

Hair Trap Design and Testing for Swift Fox, *Vulpes velox*

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Introduction:

Swift foxes (*Vulpes velox*) have been reintroduced in SE Alberta and SW Saskatchewan from 1983 –1997. During this time, monitoring of the reintroduced populations has included radio telemetry on released animals from 1989 to 1991 (Brechtel, et al. 1993), scent post survey survey in 1995 (CEI, 1995), observations immediately after the releases (Smeeton and Weagle, 2000) and a live trapping survey in the winter of 1996-1997 (Cotterill, 1997). Throughout the reintroduction there has been an interest in the development of a less intrusive census method than live trapping. In the summer and fall of 2000, the Swift Fox Recovery Team expressed interest in developing a non-intrusive method of taking swift fox hair samples in the field and analyzing the population by DNA analysis of the hair samples.

Hair-traps, designed to collect hair for DNA analyses, have great potential as an inexpensive, non-invasive method of determining swift fox presence, and of identifying individual animals. Bear researchers have been using barbed wire as a device to snag hairs; this successfully collects hair and follicular tissue. It is important to have hair follicles in the sample because this is where the majority of DNA is found (Woods et al, 1999; Mowat & Strobeck, 2000). Genetic tagging has successfully been used to identify individuals in animals as diverse as humpback whales to grizzly bears (Mowat et al, 1999). If a way of taking hair samples from swift foxes could be developed, the technique could be used to monitor population expansion and population trends: both key objectives of the Swift Fox Recovery Team.

Bear researchers commonly string a length of barbed wire around some trees which the bears will squeeze under or step over (Woods et al, 1999; Mowat & Strobeck, 2000). The barbs catch hair as they cross. However, this design is inappropriate for swift foxes. When the wire was strung low enough that they should have had to squeeze under it to approach the attractant, they jumped over the wire and no contact was made. A closed design is necessary for the foxes to come into contact with the barbed wire.

This proposal is divided into 2 parts. In Part 1 the activities of the Cochrane Ecological Institute (CEI) to develop a device for capturing hair follicles from captive swift fox are described. Part 2 describes the proposed methodology for and testing of the device in the field on wild swift foxes.

Part 1: Developing a Hair Trapping Device for Swift Fox

Hair-traps were designed and tested at the CEI by L.Baillie, C. Smeeton, and K. Weagle. This facility is an ideal base for designing a hair trap because the effectiveness of prototypes can be tested on the 14 breeding pairs being housed there. Most of the animals are housed in single-pair enclosures with an additional four animals in a 9 ha enclosure.

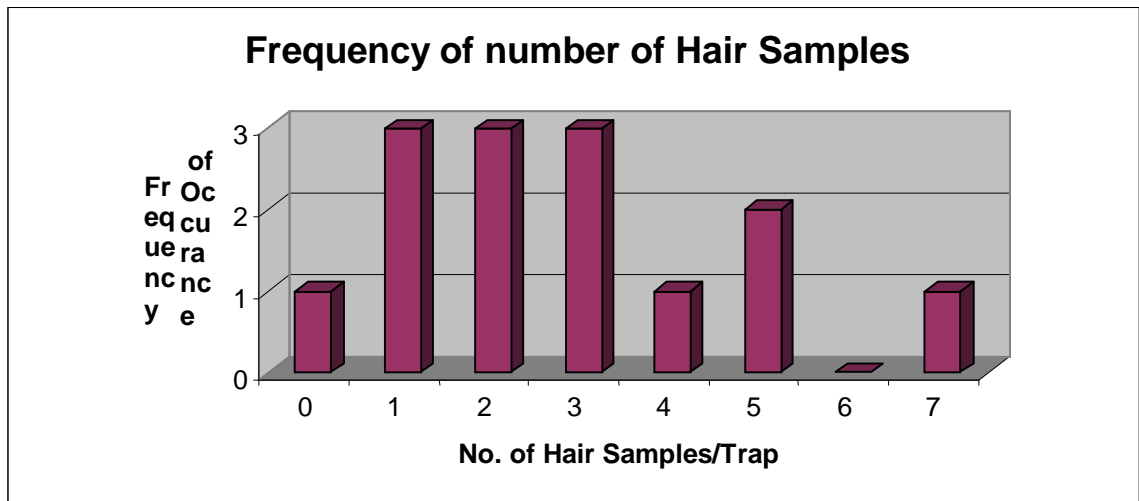
Several hair-trap designs and swift fox attractants were experimented with over a period of seven months (Keevil, 2000). The trap design that had the most consistent success was a tunnel of sheet metal that was open at each end. Barb wire is securely attached to the inside edge of each tunnel opening. The approximate dimensions of the device are: 90 cm long by 20 cm high by 17.8 cm at widest point of the tunnel opening (Photograph 1).

