trimucronatus*	46	N	1002	M	
16-Jun-12	6:00	35.1	Clear/Wind	3	A21	*Lemmus trimucronatus*	69	N	1220	M	
16-Jun-12	6:00	35.1	Clear/Wind	3	B15	*Lemmus trimucronatus*	76	N	1221	M	
16-Jun-12	6:00	35.1	Clear/Wind	2	B1	*Lemmus trimucronatus*	55	N	1222	M	
16-Jun-12	6:00	35.1	Clear/Wind	2	B10	*Lemmus trimucronatus*	52	N	1223	M	
16-Jun-12	6:00	35.1	Clear/Wind	2	A20	*Lemmus trimucronatus*	77	N	1225	M	
16-Jun-12	6:00	35.1	Clear/Wind	2	A12	*Lemmus trimucronatus*	55	R	1024	M	
16-Jun-12	6:00	35.1	Clear/Wind	5	B12	*Lemmus trimucronatus*	44	R	1048	M	
16-Jun-12	6:00	35.1	Clear/Wind	2	A17	*Lemmus trimucronatus*	53	R	1208	M	
16-Jun-12	6:00	35.1	Clear/Wind	5	B11	*Lemmus trimucronatus*	57	R	1210	M	
16-Jun-12	6:00	35.1	Clear/Wind	4	A14	*Lemmus trimucronatus*	60	R	1211	M	
16-Jun-12	6:00	35.1	Partly cloudy/Wind	6	B12	*Lemmus trimucronatus*	41	R	1219	M	
16-Jun-12	6:00	35.1	Clear/Wind	4	A12	*Lemmus trimucronatus*	52	R	1224	M	
16-Jun-12	13:00	35.1	Fog/Wind	2	A15	*Lemmus trimucronatus*	53	R	1024	M	
16-Jun-12	13:00	35.1	Clear/Wind	5	A13	*Lemmus trimucronatus*	48	R	1048	M	Fresh blood on ear tag
16-Jun-12	13:00	35.1	Clear/Wind	4	A24	*Lemmus trimucronatus*	64	R	1211	M	
16-Jun-12	13:00	35.1	Fog/Wind	2	A10	*Lemmus trimucronatus*	62	R	1213	M	
16-Jun-12	13:00	35.1	Fog/Wind	3	A13	*Lemmus trimucronatus*	68	R	1220	M	
16-Jun-12	13:00	35.1	Clear/Wind	4	A11	*Lemmus trimucronatus*	48	R	1224	M	
16-Jun-12	13:00	35.1	Fog/Wind	2	A18	*Lemmus trimucronatus*	73	R	1225	M	
16-Jun-12	20:00	33.1	Overcast	3	A4	*Lemmus trimucronatus*	75	N	1214	M	
16-Jun-12	20:00	33.1	Fog	2	A10	*Lemmus trimucronatus*	52	R	1024	M	
16-Jun-12	20:00	33.1	Fog	2	B11	*Lemmus trimucronatus*	64	R	1223	M	

19-Jun-12	6:00	39.9	Clear/Wind	10	B6	*Lemmus trimucronatus*	61	N	1003	M	
19-Jun-12	6:00	39.9	Clear/Wind	9	B12	*Lemmus trimucronatus*	65	N	1005	M	
19-Jun-12	6:00	39.9	Clear/Wind	10	A13	*Lemmus trimucronatus*	45	N	1007	M	
19-Jun-12	6:00	39.9	Clear/Wind	10	A19	*Lemmus trimucronatus*	65	N	1016	M	
19-Jun-12	6:00	39.9	Clear	12	B7	*Lemmus trimucronatus*	70	N	1017	F	Tagged left ear, possibly gravid
19-Jun-12	6:00	39.9	Clear	12	B6	*Lemmus trimucronatus*	75	N	1018	M	
19-Jun-12	6:00	39.9	Clear/Wind	8	A21	*Lemmus trimucronatus*	55	N	1215	M	
19-Jun-12	6:00	39.9	Clear/Wind	8	A18	*Lemmus trimucronatus*	43	N	1216	M	
19-Jun-12	6:00	39.9	Clear/Wind	8	A8	*Lemmus trimucronatus*	55	N	1217	M	
19-Jun-12	6:00	39.9	Clear/Wind	7	B1	*Lemmus trimucronatus*	62	N	1218	M	
19-Jun-12	13:00	43.0	Clear/Wind	7	B2	*Lemmus trimucronatus*	49	N	1251	F	
19-Jun-12	13:00	43.0	Clear/Wind	7	A3	*Lemmus trimucronatus*	43	N	1275	M	
19-Jun-12	13:00	43.0	Clear/Wind	8	A20	*Lemmus trimucronatus*	45	R	1215	M	
19-Jun-12	13:00	43.0	Clear/Wind	7	B5	*Lemmus trimucronatus*	58	R	1218	M	
19-Jun-12	20:00	45.0	Clear/Wind	7	A17	*Lemmus trimucronatus*	62	N	1008	F	
19-Jun-12	20:00	45.0	Clear/Wind	8	B18	*Lemmus trimucronatus*	52	N	1011	UNK	
19-Jun-12	20:00	45.0	Clear/Wind	8	A20	*Lemmus trimucronatus*	50	R	1215	M	
20-Jun-12	6:00	43.0	Overcast/wind	8	B7	*Lemmus trimucronatus*	44	N	1276	F	
20-Jun-12	6:00	43.0	Overcast/wind	10	A13	*Lemmus trimucronatus*	64	R	1016	UNK	
20-Jun-12	6:00	43.0	Overcast/wind	8	A19	*Lemmus trimucronatus*	44	R	1215	M	
20-Jun-12	6:00	43.0	Overcast/wind	8	A18	*Lemmus trimucronatus*	44	R	1216	M	
20-Jun-12	6:00	43.0	Clear/Wind	7	A3	*Lemmus trimucronatus*	60	R	1218	M	
20-Jun-12	6:00	43.0	Clear/Wind	7	B2	*Lemmus trimucronatus*	45	R	1251	F	
20-Jun-12	13:00	44.1	Clear/Wind	7	B16	*Lemmus trimucronatus*	58	N	1004	UNK	
20-Jun-12	13:00	44.1	Clear/Wind	7	B7	*Lemmus trimucronatus*	62	R	1008	F	
20-Jun-12	13:00	44.1	Clear/Wind	8	B19	*Lemmus trimucronatus*	52	R	1215	M	
20-Jun-12	13:00	44.1	Clear/Wind	7	A3	*Lemmus trimucronatus*	57	R	1218	M	
20-Jun-12	13:00	44.1	Clear/Wind	7	A1	*Lemmus trimucronatus*	51	R	1251	F	
20-Jun-12	20:00	43.0	Clear/Wind	11	A8	*Lemmus trimucronatus*	64	N	1009	M	
20-Jun-12	20:00	43.0	Clear/Wind	7	A18	*Lemmus trimucronatus*	57	R	1004	M	
20-Jun-12	20:00	43.0	Clear/Wind	7	A3	*Lemmus trimucronatus*	64	R	1008	F	
20-Jun-12	20:00	43.0	Clear/Wind	8	B7	*Lemmus trimucronatus*	59	R	1011	M	

