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Lemming and Vole Population Monitoring Protocol

Gilles Gauthier, Dominique Fauteux and Marie-Christine Cadieux

Department of biology and Centre d'Études Nordiques, Université Laval, Québec, Canada

PURPOSE

Lemmings are key players of the tundra food web. They are notoriously difficult to study due to their periodic, 3-4 year fluctuations of abundance. Between peak and low years, their abundance may vary by almost 100-fold. The causes of these cyclic fluctuations are still not entirely clear but the consequences on other tundra species are enormous. Predators regularly loose an important food source when lemming populations crash and turn to other herbivorous/insectivorous species like geese and shorebirds. There is also increasing evidence that climate change may affect the amplitude and even the occurrence of population peaks, primarily through disturbance of the snow cover. However, we still know very little of this phenomenon, especially in the vast Canadian Arctic. Some simple, yet essential information that is missing includes the exact periodicity of these population fluctuations (i.e. when peak and low phases occur) and the scale of spatial synchrony of lemming population fluctuations. A long-term monitoring of lemming abundance at several sites in the Arctic is the only way to address these questions.

FOCAL SPECIES

Brown Lemming (*Lemmus trimucronatus*)
Collared Lemming (*Dicrostonyx* spp.)

In low Arctic areas, other small mammal species present include:
Tundra (root) Vole (*Microtus oeconomus*)
Tundra Red-backed Vole (*Myodes rutilus*)

OVERVIEW OF METHODS

In this section we provide an overview of available methods. We divided methods into qualitative and quantitative ones. Different methods require varying degrees of effort. The table below summarizes the pros and cons of each method and gives an idea of the effort involved in each method. Although most methods can give a relative abundance estimate, only the live-trapping and marking animals on a grid can provide an absolute density estimate. Methods are ranked from those requiring the lowest effort/material to those required the most effort/material. Note that more than one method can be used simultaneously if time allows. For instance, one can report field impressions along with incidental observations, or incidental observations along with winter nest counts.

Table 1. Overview of methods to monitor small mammals in the tundra

Method	Equipment required	Time Required	Accuracy and Precision	Comments
Qualitative estimates				
Field impression	None	Hardly any	Very Low	*Pros*: quick and easy; *Cons*: subjective and very low precision but better than nothing.
Incidental observations	Pencil & notebook	Very little	Low	*Pros*: quick, cheap and easy; *Cons*: low precision but already far better than the previous one.
Quantitative estimates				
Winter nest counts	Pencil & notebook, GPS	Low to medium	Medium – less accurate than trapping; precision depends on number of nests found	*Pros*: relatively quick, cheap and easy; not necessary to kill or capture animals; can be done while walking between sites or doing other protocols *Cons*: detection of nest more difficult in tall grass or sedge; determining what constitutes a nest sometimes difficult, fresh or old nests not always easy to distinguish.
Burrow counts	Pencil & notebook	Medium – 3-4 person hours per ha	Low	*Pros*: quick, cheap and easy; not necessary to kill or capture animals *Cons*: limited to *Dicrostonyx* in good soils; determining what constitutes an active burrow sometimes difficult.
Snap-trapping	Snap traps, peanut butter, oatmeal, stakes & flags	Medium – About 6 person hours over 3 days	High	*Pros*: good estimates for all species, gives parasite, sex, body mass, and reproductive data if needed *Cons*: kills the animals, animal ethics concerns (though snap-traps could be replaced with live-traps).
Live trapping and marking of individuals	Stakes & flags, Longworth traps, bedding, bait, tagging material	High – 6 person days per 3-day trapping session	High	*Pros*: best estimates; definite species identification; demographic data; *Cons*: requires expensive equipment and skills in handling small mammals.

PROTOCOLS

Field impression

Presence and relative abundance of lemmings is usually relatively easy to assess for any team spending a week or more in the field. In years of low abundance, you are likely to encounter no lemming at all during your field work, very few signs of their presence (e.g. winter nests, fresh pile of faeces, freshly excavated burrows, clipping marks on vegetation and especially willow, runaway) and few predators specialized of lemmings (in particular snowy owls and long-tailed jaegers). The situation is likely to be very different in a year of peak abundance. In those years you are likely to encounter lemmings running on the tundra almost every day of your field work, including in your camp site or under your tent! Signs of their presence described above should be numerous, as well as sightings of predators like snowy owls or long-tailed jaegers, including nests of those species. Years of intermediate densities should be somewhere between the two extreme situations that I described above.