Photograph 1 - Hair Trap Prototype



Initial testing of the tunnel hair-trap was conducted in the single pair pens and the 9 ha. Enclosure using anchovy paste as an attractant. The traps were left in the enclosures for 24 hours and then checked for hair. Hair was successfully captured from 13 of the 14 single pair pens but no hair was collected in the 9 ha enclosure. The successful traps collected from one to seven samples per trap (Figure 1).

Figure 1: Summary of the test results from single pair enclosures at CEI.



The next phase of testing evaluated the effectiveness using day old chicks secured to the ground in the center of the trap. Six traps were left in the 9 ha pen for a period of 24 hours and then checked. All chicks were still in the traps and no hair was collected. However, footprints observed in the snow around the traps showed that foxes had visited the sites. Three traps then were modified to reduce the size of entrance points so the foxes would have more contact with the barbed wire if they chose to stretch in to investigate the bait. Twenty-four hours later the six traps were checked. The three original traps still had no hair samples but two out of the three modified traps had collected hair. The conclusion was that the device will successfully collect hairs provided that the foxes will stick their heads in the trap to investigate or remove the bait. Butcher scraps mixed with bacon was used as an attractant in these tests as it was easier to obtain in the field than day old chicks.

Part 2: Field Testing Hair Trap

The next phase of the hair trap device testing was to determine the effectiveness of the device to extract hair from wild foxes in a prairie environment. The objectives of this phase of the project were as follows.

To determine:

- 1) The frequency that wild foxes will take the bait and leave hair samples with follicles;
- 2) Whether other wildlife interfere significantly with the traps;

- 3) The frequency of multiple entries by different foxes (reporting on this objective can only be done once DNA analysis is complete which is a separate project);
- 4) The logistic costs (i.e. the number of traps that can be deployed and monitored in a day) of this technique for use in future census planning;
- 5) Given sufficient snow cover, compare trap visits with the ability to successfully capture hair; and,
- 6) Determine the frequency that scat is deposited at the trap when no hair is collected

Prior to commencing the field trial 2 modifications were made to the original trap design. The traps were secured to a wooden base using staples. This was to ensure they would be sturdy enough for transportation and use in the field. In addition to this, the interior of each hair trap was painted black. This was to prevent any reflection occurring from within the trap which may startle the fox and deter it from entering.

Study Design

Two areas were selected for the field tests of the hair traps. Area 1 was on the Masfield Community pasture (south of the West Block of Grasslands National Park). Area 2 was southwest of Consul at the Govenlock Community Pasture. Swift fox presence was determined by live-trapping, scent-posting and spotlighting during the 2000-2001 census and the probability that swift foxes would encounter the hair trapping device was high. Unfortunately a planned calibration of the hair trap results against the live trapping results was not possible because data from the live trpa study was not provided to CEI. Twenty-five (25) hair traps were deployed in each area. Two trap lines were set up in Area 1, 18 traps in the first line and seven in the second and were monitored from February 14 to February 16, 2001. Three trap lines were set up in Area 2, six in the first, seven in the second and 12 in the third and were monitored from February 15 to February 17, 2001. Traps were deployed at one km intervals along each line. The traps were set up by roads and fence-lines as this is where the foxes commonly travel. Trap UTM locations were noted using a handheld GPS (Appendix 1).

The traps were checked every day for three days. All hair and scat samples from each trap site were collected. All hair captured on one barb was counted as one sample. Each hair sample was collected individually using haemostats. The sample was then put in a coin envelope. All hair samples from one trap site were then kept together in a ziploc bag. Each barb that had successfully captured hair was sterilized with a cigarette lighter after the sample had been collected. This technique is used to prevent future contamination. Scat samples were placed in ziploc bags and, as with the hair collection, all samples from one site were kept together in another ziploc bag. All samples were clearly labeled with the trap number and the date. All samples were frozen each night on return to the field base, this was to preserve them until DNA analysis takes place.