20-Jun-12	20:00	43.0	Clear/Wind	8	B4	*Lemmus trimucronatus*	45	R	1276	F	
21-Jun-12	6:00	41.0	Clear/Wind	7	B5	*Lemmus trimucronatus*	60	R	1008	F	Possibly gravid
21-Jun-12	6:00	41.0	Clear/Wind	8	B5	*Lemmus trimucronatus*	68	R	1011	M	
21-Jun-12	6:00	41.0	Clear/Wind	8	A19	*Lemmus trimucronatus*	45	R	1215	M	
21-Jun-12	6:00	41.0	Clear/Wind	8	A15	*Lemmus trimucronatus*	44	R	1216	M	
21-Jun-12	6:00	41.0	Clear/Wind	7	A17	*Lemmus trimucronatus*	57	R	1218	M	
21-Jun-12	6:00	41.0	Clear/Wind	7	A1	*Lemmus trimucronatus*	54	R	1251	F	
21-Jun-12	13:00	39.9	Clear/Wind	8	B7	*Lemmus trimucronatus*	59	R	1011	M	
21-Jun-12	13:00	39.9	Clear/Wind	7	A17	*Lemmus trimucronatus*	70	R	1218	M	
21-Jun-12	13:00	39.9	Clear/Wind	7	A1	*Lemmus trimucronatus*	43	R	1251	F	
21-Jun-12	20:00	39.0	Partly cloudy/Wind	7	A15	*Lemmus trimucronatus*	37	UNK	UNK	F	Small amounts of blood in trap, bloody nose.
21-Jun-12	20:00	39.0	Clear/Wind	10	B8	*Lemmus trimucronatus*	49	N	1300	F	
21-Jun-12	20:00	39.0	Clear/Wind	8	A21	*Lemmus trimucronatus*	51	R	1215	M	
21-Jun-12	20:00	39.0	Partly cloudy/Wind	7	B16	*Lemmus trimucronatus*	60	R	1218	M	
22-Jun-12	6:00	44.1	Clear	9	B4	*Lemmus trimucronatus*	46	N	1299	F	
22-Jun-12	6:00	44.1	Clear	10	B6	*Lemmus trimucronatus*	65	R	1003	M	
22-Jun-12	6:00	44.1	Clear	7	B16	*Lemmus trimucronatus*	68	R	1008	F	
22-Jun-12	6:00	44.1	Clear	11	A5	*Lemmus trimucronatus*	59	R	1009	M	Very lethargic, cold. Attempted to warm, left with food out of the wind. Not very responsive.
22-Jun-12	6:00	44.1	Clear	8	B3	*Lemmus trimucronatus*	58	R	1011	M	
22-Jun-12	6:00	44.1	Clear	10	B17	*Lemmus trimucronatus*	65	R	1016	M	
22-Jun-12	6:00	44.1	Clear	12	B6	*Lemmus trimucronatus*	54	R	1017	F	
22-Jun-12	6:00	44.1	Clear	8	A20	*Lemmus trimucronatus*	48	R	1215	M	
22-Jun-12	6:00	44.1	Clear	7	A17	*Lemmus trimucronatus*	55	R	1218	M	
22-Jun-12	6:00	44.1	Clear	7	A1	*Lemmus trimucronatus*	48	R	1251	F	
22-Jun-12	6:00	44.1	Clear	7	A5	*Lemmus trimucronatus*	49	R	1275	UNK	
22-Jun-12	13:00	42.1	Partly cloudy/wind	11	A5	*Lemmus trimucronatus*	59	M	1009	M	Found near trap A5 at 0600, very lethargic, attempted to revive.
22-Jun-12	13:00	42.1	Clear	7	B1	*Lemmus trimucronatus*	58	N	1012	F	
22-Jun-12	13:00	42.1	Clear/wind	8	A1	*Lemmus trimucronatus*	70	N	1014	M	
22-Jun-12	13:00	42.1	Clear	7	A1	*Lemmus trimucronatus*	73	R	1004	M	
22-Jun-12	13:00	42.1	Clear/wind	8	B6	*Lemmus trimucronatus*	58	R	1011	M	
22-Jun-12	13:00	42.1	Clear/wind	8	B18	*Lemmus trimucronatus*	51	R	1215	M	
22-Jun-12	13:00	42.1	Clear	7	B16	*Lemmus trimucronatus*	55	R	1218	M	

22-Jun-12	20:00	39.0	Overcast/rain	8	B4	*Lemmus trimucronatus*	58	R	1011	M	
22-Jun-12	20:00	39.0	Overcast/rain	10	B9	*Lemmus trimucronatus*	61	R	1016	UNK	Released prior to identification of sex
22-Jun-12	20:00	39.0	Overcast/rain	7	B7	*Lemmus trimucronatus*	57	R	1218	M	
22-Jun-12	20:00	39.0	Overcast/wind	9	B6	*Lemmus trimucronatus*	46	R	1299	M	
23-Jun-12	6:00	37.0	Overcast	8	B11	*Lemmus trimucronatus*	51	N	1296	M	
23-Jun-12	6:00	37.0	Overcast	8	B17	*Lemmus trimucronatus*	53	N	1297	M	Torn right ear, may have been previously tagged
23-Jun-12	6:00	37.0	Overcast	7	A3	*Lemmus trimucronatus*	54	R	1004	M	
23-Jun-12	6:00	37.0	Overcast	9	A17	*Lemmus trimucronatus*	72	R	1005	M	
23-Jun-12	6:00	37.0	Partly cloudy	10	A13	*Lemmus trimucronatus*	52	R	1007	M	
23-Jun-12	6:00	37.0	Overcast	7	A18	*Lemmus trimucronatus*	69	R	1008	F	
23-Jun-12	6:00	37.0	Overcast	8	B7	*Lemmus trimucronatus*	52	R	1011	M	
23-Jun-12	6:00	37.0	Overcast	8	A20	*Lemmus trimucronatus*	45	R	1216	M	Tagged left ear
23-Jun-12	6:00	37.0	Overcast	7	A1	*Lemmus trimucronatus*	50	R	1251	F	
23-Jun-12	13:00	41.0	Overcast/fog	7	A2	*Lemmus trimucronatus*	38	N	1047	F	
23-Jun-12	13:00	41.0	Overcast/rain	11	B11	*Lemmus trimucronatus*	79	N	1295	M	
23-Jun-12	13:00	41.0	Overcast/fog	7	A18	*Lemmus trimucronatus*	68	R	1008	F	
12-Jun-12	6:00	28.4	Fog	3	A16	*Dicrostonyx groenlandicus*	47	N	N/A	F	
13-Jun-12	6:00	30.0	Fog/Wind	1	A19	*Dicrostonyx groenlandicus*	64	N	N/A	F	
13-Jun-12	6:00	30.0	Fog/Wind	1	B10	*Dicrostonyx groenlandicus*	56	N	N/A	M	
13-Jun-12	20:00	34.0	Overcast	1	A15	*Dicrostonyx groenlandicus*	67	N	N/A	F	
13-Jun-12	20:00	34.0	Overcast	3	B13	*Dicrostonyx groenlandicus*	63	N	N/A	M	
14-Jun-12	6:00	35.1	Clear	1	B14	*Dicrostonyx groenlandicus*	59	N	N/A	F	
14-Jun-12	13:00	44.1	Clear/Wind	1	A17	*Dicrostonyx groenlandicus*	62	N	N/A	F	
14-Jun-12	13:00	44.1	Clear/Wind	2	B10	*Dicrostonyx groenlandicus*	39	N	N/A	F	
14-Jun-12	20:00	42.0	Clear	1	A17	*Dicrostonyx groenlandicus*	58	N	N/A	F	
14-Jun-12	20:00	42.0	Clear	1	A16	*Dicrostonyx groenlandicus*	88	N	N/A	M	
14-Jun-12	20:00	42.0	Clear/Wind	6	B15	*Dicrostonyx groenlandicus*	36	N	N/A	F	
15-Jun-12	6:00	35.6	Clear/Wind	1	B13	*Dicrostonyx groenlandicus*	43	N	N/A	M	B13 and B14 flags switched
15-Jun-12	6:00	35.6	Clear/Wind	1	B7	*Dicrostonyx groenlandicus*	60	N	N/A	F	
15-Jun-12	6:00	35.6	Clear	6	B15	*Dicrostonyx groenlandicus*	34	N	N/A	UNK	
15-Jun-12	13:00	53.2	Clear	3	A11	*Dicrostonyx groenlandicus*	65	N	N/A	F	
15-Jun-12	13:00	53.2	Clear	3	B1	*Dicrostonyx groenlandicus*	35	N	N/A	F	
15-Jun-12	13:00	53.2	Clear/Wind	6	B15	*Dicrostonyx groenlandicus*	50	N	N/A	F	Lethargic