At the end of your field season, it would be useful if you could record at the minimum your qualitative observations regarding the presence of lemmings, the signs of their presence or the presence of their predators. Based on that, you should provide an assessment if you consider that lemming abundance was high, low or intermediate. Making this qualitative assessment will become easier as somebody return to the same field site for several years and they encounter contrasting situations regarding lemming abundance.

Incidental observations

A systematic recording of incidental observations of lemmings or their predators during the summer is an improved way to assess the relative abundance of lemmings at a site with a minimum of effort. The idea is to record every evening the exact number of lemmings or of their predators (such as snowy owls or long-tailed jaegers) encountered during each day of field work outside your camp. For each day, it is important to also indicate the time spent in the field and the distance that you walked. The number should be recorded for every field party that remained together for most of the time while in the field and not for every individual of that party (i.e. one lemming seen by 2 persons out of group of 4 is one observation, not 2). However, if two parties worked independently in two parts of the study area, then each party should report their observations separately. If you find nests of lemming predators like snowy owls and long-tailed jaegers, record each nest found, its position with a GPS, and how many eggs or young were present in each nest. A gross estimate of lemming abundance could be calculated if the total distance walked or the total number of hours spent in the field is known: # lemmings/km VS # lemmings/hour of observations. For groups, we note the number of person-hours (i.e. if a party of two spends 8h in the field, the number of hours to log is then 16h). You should record these observations for as many days that you spend in the field as possible.

Winter nest counts

Lemming abundance over the previous winter is relatively easy to measure indirectly by surveying winter nests. Lemmings build winter nests made of grasses and sedges under the snow and use them to keep warm. They appear to us like a ball of cut grass, about 12 cm in diameter (see Figure 1). Since they are abandoned in spring and not reused, they can be counted and picked up without harming the animals.

Both the brown lemming and the collared lemming build winter nests, as do voles like *Microtus* (tundra vole) and *Myodes* (red-backed vole) in tundra habitats. The two species of lemmings may be separated relatively easily based on some characteristics of the nest and especially the size and color of the faeces (see Table 2 below). Sometimes, the same nest may have been occupied by both species at different moments during the winter. You may also find winter nests larger than usual and lined with fur. These are weasel (ermine) nests. Weasels hunt lemmings and voles under the snow and convert lemming nests to their own use. Often you will find lemming stomachs left behind in weasel nests. This information should be noted when such nests are found. All nests should be torn open to check for fur lining (and therefore use by weasels) and to avoid re-counting them later in the season or next year.

Table 2. Criteria to identify lemming species from their winter nest (see also Fig. 2).

	Brown lemming	Collared lemming
Nest characteristics	Outer and inner portions of the nests look uniformly similar.	Outer portion of the nests is composed of whole vegetation fragments whereas the inner portion is composed of shredded plant fragments.
Faeces characteristics	Faeces are pale green-brown, about 6-10 mm long and rounded at both ends. Faeces are shaped like *Tic-Tac* (breath freshener).	Faeces are dark reddish brown, about 4-6 mm long, blunt at one end and rather pointed at the other end. Faeces often look like kidney beans with one side rather curvy.

Nest surveys are best done as soon as possible after snow melt (early in summer), since high winds can blow the nests around after the snow melts. They cannot be done in dense willow habitats or in tussock tundra where the winter nests are often invisible under the tussocks. All nests encountered are noted, and if possible the species identified. Count only fresh winter nests. Nests that are one year old are usually completely flattened and the grass has a grey colour rather than a tan colour because they have been exposed to sun for at least one complete summer. Old nests are also often composed of dry, pale, degraded faeces.

There are two potential sampling approaches to estimate nest density: (i) complete count on a fixed area; (ii) line transect count. If time is limited, a simpler line transect count could be used, though this method would only yield an index of abundance of winter nests rather than a true measure of density. This method is referred to as the incidental line transect count below.