Notes were made on any tracks in or around the traps and, where possible, the species was identified. Ambient weather conditions were also recorded (temperature, wind strength, snow conditions).

Results

Over the three day collection period a total of 17 hair samples and 17 scat samples were collected from Area 1. No samples were collected from Area 2. During the trial swift fox presence was noted on only one occasion in Area 2. This was believed to be due to severe weather conditions. During the first 2 nights there were snow storms accompanied by strong winds in Govenlock Community Pasture. This led to most of the traps being completely covered by snow. There was little evidence of movement from any animal species' during this time. The data for both Area 1 and Area 2 is recorded in Appendix 2.

A total of 10 traps were visited during the trial period in Area 1 Table 1 and Figure 1.

Table 2: Locations of traps visited

Trap number	UTM E	UTM N
7	298064	5437411
9	298205	5435968
12	301159	5436115
19	309138	5443684
20	308011	5443750
21	298064	5437411
23	298205	5435968
24	301159	5436115
25	309138	5443684
31	308011	5443750

A total of 17 trap visits were made to these 10 traps. Repeat visits were made on five occasions (Figure 3). The traps were approached but not entered 6 times and were entered 11 times. Figure 4 summarizes the data for trap entry and approaches and the number of hair and scat samples collected.

The presence of species other than the swift fox and their proximity to the traps was also recorded (Table 2).

Figure 2: Number of single and repeat visits to traps

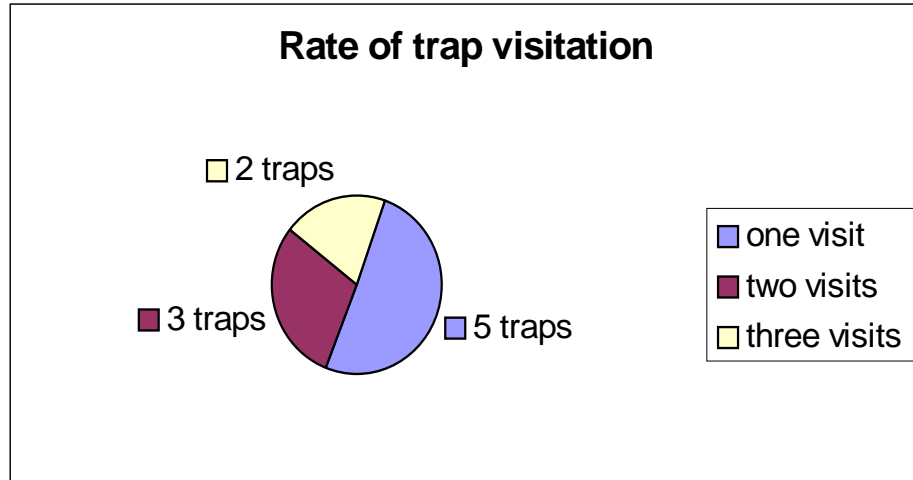


Figure 4: Number of hair and scat samples collected per trap visit

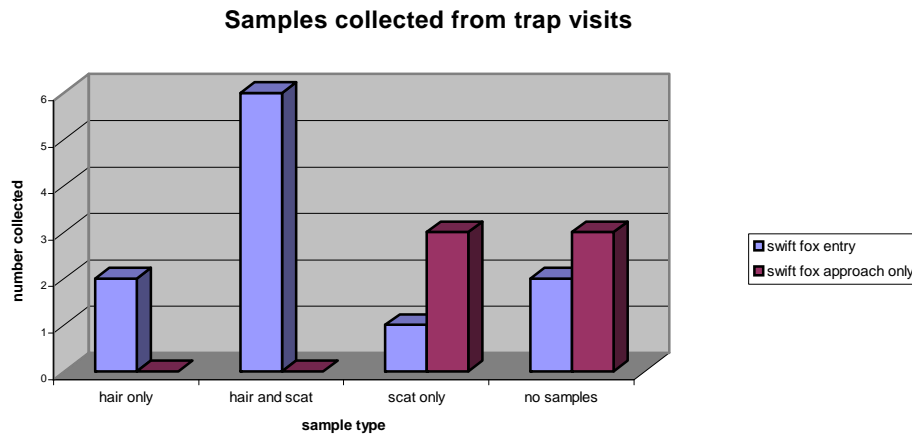


Table 3: Trap visits by other animal species.