15-Jun-12	20:00	46.8	Clear/Wind	1	B19	*Dicrostonyx groenlandicus*	58	N	N/A	F	
15-Jun-12	20:00	46.8	Clear/Wind	1	A6	*Dicrostonyx groenlandicus*	65	N	N/A	F	
15-Jun-12	20:00	46.8	Clear/Wind	3	B9	*Dicrostonyx groenlandicus*	68	N	N/A	F	
15-Jun-12	20:00	46.8	Clear	6	A12	*Dicrostonyx groenlandicus*	45	N	N/A	M	
16-Jun-12	6:00	35.1	Clear/Wind	1	B19	*Dicrostonyx groenlandicus*	57	N	N/A	F	
16-Jun-12	6:00	35.1	Partly cloudy/Wind	6	A16	*Dicrostonyx groenlandicus*	22	N	N/A	F	
16-Jun-12	13:00	35.1	Fog/Wind	1	B7	*Dicrostonyx groenlandicus*	69	N	N/A	F	
16-Jun-12	13:00	35.1	Fog/Wind	3	B2	*Dicrostonyx groenlandicus*	29	N	N/A	F	
16-Jun-12	13:00	35.1	Partly cloudy/Wind	6	A16	*Dicrostonyx groenlandicus*	58	N	N/A	M	
16-Jun-12	20:00	33.1	Fog	1	B16	*Dicrostonyx groenlandicus*	59	N	N/A	F	
16-Jun-12	20:00	33.1	Overcast/Fog/Wind	6	B18	*Dicrostonyx groenlandicus*	37	N	N/A	F	
19-Jun-12	6:00	39.9	Clear/Wind	7	B12	*Dicrostonyx groenlandicus*	33	M	N/A	M	Trap mortality, no apparent injuries
19-Jun-12	6:00	39.9	Clear/Wind	7	B6	*Dicrostonyx groenlandicus*	63	N	N/A	M	
19-Jun-12	13:00	43.0	Clear/Wind	7	A15	*Dicrostonyx groenlandicus*	71	N	N/A	F	
19-Jun-12	20:00	45.0	Clear/Wind	7	A7	*Dicrostonyx groenlandicus*	73	N	N/A	M	
19-Jun-12	20:00	45.0	Clear/Wind	7	B10	*Dicrostonyx groenlandicus*	45	N	N/A	M	
20-Jun-12	6:00	43.0	Clear/Wind	7	A15	*Dicrostonyx groenlandicus*	70	N	N/A	F	
20-Jun-12	6:00	43.0	Partly cloudy/wind	11	A2	*Dicrostonyx groenlandicus*	58	N	N/A	M	
20-Jun-12	13:00	44.1	Clear/Wind	7	B10	*Dicrostonyx groenlandicus*	51	N	N/A	M	
20-Jun-12	20:00	43.0	Clear/Wind	7	A5	*Dicrostonyx groenlandicus*	41	N	N/A	M	Large lump on abdomen
20-Jun-12	20:00	43.0	Clear/Wind	12	B17	*Dicrostonyx groenlandicus*	83	N	N/A	M	
21-Jun-12	13:00	39.9	Clear/Wind	7	A7	*Dicrostonyx groenlandicus*	80	N	N/A	F	
21-Jun-12	13:00	39.9	Clear/Wind	7	A10	*Dicrostonyx groenlandicus*	40	N	N/A	F	
21-Jun-12	13:00	39.9	Clear/Wind	11	A5	*Dicrostonyx groenlandicus*	59	N	N/A	M	
21-Jun-12	13:00	39.9	Clear/Wind	12	B17	*Dicrostonyx groenlandicus*	37	N	N/A	M	
21-Jun-12	20:00	39.0	Partly cloudy/Wind	7	B10	*Dicrostonyx groenlandicus*	71	N	N/A	M	
21-Jun-12	20:00	39.0	Partly cloudy/Wind	7	A15	*Dicrostonyx groenlandicus*	37	N	N/A	F	Small amounts of blood in trap, bloody nose.
21-Jun-12	20:00	39.0	Clear/Wind	9	B3	*Dicrostonyx groenlandicus*	42	N	N/A	M	
21-Jun-12	20:00	39.0	Clear/Wind	12	B15	*Dicrostonyx groenlandicus*	83	N	N/A	F	
22-Jun-12	6:00	44.1	Clear	7	A9	*Dicrostonyx groenlandicus*	73	N	N/A	M	
22-Jun-12	6:00	44.1	Clear	7	A10	*Dicrostonyx groenlandicus*	44	N	N/A	F	
22-Jun-12	13:00	42.1	Clear/wind	8	B10	*Dicrostonyx groenlandicus*	38	N	N/A	F	
22-Jun-12	20:00	39.0	Overcast/rain	7	A10	*Dicrostonyx groenlandicus*	71	N	N/A	M	
23-Jun-12	6:00	37.0	Overcast	7	B10	*Dicrostonyx groenlandicus*	73	N	N/A	M	

23-Jun-12	6:00	37.0	Overcast	7	A15	*Dicrostonyx groenlandicus*	38	N	N/A	M
23-Jun-12	13:00	41.0	Overcast/fog	7	B7	*Dicrostonyx groenlandicus*	65	N	N/A	M
23-Jun-12	20:00	48.0	Partly cloudy	7	A5	*Dicrostonyx groenlandicus*	64	N	N/A	M
12-Jun-12	6:00	28.4	Fog	3	A16	*Dicrostonyx groenlandicus*	47	N	N/A	F
13-Jun-12	6:00	30.0	Fog/Wind	1	A19	*Dicrostonyx groenlandicus*	64	N	N/A	F
13-Jun-12	6:00	30.0	Fog/Wind	1	B10	*Dicrostonyx groenlandicus*	56	N	N/A	M
13-Jun-12	20:00	34.0	Overcast	1	A15	*Dicrostonyx groenlandicus*	67	N	N/A	F
13-Jun-12	20:00	34.0	Overcast	3	B13	*Dicrostonyx groenlandicus*	63	N	N/A	M
14-Jun-12	6:00	35.1	Clear	1	B14	*Dicrostonyx groenlandicus*	59	N	N/A	F

Appendix B. Encounter data for brown (*Lemmus trimucronatus*) and collared lemmings (*Dicrostonyx groenlandicus*) live-trapped near Barrow, Alaska in August 2012. Fate was recorded as new (N), recapture (R), or mortality (M). Missing data are identified by UNK.

Date	Visit	Temperature (°F)	Weather	Grid	Trap	Species	Weight (g)	Fate	Tag	Sex	Comments
12-Aug-12	6:00	33.1	Clear/Fog	2	B15	*Lemmus trimucronatus*	27	N	1253	M	
12-Aug-12	6:00	33.1	Clear/Fog	2	B16	*Lemmus trimucronatus*	29	N	1254	F	
12-Aug-12	6:00	33.1	Clear/Fog	2	A8	*Lemmus trimucronatus*	30	N	1255	UNK	
12-Aug-12	6:00	33.1	Clear/Fog	2	B1	*Lemmus trimucronatus*	67	N	1257	M	
12-Aug-12	6:00	33.1	Clear/Fog	2	B10	*Lemmus trimucronatus*	58	N	1258	F	Torn right ear, possible recapture.
12-Aug-12	6:00	33.1	Clear/Fog	2	A6	*Lemmus trimucronatus*	61	N	1263	M	
12-Aug-12	6:00	33.1	Clear/Fog	2	A14	*Lemmus trimucronatus*	22	N	1265	M	
12-Aug-12	6:00	33.1	Clear/Fog	2	A4	*Lemmus trimucronatus*	38	N	1266	F	
12-Aug-12	6:00	33.1	Clear/Fog	2	A3	*Lemmus trimucronatus*	27	N	1286	M	
12-Aug-12	6:00	33.1	Clear/Fog	2	B6	*Lemmus trimucronatus*	33	N	1293	M	
12-Aug-12	6:00	33.1	Clear/Fog	2	A11	*Lemmus trimucronatus*	27	M	UNK	M	Apparently healthy but succumbed during handling, presumed capture myopathy
12-Aug-12	6:00	33.1	Clear/Fog	3	B7	*Lemmus trimucronatus*	31	N	1260	M	
12-Aug-12	6:00	33.1	Clear/Fog	3	B14	*Lemmus trimucronatus*	39	N	1268	F	
12-Aug-12	6:00	33.1	Clear/Fog	3	A14	*Lemmus trimucronatus*	41	N	1273	F	
12-Aug-12	6:00	33.1	Clear/Fog	3	B12	*Lemmus trimucronatus*	38	N	1274	M	
12-Aug-12	6:00	33.1	Clear/Fog	3	A17	*Lemmus trimucronatus*	25	N	1290	M	
12-Aug-12	6:00	33.1	Clear	4	A1	*Lemmus trimucronatus*	20	N	1085	M	
12-Aug-12	6:00	33.1	Clear	4	A16	*Lemmus trimucronatus*	34	N	1086	M	
12-Aug-12	6:00	33.1	Clear	4	B15	*Lemmus trimucronatus*	35	N	1087	F	
12-Aug-12	6:00	33.1	Clear	4	A5	*Lemmus trimucronatus*	23	N	1088	M	
12-Aug-12	6:00	33.1	Clear	4	B1	*Lemmus trimucronatus*	25	N	1089	M	
12-Aug-12	6:00	33.1	Clear	4	B3	*Lemmus trimucronatus*	22	M	1090	M	Lethargic
12-Aug-12	6:00	33.1	Clear	4	B9	*Lemmus trimucronatus*	23	N	1091	M	
12-Aug-12	6:00	33.1	Clear	4	B11	*Lemmus trimucronatus*	22	M	UNK	M	Lethargic, attempted to revive
12-Aug-12	6:00	33.1	Clear	5	A5	*Lemmus trimucronatus*	20	N	1027	M	Very lethargic, attempted to revive
12-Aug-12	6:00	33.1	Clear	5	A7	*Lemmus trimucronatus*	26	N	1051	M	
12-Aug-12	6:00	33.1	Clear	5	A20	*Lemmus trimucronatus*	63	N	1081	F	
12-Aug-12	6:00	33.1	Clear	5	A15	*Lemmus trimucronatus*	29	N	1082	M	
12-Aug-12	6:00	33.1	Clear	5	B15	*Lemmus trimucronatus*	22	N	1083	M	
12-Aug-12	6:00	33.1	Clear	5	B3	*Lemmus trimucronatus*	30	N	1084	F	
12-Aug-12	6:00	33.1	Fog	6	A4	*Lemmus trimucronatus*	30	N	1026	M	

