Arctic WOLVES Protocol
Lemming Habitat Selection

WRITING TEAM:

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CONCEPTUAL BACKGROUND AND PURPOSE:

The choice of one habitat over another influences an individual's fitness, and thus the demography and dynamics of its population. Optimally behaving individuals will choose the habitat that maximizes fitness. This choice depends not only on density, but also on the frequency of individuals living in different habitats. Inter-specific competitors confound habitat choice because their decisions are also density and frequency dependent. Fortunately, these complex interactions can be disentangled by isodar analysis (e.g., Morris et al. 2000) on replicated abundance estimates of competing species. It is thereby crucial to include density-dependent habitat selection in any study investigating temporal and spatial population dynamics, and species interactions.

Habitat choice also reflects risks of predation. Unfortunately, computer simulations suggest that isodars may be unable to parcel out the confounding influences of predators on habitat-dependent prey coexistence. We must consider alternative techniques that allow us to evaluate whether habitat selection by prey species reduces predation risk. If prey optimize habitat use relative to risk, then their habitat selection will need to be incorporated into any assessment of spatial variation in food webs and the dynamics of predators and prey.

Climate change alters habitat quality, the spatial-temporal distribution of habitat patches, the relative values of different habitats, and time-course of habitat selection. Each of these effects has direct and indirect linkages to population dynamics and must be included in theories and models of ecological responses to climate change.

We will use two parallel approaches on lemmings to explore the potentially profound implications of habitat-selection on northern ecosystems. 1. We will collect comparative data for isodar analyses of habitat selection and competitive coexistence between collared and brown lemmings (Morris et al. 2000). These data will let us assess whether habitat selection by lemmings at Walker Bay has diverged from the patterns we documented a decade ago, allow us to evaluate differences in habitat selection among age classes, and compare the Walker Bay model with habitat selection at other localities (Herschel Island, possibly Bylot Island). 2. We will test a new method to assess whether lemming habitat preference incorporates predation risk.

TIME PERIOD:

Late June or July

PROCEDURES:

I. Live-trapping micro-grids (2-3 persons).

Choose up to 12 0.36 ha sites with a distinct boundary between suitable “wet” and “dry” lemming habitats. Sites should be separated from one another by at least 100 m.

At each site, set up a square live-trap grid that includes at least 20% of the least common habitat at that site.

Ensure that the location of trap stations allows trap placements free of standing water.

Orient the grid to make the best use of the habitat boundary (Fig. 1).

Place either temporary (stake-wire flags) or permanent (wooden stakes) markers at each trap station. Space stations at 15-m intervals. Adjust station placements to ensure that all are aligned in straight rows (rows, columns, and diagonal).

Label each station according to its location (HR, BY, WB) plot number (1-12), column (alpha code; A-E) and row (numeric code; 1-5).

Live-trap lemmings as described in the live-trap protocol. Ensure that data include the full station identity at each capture point (location, plot, column, row).

II. Habitat measurements (2-3 persons):

At each live-trapping station (10-15 minutes).

Using a tape measure, center a randomly-oriented 10 m transect on the trap station. Mark each end with a temporary stake-wire flag. Using one observer (always the same one) and one recorder, hold the tape at the station marker and extend toward one of the two flags. Record the “point cover” at each 1 m marker along the tape measure. Record the data using the cover classes on the appropriate data sheet. Also record the number of hummocks or tussocks (5 cm or greater in height), as well as the height of the tallest hummock (cm). Then repeat on the remaining half of the 10 m transect.

Leaving the stake-wire flags in place, use the tape measure to circumscribe a circle with 5 m radius. Using a rigid meter stick, record the height of the tallest shrub (cm) in each hemisphere bisected by the transect. Then, always using the same observer, record the proportion of the entire circle composed of “dry” versus “wet” habitat (when common, to the nearest 5 %, when rare (between 1% and 5%) to the nearest 1%. Before writing these proportions down, ensure that the recorder agrees with the classification. If not, discuss the most appropriate value. Ensure that the total equals 100%.

The recorder must verify that all values are properly filled in before removing the stake-wire flags and moving to the next station.

On each plot.

Use a single piece of letter-sized paper with a 5 × 5 grid to map the habitat of each plot. Draw habitat to a scale of 5 m accuracy and label each type. Be certain to indicate TRUE NORTH on the map, and ensure that the data sheet includes the plot number, date, author, line, and station numbers. Complete this map before heading to another plot.