Tracks	Enter trap	Beside trap	10m+ from trap
Bird	Yes	Yes	Yes
Coyote	No	No	Yes
Jack rabbit	No	Yes	Yes

It was found that under ideal conditions each trap took between 5 and 10 minutes to set up. This included attaching bait. The time could be significantly reduced if the traps were baited beforehand. Driving time must be added on. This can vary depending on the terrain, distances involved and weather conditions.

Discussion

The field trial has been viewed as a success and it is expected that the hair traps will be used in future studies. Hair collection allows identification of individual animals without the need for live trapping therefore the animals need not be subjected to unnecessary stress. In addition, it is expected that more foxes can be identified using the hair collection method. It is a strong possibility that animals may become trap shy after having been live trapped once whereas there will be no negative effect on animals that have entered the hair trapping device previously. It is impossible to determine how many individual foxes visited the traps during the trial period until DNA analysis of the hair samples collected has been completed.

Prior to the field trial one major concern was that coyotes might destroy the traps such that hair could not be captured from foxes visiting the site. However, during the trial, it was found that coyotes chose not to approach the devices, probably due to the human scent associated with them.

The main problem that was encountered was severe weather conditions. Heavy snow storms caused the traps to be completely covered and filled with snow. Foxes did not attempt to dig through the snow to reach the bait. When conditions were extreme few animal tracks were seen so the traps were not even encountered. In such conditions live trapping would not take place. When there was no snow yet temperatures were low, swift foxes were active and hair was collected. The hair traps therefore have the advantage over live traps in that live trapping is not carried out at temperatures below -20°C . Also hair traps can be left out in unpredictable weather as there is no risk to the fox. Hair will not be collected during severe conditions but it is merely a case of resetting the trap the next day.

Another problem that was encountered was that the barbed wire hoops would loosen slightly during transit. With an increased diameter the chances of hair being snagged from the visiting fox is decreased. In order to maintain the correct hoop size the tunnel design may have to be modified slightly. A more sturdy tube of the correct diameter could replace the tunnel and hold the barbed wire firmly in place. This, however, would have to be made from a material that would withstand burning because of the sterilization process which must take place.

The hair traps have been proven to work successfully in the field. Further testing is recommended. It is intended that a further field trial will take place on the Blackfoot Nation's Tribal Land, Montana in March. This is during breeding season and is when the

foxes are at their most active. It is also advised that the hair traps be tested in spring and summer when food is abundant to see if there is still an attraction to enter the traps when the foxes can readily find food elsewhere.

References

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APPENDIX 1

Masefield Community Pasture

TRAP	UTM E	UTM N
1	293316	5438530
2	294189	5437959
3	295163	5438092
4	296069	5437891
5	297033	5437960
6	297959	5438258
7	298064	5437411
8	297955	5436468
9	298205	5435968
10	299196	5435922
11	300144	5435909
12	301159	5436115
13	301950	5436573
14	302804	5437025
15	303682	5437307
16	304633	5437358
17	305614	5437327
18	306616	5437296
19	309138	5443684
20	308011	5443721
21	307069	5443750
22	306053	5443788
23	305152	5443819
24	304155	5443855
25	303121	5443892

Govenlock Community Pasture

TRAP	UTM E	UTM N
26	594719	5446831
27	594747	5445806
28	595810	5445825
29	596356	5445421
30	597209	5445280
31	598164	5445308
32	582000	5438818
33	583038	5438606
34	583478	5437953
35	584935	5437542
36	584935	5437542
37	585907	5437550
38	586490	5437139
39	577079	5430169
40	578008	5430422
41	578967	5430691
42	579696	5431293
43	580345	5431929
44	581229	5432525
45	582158	5432659
46	583165	5432674
47	584169	5432674
48	585155	5432695
49	586132	5432708
50	586895	5432214