12-Aug-12	6:00	33.1	Fog	6	A18	*Lemmus trimucronatus*	61	N	1076	F	
12-Aug-12	6:00	33.1	Fog	6	B15	*Lemmus trimucronatus*	72	N	1077	M	
12-Aug-12	6:00	33.1	Fog	6	A8	*Lemmus trimucronatus*	44	N	1078	F	
12-Aug-12	6:00	33.1	Fog	6	A1	*Lemmus trimucronatus*	33	N	1079	F	
12-Aug-12	6:00	33.1	Fog	6	B8	*Lemmus trimucronatus*	62	N	1080	F	
12-Aug-12	13:00	48.9	Clear	2	B14	*Lemmus trimucronatus*	42	N	1082	F	
12-Aug-12	13:00	48.9	Clear	2	A6	*Lemmus trimucronatus*	59	R	1263	M	
12-Aug-12	13:00	48.9	Clear	4	A14	*Lemmus trimucronatus*	29	N	1269	M	
12-Aug-12	13:00	48.9	Clear	5	A19	*Lemmus trimucronatus*	64	N	1287	M	
12-Aug-12	13:00	48.9	Clear	6	A1	*Lemmus trimucronatus*	31	R	1079	F	
12-Aug-12	13:00	48.9	Clear	6	A19	*Lemmus trimucronatus*	50	N	1264	F	
12-Aug-12	13:00	48.9	Clear	6	A11	*Lemmus trimucronatus*	42	N	1288	F	
12-Aug-12	20:00	51.1	Clear/Wind	1	A14	*Lemmus trimucronatus*	29	N	1289	M	
12-Aug-12	20:00	51.1	Clear/Wind	2	A4	*Lemmus trimucronatus*	68	R	1257	M	
12-Aug-12	20:00	51.1	Clear/Wind	2	B10	*Lemmus trimucronatus*	58	R	1258	F	
12-Aug-12	20:00	51.1	Clear/Wind	2	A14	*Lemmus trimucronatus*	32	N	1285	M	
12-Aug-12	20:00	51.1	Clear	5	A4	*Lemmus trimucronatus*	28	N	1092	M	
12-Aug-12	20:00	51.1	Clear	6	B12	*Lemmus trimucronatus*	69	R	1080	F	
13-Aug-12	6:00	39.9	Clear/Wind	1	A21	*Lemmus trimucronatus*	41	N	1072	F	
13-Aug-12	6:00	39.9	Clear/Wind	2	B10	*Lemmus trimucronatus*	27	N	1015	M	
13-Aug-12	6:00	39.9	Clear/Wind	2	B3	*Lemmus trimucronatus*	37	N	1093	F	
13-Aug-12	6:00	39.9	Clear/Wind	2	B1	*Lemmus trimucronatus*	53	N	1094	F	
13-Aug-12	6:00	39.9	Clear/Wind	2	A3	*Lemmus trimucronatus*	66	N	1095	F	
13-Aug-12	6:00	39.9	Clear/Wind	2	A6	*Lemmus trimucronatus*	66	N	1096	F	
13-Aug-12	6:00	39.9	Clear/Wind	2	A8	*Lemmus trimucronatus*	29	N	1097	M	
13-Aug-12	6:00	39.9	Clear/Wind	2	A19	*Lemmus trimucronatus*	52	N	1098	UNK	Tag placement suboptimal
13-Aug-12	6:00	39.9	Clear/Wind	3	A20	*Lemmus trimucronatus*	48	N	1046	F	
13-Aug-12	6:00	39.9	Clear/Wind	3	B1	*Lemmus trimucronatus*	24	N	1052	F	
13-Aug-12	6:00	39.9	Clear/Wind	3	B17	*Lemmus trimucronatus*	40	N	1053	F	
13-Aug-12	6:00	39.9	Clear/Wind	3	B9	*Lemmus trimucronatus*	31	N	1071	M	
13-Aug-12	6:00	39.9	Clear/Wind	3	A16	*Lemmus trimucronatus*	36	R	1273	F	
13-Aug-12	6:00	39.9	Clear/Wind	3	B12	*Lemmus trimucronatus*	36	R	1274	M	
13-Aug-12	6:00	39.9	Clear/Wind	3	A17	*Lemmus trimucronatus*	UNK	R	1290	M	Weight not recorded
13-Aug-12	6:00	39.9	Clear	4	A16	*Lemmus trimucronatus*	32	R	1086	M	

13-Aug-12	6:00	39.9	Clear	4	A3	*Lemmus trimucronatus*	23	N	1227	M	
13-Aug-12	6:00	39.9	Clear	4	A14	*Lemmus trimucronatus*	66	N	1256	F	
13-Aug-12	6:00	39.9	Clear	4	B3	*Lemmus trimucronatus*	30	N	1262	M	
13-Aug-12	6:00	39.9	Clear	4	A1	*Lemmus trimucronatus*	39	N	1271	F	Lethargic
13-Aug-12	6:00	39.9	Clear	4	A12	*Lemmus trimucronatus*	28	N	1294	M	
13-Aug-12	6:00	39.9	Clear	4	B1	*Lemmus trimucronatus*	32	M	UNK	F	
13-Aug-12	6:00	39.9	Clear	5	A7	*Lemmus trimucronatus*	26	R	1051	M	
13-Aug-12	6:00	39.9	Clear	5	B13	*Lemmus trimucronatus*	23	R	1083	M	
13-Aug-12	6:00	39.9	Clear	5	B6	*Lemmus trimucronatus*	58	N	1267	F	
13-Aug-12	6:00	39.9	Clear	5	B9	*Lemmus trimucronatus*	21	N	1278	M	
13-Aug-12	6:00	39.9	Clear	5	A15	*Lemmus trimucronatus*	28	N	1281	M	Lethargic, reduced mobility
13-Aug-12	6:00	39.9	Clear	5	B3	*Lemmus trimucronatus*	24	N	1291	M	
13-Aug-12	6:00	39.9	Clear	6	A19	*Lemmus trimucronatus*	58	R	1076	F	
13-Aug-12	6:00	39.9	Clear	6	A14	*Lemmus trimucronatus*	63	R	1077	M	
13-Aug-12	6:00	39.9	Clear	6	A8	*Lemmus trimucronatus*	44	R	1078	F	
13-Aug-12	6:00	39.9	Clear	6	B8	*Lemmus trimucronatus*	67	R	1080	F	
13-Aug-12	6:00	39.9	Clear	6	B19	*Lemmus trimucronatus*	50	R	1264	F	
13-Aug-12	6:00	39.9	Clear	6	A17	*Lemmus trimucronatus*	32	N	1272	M	
13-Aug-12	6:00	39.9	Clear	6	A3	*Lemmus trimucronatus*	54	N	1283	M	
13-Aug-12	13:00	60.1	Clear/Wind	4	B1	*Lemmus trimucronatus*	0	M	1271	F	Lethargic, attempted to revive, encountered later as mortality
13-Aug-12	13:00	60.1	Clear/Wind	6	A4	*Lemmus trimucronatus*	63	N	1070	F	
13-Aug-12	20:00	60.1	Clear/Wind	3	B14	*Lemmus trimucronatus*	UNK	R	1274	UNK	Weight not recorded
13-Aug-12	20:00	60.1	Clear/Wind	6	A2	*Lemmus trimucronatus*	48	N	1277	M	
14-Aug-12	6:00	50.0	Overcast/Wind	1	A14	*Lemmus trimucronatus*	27	N	1270	M	
14-Aug-12	6:00	50.0	Overcast/Wind	2	B12	*Lemmus trimucronatus*	37	R	1028	F	
14-Aug-12	6:00	50.0	Overcast/Wind	2	A4	*Lemmus trimucronatus*	57	R	1096	F	
14-Aug-12	6:00	50.0	Overcast/Wind	2	B19	*Lemmus trimucronatus*	65	R	1222	M	
14-Aug-12	6:00	50.0	Overcast/Wind	2	A11	*Lemmus trimucronatus*	27	N	1249	M	
14-Aug-12	6:00	50.0	Overcast/Wind	2	B8	*Lemmus trimucronatus*	31	N	1250	M	
14-Aug-12	6:00	50.0	Overcast/Wind	2	A6	*Lemmus trimucronatus*	61	R	1257	M	
14-Aug-12	6:00	50.0	Overcast/Wind	2	A15	*Lemmus trimucronatus*	29	N	1259	M	
14-Aug-12	6:00	50.0	Overcast/Wind	2	A3	*Lemmus trimucronatus*	36	M	1266	F	Trap mortality
14-Aug-12	6:00	50.0	Overcast/Wind	3	B17	*Lemmus trimucronatus*	39	N	1226	F	