Be certain to record the date, personnel, and all habitat tasks completed, in the field log book.

III. Tracking tubes (2 persons).

Use standard tracking tubes (ABS tubing, 40 mm diameter, 30 cm long, 2 internal spring clips, Fig. 4, these should be ordered from D. Morris).

Construct tracking papers by using a standard paper-cutting board to cut letter-size photocopy paper into 5 equally wide 11.5" long strips.

Centre a square piece of white "mac-tac" (self-adhesive shelving paper), of equal width to the strips, in the middle of each strip.

Use a 1" paint brush to apply a slurry of carbon ink (approximately a 50-50 mix of powdered carbon and mineral oil – use a consistency that will remain moist for at least 5 days, and verify this with a test group of tubes placed in field conditions before actually attempting to collect field data) on only the mac-tac (leave a small clear boundary on all sides to ensure that the ink does not wick onto the paper strip). Prepare strips on the same or preceding day that they will be placed in the field.

Place each strip into a tracking tube and secure it in place with the spring clips.

Place tubes in suitable runways so that lemmings can run through the strips without climbing.

Label THE UNDERSIDE of each strip in pencil with the plot, column, row, and treatment (e.g., under artificial cover "C", or in the open "O"). This can be done when strips are prepared, as long as each tube is double-checked when placed in the field.

It is also a good idea to label the outside of one end of each tube using a short piece of green masking tape.

Record the time and location of tracking tubes in the field log.

For general lemming assessments, place two tubes at each station. Label them as 1 and 2.

For cover vs open treatments (using the cover tent as described below), place 6 tubes ~1-m from each corner of the "tent", and another in the middle. Repeat for the paired open treatment located 2 m from the tent (Fig. 2 and 3).

Leave all tubes in place for 5 consecutive days. Collect tubes on the 5th day. Ensure that each strip's identifier data can be read before removing the tube from the field. Write identifier information on any strips lacking this information. Replace each tube on cover vs open experiments, then move the tent from the "cover" position to the "open" position.

COUNT to ensure that all tubes have been collected and replaced at each station and plot before moving to the next one.

Record, in the field log, when, and from where, tubes were collected.

In the lab, score lemming tracks on the strip as a 5-point scale:

0 = no tracks
1 = trace – 20% cover by tracks
2 = 20.1 – 40% cover by tracks
3 = 40.1 – 60% cover by tracks
4 = 60.1 – 80% cover by tracks
5 = 80.1 – 100% cover by tracks

Record any abnormal data and summarize data collection in the field log.

Enter the data in Excel and include location, plot, column, row, treatment, date and time placed in the field, date and time collected, track score, collector's initials, proofreader's initials, corrector's initials, and comments.

Destroy strips only after the data are proofread and corrected for errors.

Clean any soiled tubes, ensure that the clips are in place, and pack for transport at the completion of the experiment.

IV. Artificial cover (2 persons).

Use two standard tent structures (from D. Morris) on each randomly selected plot. Select a trap station at random from the largest units of both wet and dry habitat. Using the station marker as a reference, choose a random direction and place one side of a hexagonally shaped tent perpendicular to this axis and 1 m distant from the marker. Mark the six corners with stake-wire flagging.

Move the tent structure to the opposite side of the station marker and repeat. Ensure that the two “grids” lie perpendicular to one another. Temporarily remove the tent and place 7 tracking tubes within the boundaries of each hexagon (in likely lemming runways approximately1 m from each corner, plus 1 in the middle). Be certain to label the tubes by the treatment that they represent (artificial cover or “open”).

Choose one of the hexagons at random, place the tent so that it fits within the vertices of the stake-wire hexagon and fasten it in place securely with tent pegs, guy lines, and rocks.

Return in 5 days. Remove the tent, collect and replace all tubes ensuring that the track strips are still properly labeled, then secure the tent in place on the opposite “hexagon”.

Return in 5 days. Collect all data. Remove the rocks, and stake-wire flags. Count all pegs, guy lines, and flags.

Move the entire setup to another plot and repeat.