Fixed area count

We use this approach to count nests on fixed, permanent plots. Position of the plot should be recorded with a GPS. The size of the plots could vary depending of the density of lemmings in the area but normally should be in the range of ~5-10 ha (i.e. ~225x225 m to ~315x315 m) and be located in areas representative of the general landscape. Ideally, one should do at least 2 plots. The observer walks slowly back and forth across the grid following a series of straight-line transects that are close enough together to allow a complete search and count. Depending of the type of terrain, lines should be spaced out by 5 to 10 m (shorter distance on more rugged terrain) and a GPS could be used to ensure that observers walked on a straight line. Alternatively, the

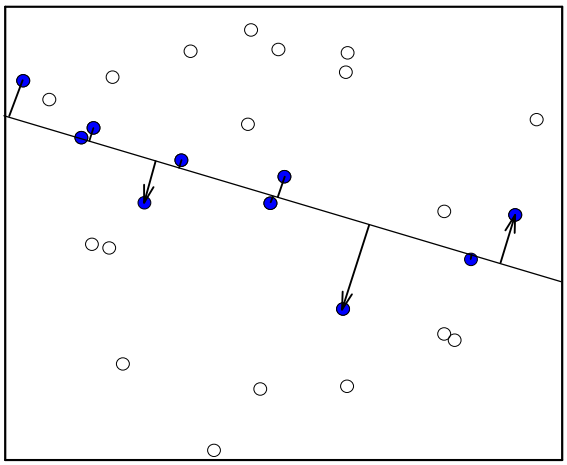
surveyed area may be marked by stakes at fixed intervals to help the observer to maintain straight lines and ensure complete coverage of the plot. Record individually each nest encountered on the datasheet and, if possible, their exact position with a GPS.

Line transect count - systematic

This approach is best for long-term monitoring because it crosses a greater variety of habitats than the grid sampling, and is more likely to achieve a reasonable sample size. The procedure is described extensively at http://www.ruwpa.st-and.ac.uk/distance/ (which has a book on-line to explain the details of the line transect method).

This method requires that the position of transects are selected beforehand. These transects should be selected randomly in the study area and the same transects reused year after year. If needed, you can stratify according to different types of habitats. For instance, on Bylot Island, we recognized 3 habitats: wet tundra, mesic tundra and gullies in mesic tundra (the latter habitat being conducive to high snow accumulation, which are areas preferred by lemmings in winter). Transects should not cross each other. Thus, their starting point could be selected randomly and they could all have the same orientation. Transects could be 500-m long (or any distance deemed suitable for the area) and spaced out by at least 100 m. The beginning and end of each transect should be recorded with a GPS.

The observer walks a straight line along the transect with a GPS searching visually for lemming nests. Upon sighting a nest, he or she records the perpendicular distance of the nest from the line of travel (either by measuring it with a GPS, using a 30+ m measuring tape or counting the number of steps, which can be subsequently transformed into meters). The data set consists of these perpendicular distances and the total length of survey line the observer walks. The procedure can be illustrated schematically as follows: circles represent winter nests, and the line marks the survey line walked by the observer. Solid circles represent winter nests seen by the observer, and the lines mark the perpendicular distances measured to the center of the winter nest. Only one survey line is shown for clarity.



Two key aspects of line transect sampling are shown in the diagram. First, not all winter nests are seen along the travel path. Second, all winter nests exactly on the line of travel are seen. But in general, the farther the nest is from the line of travel, the less likely it is to be seen, so that

detection falls off with distance. The perpendicular distance to each nest seen is measured, no matter how far it is from the line of travel. The exact position of each winter nest found could also be recorded with a GPS if time permits. Another important aspect is that only nests detected while walking the transect line are recorded. As you walk the perpendicular distance from the line to a newly-found nest, you may see other nests that had not been detected from the transect line itself. These additional nests should NOT be recorded.

The total number of transects to run depends on the density of small mammals in your area. On Bylot Island, we have 20 transects in each of our 3 habitats. As a rule-of-thumb, one should aim at detecting and measuring the perpendicular distance of at least 40 nests (cumulative number across transects, for a given habitat unit) and 60 to 80 would be ideal. These sample sizes apply in a good lemming year because these numbers would be impossible to achieve in a low lemming year.