14-Aug-12	6:00	50.0	Overcast/Wind	3	A12	*Lemmus trimucronatus*	35	N	1228	F	Previously marked, tag lost, torn right ear, re-tagged
14-Aug-12	6:00	50.0	Overcast/Wind	3	A16	*Lemmus trimucronatus*	22	N	1235	M	
14-Aug-12	6:00	50.0	Overcast/Wind	3	B7	*Lemmus trimucronatus*	31	N	1244	M	
14-Aug-12	6:00	50.0	Overcast/Wind	3	A17	*Lemmus trimucronatus*	21	N	1248	M	Previously marked, tag lost, torn right ear, re-tagged
14-Aug-12	6:00	50.0	Overcast/Wind	3	B13	*Lemmus trimucronatus*	41	R	1268	F	
14-Aug-12	6:00	50.0	Overcast/Wind	3	B12	*Lemmus trimucronatus*	33	N	1280	M	
14-Aug-12	6:00	50.0	Overcast	4	A19	*Lemmus trimucronatus*	95	N	1042	F	
14-Aug-12	6:00	50.0	Overcast	4	A1	*Lemmus trimucronatus*	31	N	1043	M	
14-Aug-12	6:00	50.0	Overcast	4	B15	*Lemmus trimucronatus*	27	N	1045	M	
14-Aug-12	6:00	50.0	Overcast	4	A16	*Lemmus trimucronatus*	76	N	1069	M	
14-Aug-12	6:00	50.0	Overcast	4	A14	*Lemmus trimucronatus*	65	R	1256	F	
14-Aug-12	6:00	50.0	Overcast	4	A21	*Lemmus trimucronatus*	28	R	1294	M	
14-Aug-12	6:00	50.0	Overcast	5	A14	*Lemmus trimucronatus*	16	N	1044	M	
14-Aug-12	6:00	50.0	Overcast	5	A20	*Lemmus trimucronatus*	49	R	1081	F	
14-Aug-12	6:00	50.0	Overcast	5	A4	*Lemmus trimucronatus*	56	R	1267	F	
14-Aug-12	6:00	50.0	Overcast	5	B17	*Lemmus trimucronatus*	65	R	1287	M	
14-Aug-12	6:00	50.0	Overcast	6	A14	*Lemmus trimucronatus*	50	N	1029	F	
14-Aug-12	6:00	50.0	Overcast	6	B10	*Lemmus trimucronatus*	UNK	R	1077	M	
14-Aug-12	6:00	50.0	Overcast	6	A3	*Lemmus trimucronatus*	32	R	1079	F	
14-Aug-12	6:00	50.0	Overcast	6	B13	*Lemmus trimucronatus*	63	R	1080	F	
14-Aug-12	6:00	50.0	Overcast	6	A2	*Lemmus trimucronatus*	52	R	1283	M	
14-Aug-12	13:00	60.1	Partly Cloudy/Wind	1	A11	*Lemmus trimucronatus*	30	R	1289	M	
14-Aug-12	13:00	60.1	Partly Cloudy/Wind	2	A3	*Lemmus trimucronatus*	0	N	1041	M	Weight not recorded
14-Aug-12	13:00	60.1	Partly Cloudy/Wind	2	A1	*Lemmus trimucronatus*	65	R	1095	F	
14-Aug-12	13:00	60.1	Partly Cloudy/Wind	2	A6	*Lemmus trimucronatus*	55	R	1096	UNK	
14-Aug-12	13:00	60.1	Partly Cloudy/Wind	3	B18	*Lemmus trimucronatus*	27	N	1068	M	
14-Aug-12	13:00	60.1	Partly Cloudy/Wind	6	A3	*Lemmus trimucronatus*	22	R	1026	M	
14-Aug-12	20:00	57.0	Overcast	1	A14	*Lemmus trimucronatus*	30	R	1270	M	
14-Aug-12	20:00	57.0	Overcast/Rain	2	A1	*Lemmus trimucronatus*	61	R	1095	F	
14-Aug-12	20:00	57.0	Overcast/Rain	2	A11	*Lemmus trimucronatus*	32	N	1232	M	
14-Aug-12	20:00	57.0	Overcast	4	A15	*Lemmus trimucronatus*	76	R	1069	M	
14-Aug-12	20:00	57.0	Overcast	5	B14	*Lemmus trimucronatus*	26	R	1083	M	
14-Aug-12	20:00	57.0	Overcast	6	A4	*Lemmus trimucronatus*	35	R	1026	M	

14-Aug-12	20:00	57.0	Overcast	6	A8	*Lemmus trimucronatus*	49	R	1078	F	
14-Aug-12	20:00	57.0	Overcast	6	A2	*Lemmus trimucronatus*	36	R	1079	F	
15-Aug-12	6:00	48.0	Overcast /Fog	1	A14	*Lemmus trimucronatus*	20	N	1030	M	
15-Aug-12	6:00	48.0	Overcast /Fog	2	A11	*Lemmus trimucronatus*	63	R	1024	M	
15-Aug-12	6:00	48.0	Overcast /Fog	2	A4	*Lemmus trimucronatus*	25	N	1031	F	
15-Aug-12	6:00	48.0	Overcast /Fog	2	A6	*Lemmus trimucronatus*	23	N	1039	M	
15-Aug-12	6:00	48.0	Overcast /Fog	2	A14	*Lemmus trimucronatus*	24	N	1040	M	Torn right ear
15-Aug-12	6:00	48.0	Overcast /Fog	2	B1	*Lemmus trimucronatus*	52	R	1093	F	
15-Aug-12	6:00	48.0	Overcast /Fog	2	A1	*Lemmus trimucronatus*	71	R	1094	F	
15-Aug-12	6:00	48.0	Overcast /Fog	2	B2	*Lemmus trimucronatus*	UNK	R	1257	M	
15-Aug-12	6:00	48.0	Overcast /Fog	2	B10	*Lemmus trimucronatus*	60	R	1258	F	
15-Aug-12	6:00	48.0	Overcast /Fog	2	A15	*Lemmus trimucronatus*	30	R	1259	M	
15-Aug-12	6:00	48.0	Overcast /Fog	3	A6	*Lemmus trimucronatus*	34	N	1032	M	
15-Aug-12	6:00	48.0	Overcast /Fog	3	B17	*Lemmus trimucronatus*	32	N	1033	M	
15-Aug-12	6:00	48.0	Overcast /Fog	3	B14	*Lemmus trimucronatus*	UNK	N	1054	F	Potential recap, torn right ear
15-Aug-12	6:00	48.0	Overcast /Fog	3	A18	*Lemmus trimucronatus*	31	N	1055	M	
15-Aug-12	6:00	48.0	Overcast /Fog	3	B11	*Lemmus trimucronatus*	31	R	1071	M	
15-Aug-12	6:00	48.0	Overcast /Fog	3	A12	*Lemmus trimucronatus*	34	R	1228	F	
15-Aug-12	6:00	48.0	Partly Cloudy	4	A19	*Lemmus trimucronatus*	73	R	1042	F	
15-Aug-12	6:00	48.0	Partly Cloudy	4	A16	*Lemmus trimucronatus*	71	R	1069	M	
15-Aug-12	6:00	48.0	Partly Cloudy	4	B9	*Lemmus trimucronatus*	23	R	1091	M	
15-Aug-12	6:00	48.0	Partly Cloudy	4	A9	*Lemmus trimucronatus*	19	N	1246	M	
15-Aug-12	6:00	48.0	Partly Cloudy	4	A14	*Lemmus trimucronatus*	31	N	1253	M	
15-Aug-12	6:00	48.0	Partly Cloudy	5	A15	*Lemmus trimucronatus*	29	R	1082	M	
15-Aug-12	6:00	48.0	Partly Cloudy	5	A3	*Lemmus trimucronatus*	30	N	1236	F	
15-Aug-12	6:00	48.0	Partly Cloudy	5	A19	*Lemmus trimucronatus*	29	N	1247	M	
15-Aug-12	6:00	48.0	Partly Cloudy	5	A21	*Lemmus trimucronatus*	63	R	1287	M	Lesion on neck
15-Aug-12	6:00	48.0	Partly Cloudy	6	A4	*Lemmus trimucronatus*	75	R	1077	M	
15-Aug-12	6:00	48.0	Partly Cloudy	6	A3	*Lemmus trimucronatus*	38	R	1079	F	
15-Aug-12	6:00	48.0	Partly Cloudy	6	B18	*Lemmus trimucronatus*	67	R	UNK	UNK	Large, premature release
15-Aug-12	13:00	55.4	Rain/ Wind	3	A16	*Lemmus trimucronatus*	23	R	1235	M	
15-Aug-12	13:00	55.4	Overcast/Rain	5	A11	*Lemmus trimucronatus*	29	N	1036	F	
15-Aug-12	13:00	55.4	Overcast/Rain	6	B8	*Lemmus trimucronatus*	42	N	1035	M	
15-Aug-12	13:00	55.4	Overcast/Rain	6	A14	*Lemmus trimucronatus*	30	N	1037	M	