MATERIALS:

I. Live-trapping. For each micro-grid.

To set: 26 Longworth live traps in proper working order (1 spare), trap carrying case, 30 pieces of Granny Smith apple for bait, one plastic shopping bag filled with cotton, 25 plywood trap covers (117/8” × 73/4”), 1 canoe pack to transport all of the above, 25 1 kg rocks to place on trap covers (to be collected near the trapping grid).

To check: 30 pieces of Granny Smith apple (5 spares), spare cotton, trapping kit (animal bag, 20 cm ruler, 50 and 100 g Pesola balances, forceps, ear-tag pliers, ear tags, [or replace ear tagging gear with RFID tags, RFID tag injector, and a RFID tag reader]), 2 pencils, clip board with trapping data sheets.

II. Habitat measurements.

List of random compass headings, compass, 15 m tape measure, rigid 1 m ruler, 2 pencils, clip board with habitat data sheets.

III. General tracking data. For each micro-grid.

52 tubes (2 spares) fitted with labeled and inked tracking paper, each with two internal clips (104 total), 2 pencils, waterproof black marking pen, roll of green masking tape, burlap bag or alternative carrying-case (e.g., collapsible milk-carton trays) to hold and transport tubes.

For each micro-plot with artificial tent covers.

15 tubes (1 spare) fitted with labeled and inked tracking paper, each with two internal clips (30 total), 2 pencils, burlap bag or alternative carrying-case (e.g., collapsible milk-carton tray) to hold tubes.

IV. Artificial cover.

2 tent structures (each with 3 sets of tent poles and shade-cloth tent), 15 m tape measure, list including appropriate randomly selected trap station and compass heading, compass, 15 tubes (1 spare) fitted with labeled and inked tracking paper, each with two internal clips (30 total), 2 pencils, burlap bag or alternative carrying-case (e.g., milk-carton tray) to hold tubes.

Literature Cited:

Morris, D. W., D. L. Davidson and C. J. Krebs. 2000. Measuring the ghost of competition: insights from density-dependent habitat selection on the co-existence and dynamics of lemmings. *Evolutionary Ecology Research* 2: 41—67.