These data can be analyzed with the program DISTANCE, which is available from the web site given above. Alternatively we could arrange a central data analysis system to which the raw data could be submitted each year. Program DISTANCE will calculate the number of lemming nests per hectare.

Line transect count - incidental

If the previous method is too time-consuming, a simpler approach would be to record any winter nests encountered during your normal activity, for instance as you walk from your camp to various sampling sites in the field. In this case, one has simply to count (identify the species when possible) and removed/rip apart any winter nest encountered as you walk in the field, trying to be alert in order to detect as many as possible. You would need to record with a GPS the starting and ending point of your travel path and the total distance travelled each time. You should count winter nests only once during the summer on each travel path. If some travel paths are repeated several times during the summer, count nests only once, preferably when all the snow has melted (but be sure of not disturbing nests seen at previous occasions while walking this travel path). The data would consist of the number of nests found along each travel path, the distance of the travel path and the date.

Burrow counts

Collared lemmings typically live in dry habitats and dig burrows, which can be surveyed indirectly by counting active burrows in a specified area of dry habitat. Active burrows can be recognized by fresh digging and soil thrown out of the burrow or by the presence of fresh faeces partly down the entrance of the burrow. Old burrows often have accumulations of dead leaves in the entrance and may also have spider webs inside them.

The general principle of this method is similar to the fixed area count for winter nests described above. Select one (or several, if time permits) areas of at least 1 ha (100 m x 100 m) and preferably about 2 ha and mark it with permanent stakes. This area should be selected in mesic/dry habitat dominated by non-organic soil (this method would not work in wet meadow dominated by organic soil such as a thick moss layer). The same area should be counted each year. Walk parallel lines within this area at approximately 5-7 m intervals looking for all burrows. Examine each burrow and classify as active or inactive. Count all burrows, indicating if

they are active or inactive. The time required for one person to search 1 ha thoroughly is approximately 3-4 hours. Burrow counts are best done in late July or August.

Snap trapping

Snap trap surveys can provide a fairly accurate index of rodent population densities and demographic data. Snap trapping should be conducted once per summer, usually in late July or early August after most juveniles of the year have been weaned.

The first step is to choose sites that can cover all potential rodent habitats. In summer, Brown lemmings and voles prefer wet polygonal areas and wet sedge meadows whereas collared lemmings prefer better drained slopes with dryer vegetation. Whenever possible, aim for 2 transects in each habitat type for a total of 4 transects. Each transect line should be 300-m long straight line. Place a marker (small wooden stake) every 15 metres, which will result in 20 trapping stations. If there is sufficient space within the habitat patch, the 2 transects of a given habitat should be laid parallel to each other with a minimum distance between the transect lines of 100 metres. These transects should be permanent and reused each year. Record the position of the beginning and end of each transect with a GPS.

Museum Special snap traps should be used for snap trapping. Each station consists of 3 traps for a total of 60 traps/transect or 240 traps in total. Each transect will be trapped for 3 nights for a total of 720 trap nights. This many trap nights are necessary statistically to obtain a reasonably precise estimate. If you are limited to 120 traps, you can set the two transects in the first habitat for 3 nights and then move the traps to the next set of transects in the other habitat and trap for another 3 nights.

At each station, the 3 snap traps should be set within a radius of 2 meters from the station marker. We recommend attaching them with a string to the marker to avoid having traps stolen by predators attracted by lemming carcasses. Separate the 3 traps as much as possible and place in areas with fresh rodent signs where possible (runways, burrows, fresh scats or grass clippings). Traps should be placed flat on the ground and clear of any vegetation that could interfere with the trap operation. If there are many ground squirrels or foxes in the area, you may need to tether the traps to a bush near the station marker with a strong piece of string to be sure they don't carry the traps away. Otherwise, make sure that you will be able to locate the traps again. If the bushes are high you may need to put flagging above each trap. It may be useful to paint the bottom of the traps bright orange so you can find them easily if they flip upside down and carried a small distance from where they were initially placed.