15-Aug-12	13:00	55.4	Overcast/Rain	6	B15	*Lemmus trimucronatus*	72	R	1077	M	
15-Aug-12	20:00	55.9	Rain/ Wind	4	A1	*Lemmus trimucronatus*	18	N	1238	M	
15-Aug-12	20:00	55.9	Rain/ Wind	6	B19	*Lemmus trimucronatus*	57	R	1264	F	Potential recap of premature release from 0600
16-Aug-12	6:00	52.0	Overcast Wind	1	A21	*Lemmus trimucronatus*	51	R	1072	F	
16-Aug-12	6:00	52.0	Overcast Wind	1	B18	*Lemmus trimucronatus*	30	N	1234	M	
16-Aug-12	6:00	52.0	Overcast Wind	2	A14	*Lemmus trimucronatus*	25	R	1040	F	
16-Aug-12	6:00	52.0	Overcast Wind	2	A1	*Lemmus trimucronatus*	67	R	1095	F	
16-Aug-12	6:00	52.0	Overcast Wind	2	B2	*Lemmus trimucronatus*	35	N	1230	F	
16-Aug-12	6:00	52.0	Overcast Wind	2	A6	*Lemmus trimucronatus*	27	N	1231	M	
16-Aug-12	6:00	52.0	Overcast Wind	2	A17	*Lemmus trimucronatus*	33	N	1237	M	
16-Aug-12	6:00	52.0	Overcast Wind	2	B6	*Lemmus trimucronatus*	27	N	1241	F	
16-Aug-12	6:00	52.0	Overcast Wind	2	B3	*Lemmus trimucronatus*	32	N	1243	F	
16-Aug-12	6:00	52.0	Overcast Wind	2	B1	*Lemmus trimucronatus*	27	N	1245	M	
16-Aug-12	6:00	52.0	Overcast Wind	2	A4	*Lemmus trimucronatus*	66	R	1257	M	
16-Aug-12	6:00	52.0	Overcast Wind	2	B10	*Lemmus trimucronatus*	57	R	1258	F	
16-Aug-12	6:00	52.0	Overcast Wind	2	B18	*Lemmus trimucronatus*	43	M	UNK	F	
16-Aug-12	6:00	52.0	Overcast Wind	2	B15	*Lemmus trimucronatus*	13	M	UNK	M	
16-Aug-12	6:00	52.0	Overcast Wind	3	A6	*Lemmus trimucronatus*	25	R	1032	M	
16-Aug-12	6:00	52.0	Overcast Wind	3	B14	*Lemmus trimucronatus*	36	R	1054	F	
16-Aug-12	6:00	52.0	Overcast Wind	3	A20	*Lemmus trimucronatus*	30	R	1055	M	
16-Aug-12	6:00	52.0	Overcast Wind	3	B17	*Lemmus trimucronatus*	44	R	1226	F	
16-Aug-12	6:00	52.0	Overcast Wind	3	A16	*Lemmus trimucronatus*	22	R	1235	M	
16-Aug-12	6:00	52.0	Overcast Wind	3	A13	*Lemmus trimucronatus*	34	N	1240	F	Previously marked, tag lost, torn right ear, left ear tagged
16-Aug-12	6:00	52.0	Overcast Wind	3	B6	*Lemmus trimucronatus*	33	R	1260	M	
16-Aug-12	6:00	52.0	Overcast	4	A15	*Lemmus trimucronatus*	72	R	1042	F	
16-Aug-12	6:00	52.0	Overcast	4	A12	*Lemmus trimucronatus*	49	N	1061	F	
16-Aug-12	6:00	52.0	Overcast	4	A16	*Lemmus trimucronatus*	70	R	1069	M	
16-Aug-12	6:00	52.0	Overcast	4	A17	*Lemmus trimucronatus*	31	R	1086	M	
16-Aug-12	6:00	52.0	Overcast	5	A10	*Lemmus trimucronatus*	73	N	1058	M	
16-Aug-12	6:00	52.0	Overcast	5	A5	*Lemmus trimucronatus*	23	N	1059	M	
16-Aug-12	6:00	52.0	Overcast	5	B10	*Lemmus trimucronatus*	37	N	1060	F	
16-Aug-12	6:00	52.0	Overcast	5	A19	*Lemmus trimucronatus*	51	R	1081	F	
16-Aug-12	6:00	52.0	Overcast	5	B8	*Lemmus trimucronatus*	22	R	1278	M	

16-Aug-12	6:00	52.0	Overcast	6	A14	*Lemmus trimucronatus*	46	N	1037	M
16-Aug-12	6:00	52.0	Overcast	6	A3	*Lemmus trimucronatus*	28	N	1038	F
16-Aug-12	6:00	52.0	Overcast	6	B9	*Lemmus trimucronatus*	19	N	1056	M
16-Aug-12	6:00	52.0	Overcast	6	B13	*Lemmus trimucronatus*	52	N	1057	M
16-Aug-12	6:00	52.0	Overcast	6	B8	*Lemmus trimucronatus*	69	R	1077	M
16-Aug-12	6:00	52.0	Overcast	6	A2	*Lemmus trimucronatus*	38	R	1079	F
16-Aug-12	6:00	52.0	Overcast	6	B19	*Lemmus trimucronatus*	54	R	1264	F
16-Aug-12	6:00	52.0	Overcast	6	A5	*Lemmus trimucronatus*	48	R	1277	M
16-Aug-12	13:00	57.9	Partly Cloudy/Wind	2	A15	*Lemmus trimucronatus*	23	R	1040	F
16-Aug-12	13:00	57.9	Partly Cloudy/Wind	3	A16	*Lemmus trimucronatus*	22	R	1235	M
16-Aug-12	13:00	57.9	Partly Cloudy/Wind	4	A1	*Lemmus trimucronatus*	18	N	1239	M
16-Aug-12	13:00	57.9	Partly Cloudy/Wind	5	A4	*Lemmus trimucronatus*	29	R	1092	M
16-Aug-12	13:00	57.9	Partly Cloudy/Wind	6	A2	*Lemmus trimucronatus*	36	R	1079	F
16-Aug-12	13:00	57.9	Partly Cloudy/Wind	6	B10	*Lemmus trimucronatus*	86	R	1080	F
16-Aug-12	13:00	57.9	Partly Cloudy/Wind	6	B19	*Lemmus trimucronatus*	51	R	1264	F
16-Aug-12	20:00	53.1	Overcast	1	A11	*Lemmus trimucronatus*	26	N	1242	M
16-Aug-12	20:00	53.1	Overcast	2	A11	*Lemmus trimucronatus*	63	R	1024	M
16-Aug-12	20:00	53.1	Overcast	2	A3	*Lemmus trimucronatus*	35	R	1243	F
16-Aug-12	20:00	53.1	Overcast	2	A14	*Lemmus trimucronatus*	60	R	1258	F
16-Aug-12	20:00	53.1	Overcast	3	B8	*Lemmus trimucronatus*	38	R	1260	M
16-Aug-12	20:00	53.1	Overcast	4	A15	*Lemmus trimucronatus*	UNK	R	1069	M
16-Aug-12	20:00	53.1	Overcast	5	A12	*Lemmus trimucronatus*	40	R	1060	F
16-Aug-12	20:00	53.1	Overcast	5	B16	*Lemmus trimucronatus*	57	R	1287	M
16-Aug-12	20:00	53.1	Overcast	6	B13	*Lemmus trimucronatus*	53	R	1057	M
16-Aug-12	20:00	53.1	Overcast	6	A6	*Lemmus trimucronatus*	66	R	1070	F
16-Aug-12	20:00	53.1	Overcast	6	B8	*Lemmus trimucronatus*	76	R	1077	M
16-Aug-12	20:00	53.1	Overcast	6	A2	*Lemmus trimucronatus*	36	R	1079	F
16-Aug-12	20:00	53.1	Overcast	6	B19	*Lemmus trimucronatus*	50	R	1264	F
19-Aug-12	6:00	48.9	Overcast	7	B16	*Lemmus trimucronatus*	30	N	1999	M
19-Aug-12	6:00	48.9	Overcast	7	B8	*Lemmus trimucronatus*	36	N	2000	F
19-Aug-12	6:00	48.9	Overcast	8	B18	*Lemmus trimucronatus*	39	N	1997	F
19-Aug-12	6:00	48.9	Overcast	8	B12	*Lemmus trimucronatus*	29	N	1998	M
19-Aug-12	6:00	48.9	Overcast	9	A3	*Lemmus trimucronatus*	69	N	1229	F
19-Aug-12	6:00	48.9	Overcast	9	A15	*Lemmus trimucronatus*	60	N	1985	F