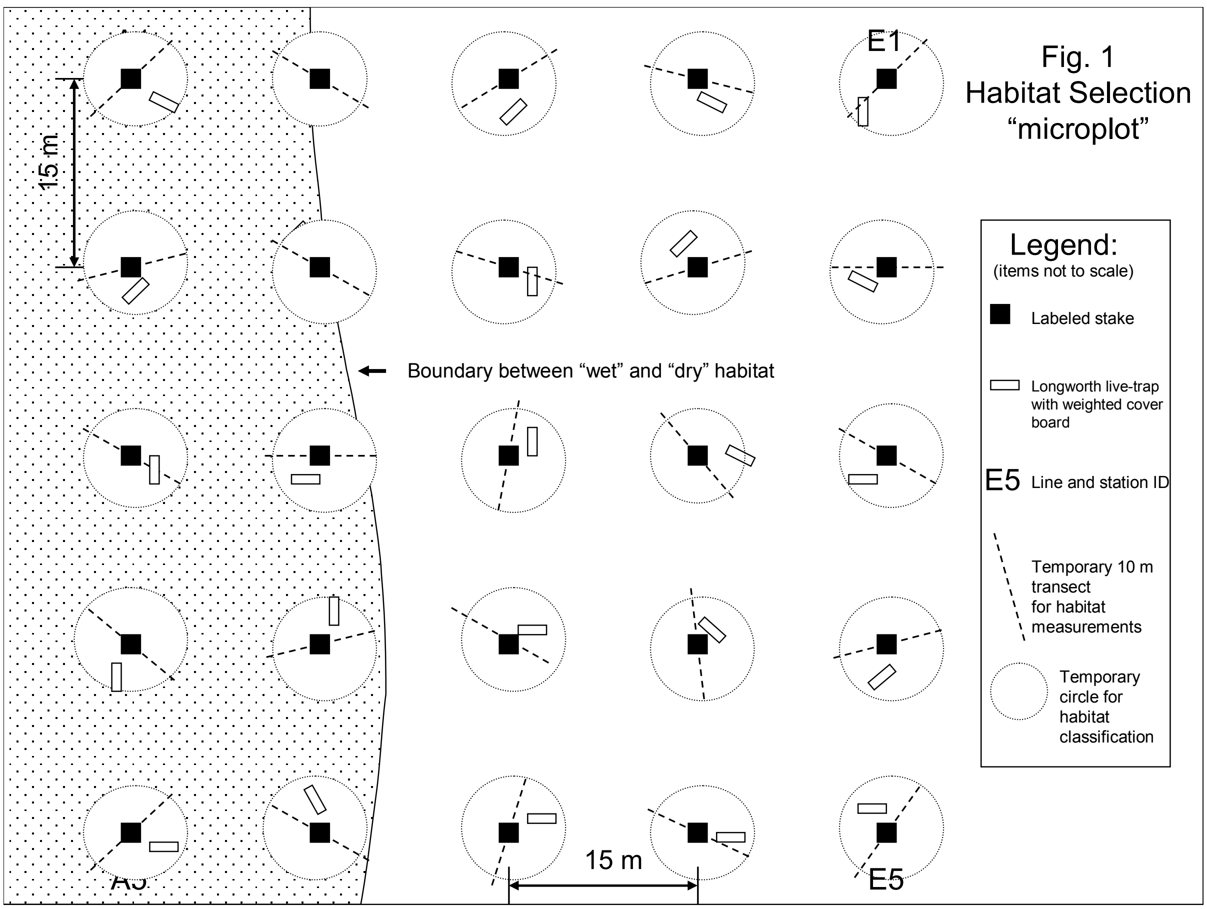


Fig. 1
Habitat Selection
"microplot"
E1
15 m
Boundary between "wet" and "dry" habitat
15 m
E5
Legend:
(items not to scale)
Labeled stake
Longworth live-trap with weighted cover board
E5 Line and station ID
Temporary 10 m transect for habitat measurements
Temporary circle for habitat classification