Each trap should be baited with a pea-sized amount of peanut butter (or alternatively a mixture of peanut butter, rolled oat and flour, which facilitates trap-cleaning afterward) on the treadle. A convenient way to carry and deploy the peanut butter is to fill a "Coghlan's squeeze tube" that you can buy from Mountain Equipment Coop for $2.50. Traps should be checked once per day, roughly 24-hr after having been set, for three days. Whenever an animal is caught, collect the animal and record the line, station number, habitat, species (see Fig. 3), age (adult, juvenile), sex and, if possible, body mass. Re-bait the trap with peanut butter and re-set the trap. It is also important to note every trap that will have sprung but is empty (e.g. due to wind or an animal that passed through but was not caught). If another species is accidentally killed by a trap, it should also be recorded. Traps should be collected during the trap check of the third day. When trapping is finished, we strongly recommend that you clean traps with hot water and soap to remove remnants of peanut butter.

Transects will take two people, 1-3 hour per transect to set out on the first day. Extra time for walking to the sites needs to be factored in. Subsequent trap checks will take about 1/2 person hour per transect. The abundance index is described as the number of animals per 100 trap nights.

If you do not want to kill animals, an alternative method is to use live traps instead of snap traps, though these traps are more expensive. We strongly recommend the Longworth® traps over the Sherman® traps, as they provide a much better environment for the animal. The live traps should be positioned along the transects in the same way as the snap-traps. They should be baited with apple (a quarter) to provide food/water for the animal. Line the box of the Longworth traps with upholstery cotton (often found as cotton batting for furniture in sewing shops or large surface shops (e.g. Fabricville, Target, Wal-Mart)) or wool fleece for bedding. Use just enough cotton or fleece to create a warm nest. Natural material is often the best because lemmings have a lower risk of being caught or strangled by loose thread. Traps should be checked every 12 hours and left in operation for only 2 days rather than 3 with the snap-traps. Upon capture, the animal should be transferred to a plastic bag. Identify species, and if possible age, weigh, and sex them before releasing them. Traps in which an animal was captured should be cleaned of faeces and urine, the bedding replaced by clean one and a new piece of apple should be added.

Working with small mammals may represent some risks for human health as some diseases may be transmissible (i.e. zoonoses) especially when in contact with faeces (e.g. hantavirus; http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/diseases-maladies/hantavirus-eng.php). Although these zoonoses have not been reported in the Canadian Arctic, wearing surgical gloves and regular hand washing is nonetheless recommended when working with small rodents.

Live trapping with marking

Live-trapping and marking lemmings on grids over 2 to 4-day periods allows application of robust capture-recapture statistical methods to estimate absolute density and other demographic parameters. It is the most accurate method. However, it requires a lot of material (a minimum of 100 live-traps per grid, tagging material), is time consuming and it requires trained personnel to handle and mark animals. We have not included a detailed protocol for this technique because few teams are likely to have the resources to conduct this activity. However, you can contact Gilles Gauthier (gilles.gauthier@bio.ulaval.ca) to obtain a detailed protocol if you are interested (see also http://www.cen.ulaval.ca/arcticwolves/en_project_descrip_CAN_method.htm for additional protocols).

PERMIT REQUIREMENTS

Field impression, incidental observations, winter nest counts and burrow counts will not require any specific research permits. However, both snap-trapping and live-trapping will require at the minimum two specific permits. First, you will need a permit from an Animal Care Committee recognized by the Canadian Council on Animal Care (universities and governmental wildlife agencies typically have such committees). Second, you will need a research permit from the territory/province where you will be conducting the work. In Nunavut and the Northwest Territories, Wildlife Research Permits are handled by the Wildlife Branch of the Department of the Environment. In Nunavik, it is the Ministère de la forêt, de la faune et des parcs. Additional permits may sometimes be required, for instance in National Parks or Inuit-owned Lands.

DATASHEETS AND DATA TRANSMISSION

Datasheets to report your observations are available upon request. At the end of the season, please send your datasheets to Gilles Gauthier (at Département de biologie, 1045 avenue de la Médecine, Université Laval, Québec, Qc, G1V 0A6; gilles.gauthier@bio.ulaval.ca).