19-Aug-12	6:00	48.9	Overcast	9	B19	*Lemmus trimucronatus*	52	N	1986	F	
19-Aug-12	6:00	48.9	Overcast	9	B17	*Lemmus trimucronatus*	42	N	1987	M	
19-Aug-12	6:00	48.9	Overcast	9	B14	*Lemmus trimucronatus*	54	N	1988	F	Possibly gravid
19-Aug-12	6:00	48.9	Overcast	9	B13	*Lemmus trimucronatus*	24	N	1989	M	
19-Aug-12	6:00	48.9	Overcast	9	A4	*Lemmus trimucronatus*	35	N	1990	F	
19-Aug-12	6:00	48.9	Overcast	9	A7	*Lemmus trimucronatus*	29	N	1991	M	
19-Aug-12	6:00	48.9	Overcast	9	A10	*Lemmus trimucronatus*	24	N	1992	M	
19-Aug-12	6:00	48.9	Overcast	9	A11	*Lemmus trimucronatus*	30	N	1993	F	
19-Aug-12	6:00	48.9	Overcast	9	B8	*Lemmus trimucronatus*	24	N	1994	M	Left ear tagged
19-Aug-12	6:00	48.9	Overcast	9	B6	*Lemmus trimucronatus*	24	N	1995	M	
19-Aug-12	6:00	48.9	Overcast	9	B4	*Lemmus trimucronatus*	24	N	1996	M	
19-Aug-12	6:00	48.9	Overcast	10	B7	*Lemmus trimucronatus*	32	N	1151	F	
19-Aug-12	6:00	48.9	Overcast	10	B14	*Lemmus trimucronatus*	26	N	1152	F	
19-Aug-12	6:00	48.9	Overcast	10	B3	*Lemmus trimucronatus*	28	N	1153	M	
19-Aug-12	6:00	48.9	Overcast	10	B6	*Lemmus trimucronatus*	28	N	1177	M	
19-Aug-12	6:00	48.9	Overcast	10	A2	*Lemmus trimucronatus*	26	N	1179	M	
19-Aug-12	6:00	48.9	Overcast	10	A4	*Lemmus trimucronatus*	27	N	1181	M	
19-Aug-12	6:00	48.9	Overcast	10	A9	*Lemmus trimucronatus*	19	N	1182	M	
19-Aug-12	6:00	48.9	Overcast	10	B1	*Lemmus trimucronatus*	27	N	1183	M	
19-Aug-12	6:00	48.9	Overcast	10	A3	*Lemmus trimucronatus*	26	N	1184	F	
19-Aug-12	6:00	48.9	Overcast	10	B11	*Lemmus trimucronatus*	52	R/N	1300	M	Marked in June
19-Aug-12	6:00	48.9	Overcast	11	A21	*Lemmus trimucronatus*	86	N	1067	M	
19-Aug-12	6:00	48.9	Overcast	11	B13	*Lemmus trimucronatus*	17	N	1101	M	
19-Aug-12	6:00	48.9	Overcast	11	B10	*Lemmus trimucronatus*	87	N	1150	F	Possibly gravid
19-Aug-12	6:00	48.9	Overcast	11	A10	*Lemmus trimucronatus*	19	M	UNK	M	
19-Aug-12	6:00	48.9	Overcast	12	A6	*Lemmus trimucronatus*	34	N	1062	F	
19-Aug-12	6:00	48.9	Overcast	12	B4	*Lemmus trimucronatus*	17	N	1063	M	
19-Aug-12	6:00	48.9	Overcast	12	B6	*Lemmus trimucronatus*	25	N	1064	M	
19-Aug-12	6:00	48.9	Overcast	12	B12	*Lemmus trimucronatus*	61	N	1065	UNK	Released prior to identification of sex
19-Aug-12	6:00	48.9	Overcast	12	B19	*Lemmus trimucronatus*	0	N	1066	M	Small, weight not recorded but < 20g
19-Aug-12	13:00	60.1	Partly Cloudy/Wind	8	B12	*Lemmus trimucronatus*	82	N	1178	F	
19-Aug-12	13:00	60.1	Partly Cloudy/Wind	9	A19	*Lemmus trimucronatus*	15	N	1124	M	
19-Aug-12	13:00	60.1	Partly Cloudy/Wind	9	A14	*Lemmus trimucronatus*	29	N	1154	F	
19-Aug-12	13:00	60.1	Partly Cloudy/Wind	9	B4	*Lemmus trimucronatus*	28	N	1176	M	

19-Aug-12	13:00	60.1	Partly cloudy	10	A3	*Lemmus trimucronatus*	33	N	1922	F	
19-Aug-12	13:00	60.1	Partly cloudy	10	B1	*Lemmus trimucronatus*	41	N	1923	M	
19-Aug-12	13:00	60.1	Partly cloudy	10	A4	*Lemmus trimucronatus*	20	N	1924	M	
19-Aug-12	13:00	60.1	Partly cloudy	11	A2	*Lemmus trimucronatus*	25	N	1925	F	
19-Aug-12	13:00	60.1	Partly cloudy	11	A12	*Lemmus trimucronatus*	21	N	1978	M	
19-Aug-12	13:00	60.1	Partly cloudy	12	B18	*Lemmus trimucronatus*	43	N	1977	F	Possibly gravid
19-Aug-12	20:00	64.0	Partly cloudy	8	A13	*Lemmus trimucronatus*	77	N	1979	F	Possibly gravid
19-Aug-12	20:00	64.0	Partly cloudy	9	B13	*Lemmus trimucronatus*	36	N	1921	M	
19-Aug-12	20:00	64.0	Partly cloudy	9	B4	*Lemmus trimucronatus*	25	N	1980	M	Tagged left ear
19-Aug-12	20:00	64.0	Partly cloudy	9	A15	*Lemmus trimucronatus*	34	N	1981	M	
19-Aug-12	20:00	64.0	Partly cloudy	9	A15	*Lemmus trimucronatus*	31	N	1982	M	
19-Aug-12	20:00	64.0	Partly cloudy	9	A4	*Lemmus trimucronatus*	37	R	1990	F	
19-Aug-12	20:00	64.0	Partly Cloudy	10	B4	*Lemmus trimucronatus*	18	N	1156	M	
19-Aug-12	20:00	64.0	Partly Cloudy	10	B7	*Lemmus trimucronatus*	UNK	R	1177	M	
19-Aug-12	20:00	64.0	Partly Cloudy	11	A21	*Lemmus trimucronatus*	88	R	1067	M	
19-Aug-12	20:00	64.0	Partly Cloudy	11	B9	*Lemmus trimucronatus*	63	R	1150	F	
19-Aug-12	20:00	64.0	Partly Cloudy	12	B18	*Lemmus trimucronatus*	50	R	1155	F	Tag lost in trap, former tag: 1977
20-Aug-12	6:00	50.0	Partly Cloudy	7	B10	*Lemmus trimucronatus*	32	N	1149	M	
20-Aug-12	6:00	50.0	Partly Cloudy	7	B8	*Lemmus trimucronatus*	20	N	1158	F	
20-Aug-12	6:00	50.0	Partly Cloudy	7	B16	*Lemmus trimucronatus*	34	N	1161	M	
20-Aug-12	6:00	50.0	Partly Cloudy	7	B5	*Lemmus trimucronatus*	27	N	1187	M	
20-Aug-12	6:00	50.0	Partly Cloudy	7	B17	*Lemmus trimucronatus*	31	R	1999	M	
20-Aug-12	6:00	50.0	Partly Cloudy	8	B12	*Lemmus trimucronatus*	19	N	1159	F	
20-Aug-12	6:00	50.0	Partly Cloudy	8	B18	*Lemmus trimucronatus*	42	R	1997	F	
20-Aug-12	6:00	50.0	Partly Cloudy	8	B9	*Lemmus trimucronatus*	29	R	1998	M	
20-Aug-12	6:00	50.0	Partly Cloudy	9	A10	*Lemmus trimucronatus*	34	N	1102	M	
20-Aug-12	6:00	50.0	Partly Cloudy	9	A6	*Lemmus trimucronatus*	30	N	1122	M	
20-Aug-12	6:00	50.0	Partly Cloudy	9	A4	*Lemmus trimucronatus*	32	R/N	1123	F	Potential recap, torn right ear
20-Aug-12	6:00	50.0	Partly Cloudy	9	B15	*Lemmus trimucronatus*	31	N	1180	M	
20-Aug-12	6:00	50.0	Partly Cloudy	9	A15	*Lemmus trimucronatus*	26	N	1191	F	
20-Aug-12	6:00	50.0	Partly Cloudy	9	B13	*Lemmus trimucronatus*	31	R	1921	M	
20-Aug-12	6:00	50.0	Partly Cloudy	9	A18	*Lemmus trimucronatus*	UNK	R	1981	M	
20-Aug-12	6:00	50.0	Partly cloudy	10	A3	*Lemmus trimucronatus*	33	R	1922	F	
20-Aug-12	6:00	50.0	Partly cloudy	10	A2	*Lemmus trimucronatus*	26	R	1924	M	