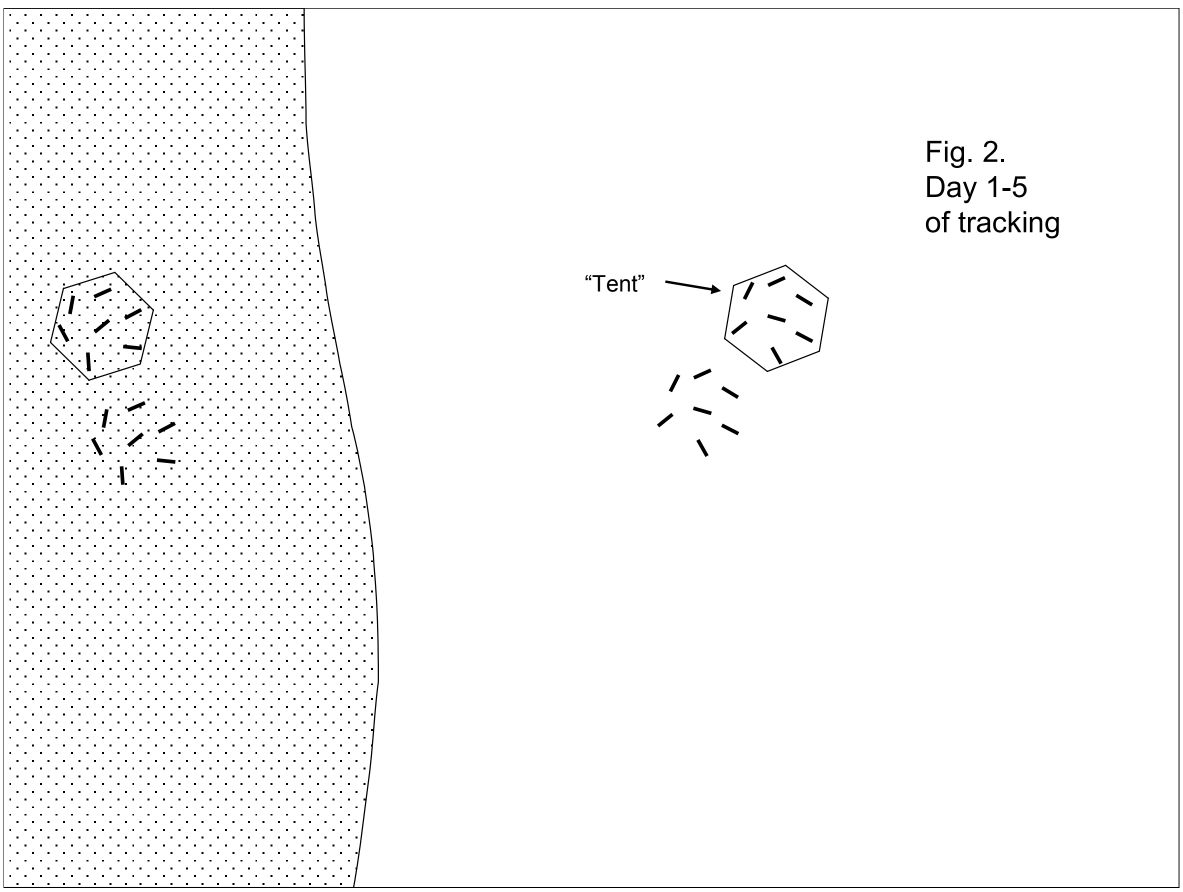


Fig. 2.
Day 1-5
of tracking

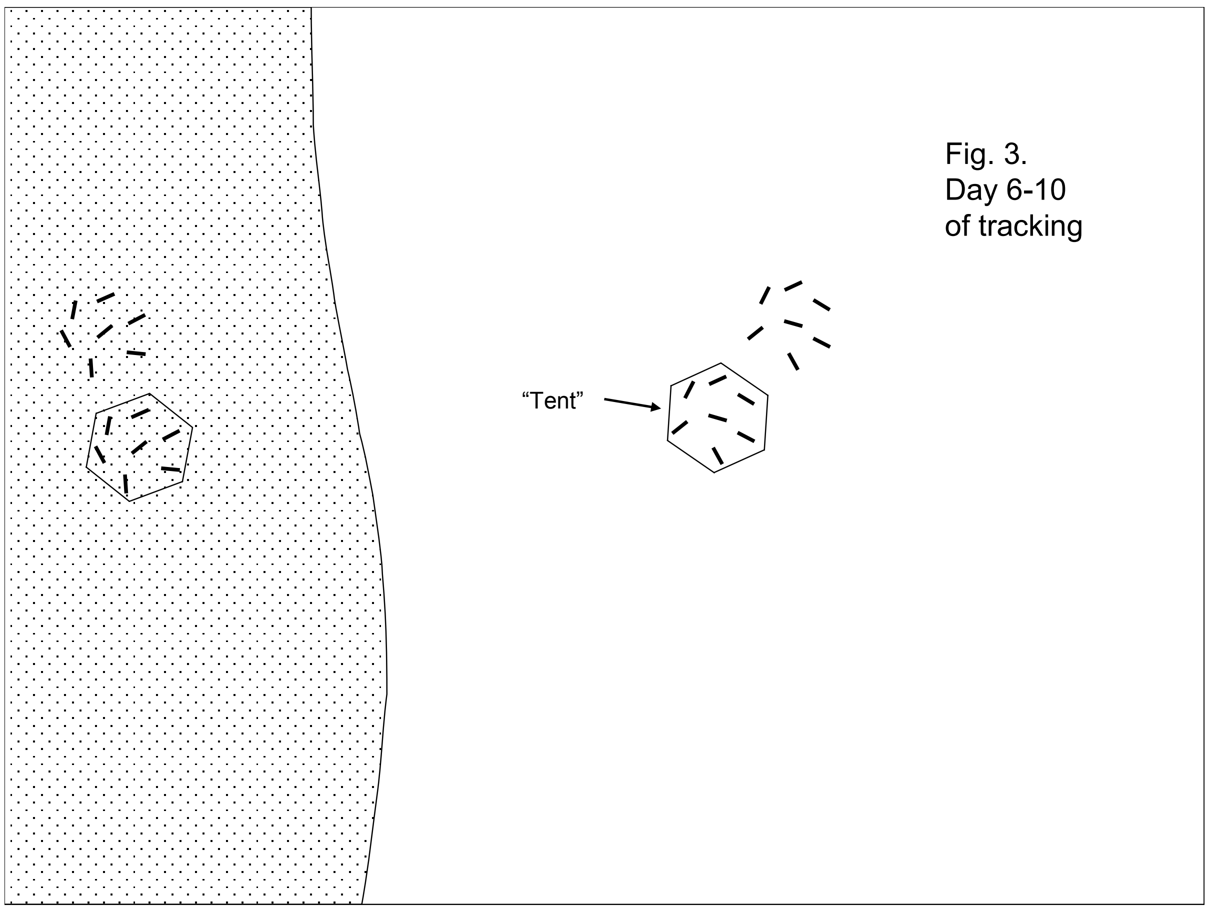
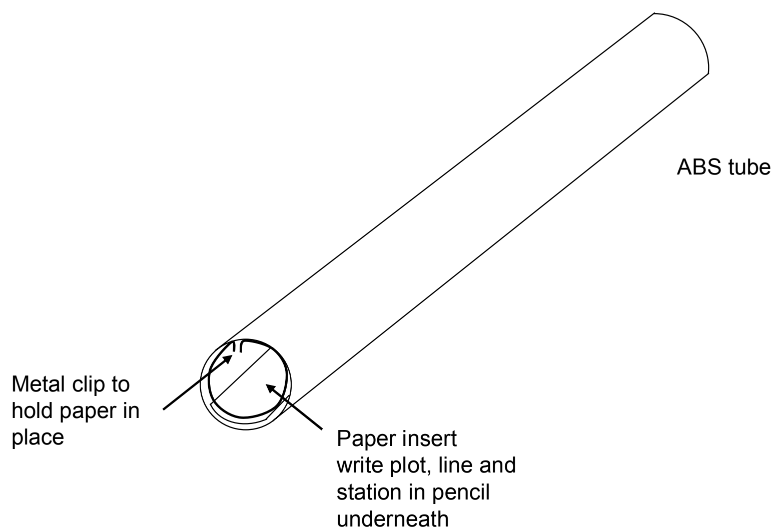