REFERENCES

Banfield, A.W.F. 1977. The mammals of Canada. Published for the National Museum of Natural Sciences of Canada by University of Toronto Press.

Krebs, C.J., F. Bilodeau, D. Reid, G. Gauthier, A.J. Kenney, S. Gilbert, D. Duchesne & D.J. Wilson. 2012. Are lemming winter nest counts a good index of population density? *Journal of Mammalogy* 93:97-92.

APPENDIX

Figure 1. Examples of lemming winter nests. The nest in the middle was lined with a thick layer of lemming fur inside (bottom) as it was transformed by an ermine for its own use after a predation.

Figure 2. Droppings of brown lemming (top) and collared lemming (bottom).

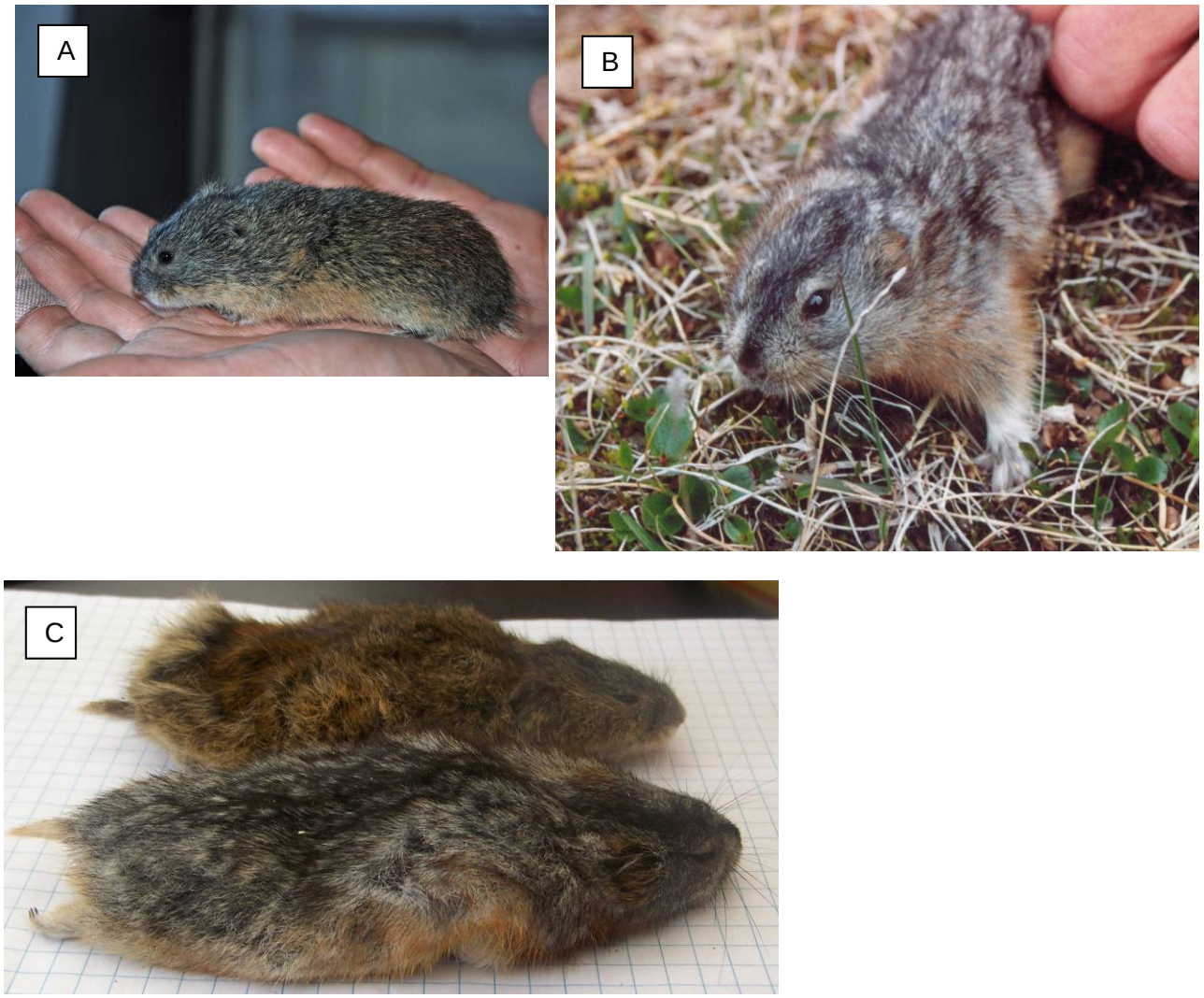


Figure 3. (A) Brown lemming, (B) collared lemming, (C) brown lemming (top) and collared lemming (bottom). Notice differences in the relative size of the eye compared to the head (larger in collared lemming) and the clearly drawn black line on the back of collared lemmings (WARNING, this line is difficult to see when the fur is wet). Although the color of the dorsal fur is often brownish in brown lemmings and greyish in collared lemmings, there is considerable variation among individuals and thus caution is needed. In dead animals, tooth morphology is also diagnostic, though a binocular is needed (see figure 43 in Banfield 1977).

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SMALL MAMMAL PROTOCOL - FIELD IMPRESSIONS

YEAR	FIELD SITE	UTM CAMP COORDINATES	DATUM	UTM ZONE	NAME OF OBSERVER
		E N			

Field impression	Presence confirmed	Assessment of abondance			Remarks and additionnal notes
		low	interm	high	
lemmings / voles					
winter nests					
fresh piles of faeces					
fresh burrows					
runways					
clipping marks on vegetation					
Snowy Owls					
jeagers					
other avian predators					specify species:

GENERAL REMARKS

Please provide contact information of observer (e-mail & phone number): _____

_____

At the end of your field season, please sent your datasheet to :

Gilles Gauthier