20-Aug-12	6:00	50.0	Partly cloudy	10	A18	*Lemmus trimucronatus*	42	N	1959	F	
20-Aug-12	6:00	50.0	Partly cloudy	10	A6	*Lemmus trimucronatus*	81	N	1960	M	Potential recap, healed injury on right ear
20-Aug-12	6:00	50.0	Partly cloudy	11	B12	*Lemmus trimucronatus*	83	N	1951	F	
20-Aug-12	6:00	50.0	Partly cloudy	11	A12	*Lemmus trimucronatus*	22	N	1954	M	
20-Aug-12	6:00	50.0	Partly cloudy	11	A9	*Lemmus trimucronatus*	24	N	1955	M	
20-Aug-12	6:00	50.0	Partly cloudy	11	A10	*Lemmus trimucronatus*	20	N	1956	M	
20-Aug-12	6:00	50.0	Partly cloudy	11	A4	*Lemmus trimucronatus*	47	N	1957	M	
20-Aug-12	6:00	50.0	Partly cloudy	11	A3	*Lemmus trimucronatus*	28	N	1958	F	
20-Aug-12	6:00	50.0	Partly cloudy	12	B13	*Lemmus trimucronatus*	60	R	1065	M	
20-Aug-12	6:00	50.0	Partly cloudy	12	A19	*Lemmus trimucronatus*	79	R	1952	M	
20-Aug-12	6:00	50.0	Partly cloudy	12	B12	*Lemmus trimucronatus*	52	N	1953	F	
20-Aug-12	6:00	50.0	Partly cloudy	12	A12	*Lemmus trimucronatus*	49	N	1975	F	
20-Aug-12	6:00	50.0	Partly cloudy	12	B6	*Lemmus trimucronatus*	41	N	1984	F	
20-Aug-12	13:00	57.9	Partly cloudy	9	A4	*Lemmus trimucronatus*	31	R	1123	F	
20-Aug-12	13:00	57.9	Partly cloudy	9	B13	*Lemmus trimucronatus*	15	N	1974	M	
20-Aug-12	13:00	57.9	Partly Cloudy/Wind	11	B15	*Lemmus trimucronatus*	24	N	1190	M	
20-Aug-12	20:00	43.0	Overcast/Wind	10	A2	*Lemmus trimucronatus*	28	R	1179	M	
20-Aug-12	20:00	43.0	Overcast/Wind	10	B4	*Lemmus trimucronatus*	35	R	1922	F	
21-Aug-12	6:00	39.1	Overcast	7	B6	*Lemmus trimucronatus*	36	N	1973	F	
21-Aug-12	6:00	39.1	Overcast	7	A17	*Lemmus trimucronatus*	31	R	1999	M	
21-Aug-12	6:00	39.1	Overcast	7	B10	*Lemmus trimucronatus*	34	R	2000	F	
21-Aug-12	6:00	39.1	Overcast	8	A11	*Lemmus trimucronatus*	29	N	1961	M	
21-Aug-12	6:00	39.1	Overcast	8	A19	*Lemmus trimucronatus*	42	N	1965	F	
21-Aug-12	6:00	39.1	Overcast	8	B18	*Lemmus trimucronatus*	48	N	1966	F	
21-Aug-12	6:00	39.1	Overcast	8	A17	*Lemmus trimucronatus*	24	N	1970	M	
21-Aug-12	6:00	39.1	Overcast	8	A15	*Lemmus trimucronatus*	29	N	1971	M	
21-Aug-12	6:00	39.1	Overcast	8	B3	*Lemmus trimucronatus*	79	N	1972	F	
21-Aug-12	6:00	39.1	Overcast	8	B11	*Lemmus trimucronatus*	30	R	1998	M	
21-Aug-12	6:00	39.1	Overcast	9	A6	*Lemmus trimucronatus*	35	R	1122	M	
21-Aug-12	6:00	39.1	Overcast	9	B8	*Lemmus trimucronatus*	28	N	1914	M	
21-Aug-12	6:00	39.1	Overcast	9	B3	*Lemmus trimucronatus*	51	N	1916	F	
21-Aug-12	6:00	39.1	Overcast	9	B13	*Lemmus trimucronatus*	35	N	1917	F	
21-Aug-12	6:00	39.1	Overcast	9	A11	*Lemmus trimucronatus*	33	N	1962	M	
21-Aug-12	6:00	39.1	Overcast	9	A18	*Lemmus trimucronatus*	31	R	1981	M	

21-Aug-12	6:00	39.1	Overcast	9	A15	*Lemmus trimucronatus*	60	R	1985	F	
21-Aug-12	6:00	39.1	Overcast	9	B16	*Lemmus trimucronatus*	42	R	1988	F	
21-Aug-12	6:00	39.1	Overcast	9	A17	*Lemmus trimucronatus*	27	R	1989	M	
21-Aug-12	6:00	39.1	Overcast	10	A10	*Lemmus trimucronatus*	27	N	1131	M	
21-Aug-12	6:00	39.1	Overcast	10	A21	*Lemmus trimucronatus*	17	N	1147	M	
21-Aug-12	6:00	39.1	Overcast	10	B11	*Lemmus trimucronatus*	73	N	1174	M	
21-Aug-12	6:00	39.1	Overcast	10	B7	*Lemmus trimucronatus*	25	R	1177	M	
21-Aug-12	6:00	39.1	Overcast	10	B16	*Lemmus trimucronatus*	16	N	1188	M	
21-Aug-12	6:00	39.1	Overcast	10	A3	*Lemmus trimucronatus*	UNK	R	1922	F	Weight not recorded but < 60g
21-Aug-12	6:00	39.1	Overcast	10	A17	*Lemmus trimucronatus*	44	R	1959	F	
21-Aug-12	6:00	39.1	Overcast	10	B4	*Lemmus trimucronatus*	12	M	UNK	M	
21-Aug-12	6:00	39.1	Overcast	11	B15	*Lemmus trimucronatus*	52	N	1120	F	
21-Aug-12	6:00	39.1	Overcast	11	B9	*Lemmus trimucronatus*	64	R	1150	F	
21-Aug-12	6:00	39.1	Overcast	11	A13	*Lemmus trimucronatus*	72	N	1193	F	
21-Aug-12	6:00	39.1	Overcast	11	A3	*Lemmus trimucronatus*	46	N	1195	M	Potential recap, torn right ear
12-Aug-12	13:00	48.9	Clear	1	B16	*Dicrostonyx groenlandicus*	65	N	N/A	F	
12-Aug-12	20:00	51.1	Clear	6	A4	*Dicrostonyx groenlandicus*	54	N	N/A	UNK	
13-Aug-12	20:00	60.1	Clear/Wind	3	B11	*Dicrostonyx groenlandicus*	58	N	N/A	UNK	
14-Aug-12	6:00	50.0	Overcast/Wind	3	B11	*Dicrostonyx groenlandicus*	43	N	N/A	F	
15-Aug-12	6:00	48.0	Overcast /Fog	1	A16	*Dicrostonyx groenlandicus*	28	N	N/A	M	
16-Aug-12	6:00	52.0	Overcast Wind	1	B6	*Dicrostonyx groenlandicus*	22	N	N/A	F	
16-Aug-12	20:00	53.1	Overcast	1	B9	*Dicrostonyx groenlandicus*	27	N	N/A	F	
16-Aug-12	20:00	53.1	Overcast	1	B6	*Dicrostonyx groenlandicus*	21	N	N/A	F	
19-Aug-12	20:00	64.0	Partly cloudy	8	B1	*Dicrostonyx groenlandicus*	46	N	N/A	F	Right rear foot caught in trap door, injury caused amputation at first joint. Animal alert with unhindered locomotion despite injury; released.
19-Aug-12	20:00	64.0	Partly Cloudy	12	B17	*Dicrostonyx groenlandicus*	31	N	N/A	UNK	
21-Aug-12	13:00	47.0	Overcast	7	B9	*Dicrostonyx groenlandicus*	37	N	N/A	M	
21-Aug-12	13:00	47.0	Overcast/Wind	11	A1	*Dicrostonyx groenlandicus*	41	N	N/A	F	
21-Aug-12	20:00	51.1	Overcast/Rain	7	B9	*Dicrostonyx groenlandicus*	35	R	N/A	M	Healed lesions on genitals
22-Aug-12	13:00	57.9	Overcast/Wind	7	B9	*Dicrostonyx groenlandicus*	34	R	N/A	M	Healed lesions on genitals