Fig. 3.
Day 6-10
of tracking

Fig. 4.
Schematic of
tracking tube



LOCATION ______ INITIALS _____

2007 Douglas Morris Trap Data
Arctic WOLVES

TRANSECT _______ MONTH ________ DAY ________ TIME ______ Page __ of __

Department of Biology

Lakehead University
Thunder Bay, Ontario, P7B 5E1
Phone: 807-343-8162

Habitat	***Station***	***Species***	***Age***	***1st/R?***	***Ear Tag***	***PIT Tag***	***Sex/Cond***	***Weight***	***Body***	***Tail***	***Comments***	
												1
												2
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												4
												5
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												19
												20

2007 Douglas Morris Habitat Data
Arctic WOLVES

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LOCATION _______ **TRANSECT** _______ **DATE** ___________ **PERSONNEL:** _____________

Cover Codes: *BA - Barren, DB - Debris, DR - Dryas, FO - Forb, GR - Grass, GV - Gravel, LI - Lichen, LS - Low shrub, MD - Mud, MO - Moss, RO - Rock, SG - Sedge, TS - Tall shrub, WA - Water*

Station _________ **Comments** _______________________________ **Classification (%)** ____________

Side 1: **Side 2:**

Shrub Height (cm) _____ **Hummocks** _____ **Shrub Height (cm)** _____ **Hummocks** _____

Cover Codes by Sample Number:	1	2	3	4	5	6	7	8	9	10
	___	___	___	___	___	___	___	___	___	___

Additional Data:

Station _________ **Comments** _______________________________ **Classification (%)** ______________

Side 1: **Side 2:**

Shrub Height (cm) _____ **Hummocks** _____ **Shrub Height (cm)** _____ **Hummocks** _____

Cover Codes by Sample Number:	1	2	3	4	5	6	7	8	9	10
	___	___	___	___	___	___	___	___	___	___

Additional Data:

Station _________ **Comments** _______________________________ **Classification (%)** ______________

Side 1: **Side 2:**

Shrub Height (cm) _____ **Hummocks** _____ **Shrub Height (cm)** _____ **Hummocks** _____

Cover Codes by Sample Number:	1	2	3	4	5	6	7	8	9	10
	___	___	___	___	___	___	___	___	___	___

Additional Data:

2007
(807) 343-8162
Page ____ of ________

Arctic WOLVES
Generic Track Data

Send to: Douglas Morris
Dep't Biology, Lakehead U.
Thunder Bay, ON, P7B 5E1

LOCATION	DAY	MONTH	YEAR	LINE	STATION	TREATMENT	TUBE 1	TUBE 2	TUBE 3	TUBE 4	TUBE 5	TUBE 6	TUBE 7	COMMENTS
WB														
WB														
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