Département de biologie
1045 avenue de la Médecine
Pavillon Vachon
Université Laval
Quebec, QC
G1V 0A6
gilles.gauthier@bio.ulaval.ca
Tel: 1-418-656-5507

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SMALL MAMMAL PROTOCOL
DAILY INCIDENTAL OBSERVATIONS

YEAR	FIELD SITE	UTM CAMP COORDINATES	DATUM	UTM ZONE
		E N		

DATE OF OBSERVATION						
INITIALS OF OBSERVER(S)						
PERSON-HOURS IN THE FIELD						
DISTANCED WALKED (km)						
BIRDS	**Nb observed**					
Gyrfalcon						
Peregrine Falcon						
Rough-legged Hawk						
Snowy Owl						
Long-tailed Jaeger						
Parasitic Jaeger						
Pomarine Jaeger						
MAMMALS						
Brown Lemming						
Collared Lemming						
Lemming (unknown species)						
Tundra Red-backed Vole						
Tundra Vole						
Vole (unknown species)						
Arctic Fox						
Red Fox						
OTHERS (specify)						

Please provide contact information of observers (full names, e-mail & phone number):

At the end of your field season, please sent your datasheet to :

Gilles Gauthier
Département de biologie
1045 avenue de la Médecine
Pavillon Vachon, Université Laval
Quebec, QC G1V 0A6
gilles.gauthier@bio.ulaval.ca
Tel: 1-418-656-5507

**** Use as many datasheets as needed for each field season ****

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SMALL MAMMAL PROTOCOL - DAILY INCIDENTAL OBSERVATIONS
LEMMING PREDATOR NESTS

YEAR	FIELD SITE	UTM CAMP COORDINATES	DATUM	UTM ZONE
		E N		

NEST ID	UTM Easting	UTM Northing	PREDATOR SPECIES	DATE	NB EGGS	NB YOUNG	NAME OF OBSERVER

Please provide contact information of observer(s)
(e-mail & phone number):

At the end of your field season, please send your datasheet to :

Gilles Gauthier
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SMALL MAMMAL PROTOCOL
LEMMING/VOLE WINTER NEST COUNTS USING FIXED AREA

YEAR	DATE	FIELD SITE	PLOT ID	PLOT SIZE	UTM NORTH-WEST CORNER	DATUM	UTM ZONE
				x m	**E** **N**		

Nest ID	Nest UTM coordinates		Fresh nest	Small mammal species	Predation	Name of observer	Notes
	Easting	Northing					

Fresh nest - from the previous winter and not the year before (Y/N)
Predation - evidence of predation by weasel inside the nest (Y/N)

Small mammal species - species that appeared to have used the nest

Please provide contact information of observer(s)
(e-mail & phone number):

At the end of your field season, please send your datasheet to :

Gilles Gauthier
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Quebec, QC G1V 0A6
gilles.gauthier@bio.ulaval.ca
Tel: 1-418-656-5507

**** Start a new datasheet for each plot; record each nest encountered on a different line and use more than one datasheet per plot if needed ****

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SMALL MAMMAL PROTOCOL
LEMMING/VOLE WINTER NEST COUNTS USING SYSTEMATIC LINE TRANSECTS

YEAR	DATE	FIELD SITE	HABITAT	DATUM	UTM ZONE

TRANSECT NO	START UTM COORDINATES		END UTM COORDINATES		Distance covered (m)	NOTES
	Easting	Northing	Easting	Northing		

Nest ID	Nest UTM coordinates		Distance from (m)	Fresh nest	Small mammal species	Predation	Name of observer
	Easting	Northing					

Distance from - perpendicular distance of the nest from the transect
Small mammal species - species that appeared to have used the nest

Fresh nest - from the previous winter and not the year before (Y/N)
Predation - evidence of predation by weasel inside the nest (Y/N)

Please provide contact information of observers
(e-mail & phone number):

_____
_____
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_____
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_____

At the end of your field season, please send your datasheet to :

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gilles.gauthier@bio.ulaval.ca
Tel: 1-418-656-5507

**** Start a new datasheet for each transect; record each nest encountered on a different line and use more than one datasheet per transect if needed ****

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SMALL MAMMAL PROTOCOL
LEMMING/VOLE WINTER NEST COUNTS USING INCIDENTAL LINE TRANSECTS

YEAR	FIELD SITE	DATUM	UTM ZONE

TRANSECT NO	DATE	START UTM COORDINATES		END UTM COORDINATES		DISTANCE COVERED (m)	NB NESTS FOUND	NAME OF OBSERVER
		Easting	Northing	Easting	Northing			

Please provide contact information of observer(s)
(e-mail & phone number):

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SMALL MAMMAL PROTOCOL - LEMMING/VOLE BURROW COUNTS

YEAR	FIELD SITE	DATUM	UTM ZONE

PLOT ID	PLOT SIZE (m)	UTM NW CORNER		DATE	NB ACTIVE BURROWS	NB INACTIVE BURROWS	NAME OF OBSERVER
		Easting	Northing				
	x						
	x						
	x						
	x						
	x						
	x						
	x						
	x						
	x						
	x						
NOTES							

Please provide contact information of observer(s)
(e-mail & phone number):

At the end of your field season, please send your datasheet to :

Gilles Gauthier
Département de biologie
1045 avenue de la Médecine
Pavillon Vachon, Université Laval
Quebec, QC G1V 0A6
gilles.gauthier@bio.ulaval.ca
Tel: 1-418-656-5507

Revised 21 May 2014

SMALL MAMMAL PROTOCOL
SMALL MAMMAL SNAP TRAPPING - PART 1

YEAR	FIELD SITE	UTM CAMP COORDINATES	DATUM	UTM ZONE
		E N		

TRANSECT NO	START UTM COORDINATES		END UTM COORDINATES		HABITAT	NB OF TRAPS DEPLOYED
	Easting	Northing	Easting	Northing		

GENERAL REMARKS

Please provide contact information of observers (full names, e-mail & phone number):

At the end of your field season, please sent your datasheet to :

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Revised 21 May 2014

SMALL MAMMAL PROTOCOL
SMALL MAMMAL SNAP TRAPPING - PART 2

DATE	FIELD SITE

Transect no	Station no	Trap no	Activity recorded / capture details	Name of observer

REMARKS

INDICATE YOUR ACTIVITY / CAPTURE CODES HERE:

Species: BL-Brown Lemming, **CL-**Collared Lemming, **TV-**Tundra Vole, **TRBV-**Tundra Red-backed Vole
Age: A-adult, **J-**juvenile **Sex: F-**female, **M-**male **misfire:** MF

**** Use a separate datasheet for each day of trapping ****