APPENDIX 2

Masefield Community Pasture Hair Trap Data

Trap	Date	Time	Tracks	Hair samples	Scat samples	Bait taken	Temp. (°C)	Wind strength	Snow cover on trap
1	14/2/01	09:20	0	0	0	no	-19	none	on ground only
	15/2/01	10:23	0	0	0	no	-17	strong	partially covered
	16/2/01	10:03	jack rabbit approach	0	0	no	-19	none	on ground only
2	14/2/01	09:29	0	0	0	no	-19	light	on ground only
	15/2/01	10:30	0	0	0	no	-16	strong	partially covered
	16/2/01	10:15	0	0	0	no	-16	none	on ground only
3	14/2/01	9:33	0	0	0	no	-19	light	on ground only
	15/2/01	10:36	0	0	0	no	-16	strong	partially covered
	16/2/01	10:19	0	0	0	no	-17	none	on ground only
4	14/2/01	09:37	0	0	0	no	-19	light	on ground only
	15/2/01	10:38	0	0	0	no	-16	strong	on ground only
	16/2/01	10:24	jack rabbit approach	0	0	no	-17	none	on ground only
5	14/2/01	9:40	0	0	0	no	-19	light	on ground only
	15/2/01	10:40	0	0	0	no	-17	strong	on ground only
	16/2/01	10:30	0	0	0	no	-16	none	on ground only
6	14/2/01	9:44	0	0	0	no	-19	light	on ground only
	15/2/01	10:43	0	0	0	no	-17	strong	on ground only
	16/2/01	10:38	0	0	0	no	-15	none	on ground only
7	14/2/01	09:46	swift fox entry	3	1	no	-19	light	on ground only
	15/2/01	10:45	swift fox approach	0	1	no	-17	strong	on ground only
	16/2/01	10:39	swift fox approach	0	1	no	-16	none	on ground only
8	14/2/01	10:02	0	0	0	no	-18	light	on ground only
	15/2/01	10:50	0	0	0	no	-17	strong	on ground only
	16/2/01	10:46	0	0	0	no	-18	none	on ground only
9	14/2/01	10:04	swift fox entry	1	0	no	-18	light	on ground only
	15/2/01	10:53	0	0	0	no	-17	strong	partially covered
	16/2/01	10:47	swift fox approach	0	2	no	-17	none	on ground only
10	14/2/01	10:15	jack rabbit approach	0	0	no	-18	light	on ground only
	15/2/01	10:55	0	0	0	no	-17	strong	on ground only
	16/2/01	10:56	0	0	0	no	-18	none	on ground only
11	14/2/01	10:17	0	0	0	no	-18	light	on ground only
	15/2/01	10:57	0	0	0	no	-16	strong	on ground only
	16/2/01	10:59	0	0	0	no	-16	none	on ground only
12	14/2/01	10:20	0	0	0	no	-18	light	on ground only
	15/2/01	11:09	swift fox approach	0	0	no	-16	strong	on ground only
	16/2/01	11:03	0	0	0	no	-13	none	on ground only
13	14/2/01	10:23	0	0	0	no	-18	light	on ground only
	15/2/01	11:12	0	0	0	no	-16	strong	on ground only
	16/2/01	11:07	0	0	0	no	-14	none	on ground only
14	14/2/01	10:25	0	0	0	no	-18	light	on ground only
	15/2/01	11:15	0	0	0	no	-17	strong	on ground only
	16/2/01	11:11	0	0	0	no	-14	none	on ground only
15	14/2/01	10:28	0	0	0	no	-19	light	on ground only
	15/2/01	11:20	0	0	0	no	-17	strong	on ground only
	16/2/01	11:14	0	0	0	no	-9	none	on ground only

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Swift Fox Hair Traps

16	14/2/01	10:30	0	0	0	no	-18	light	on ground only
	15/2/01	11:22	0	0	0	no	-17	strong	on ground only
	16/2/01	11:17	0	0	0	no	-12	none	on ground only
17	14/2/01	10:32	0	0	0	no	-18	light	on ground only
	15/2/01	11:27	0	0	0	no	-17	strong	on ground only
	16/2/01	11:21	0	0	0	no	-16	none	on ground only
18	14/2/01	10:37	0	0	0	no	-18	light	on ground only
	15/2/01	11:29	0	0	0	no	-17	strong	on ground only
	16/2/01	11:24	0	0	0	no	-17	none	on ground only
19	14/2/01	10:57	0	0	0	no	-18	light	on ground only
	15/2/01	11:40	0	0	0	no	-17	strong	on ground only
	16/2/01	11:42	swift fox entry	0	0	yes	-8	none	on ground only
20	14/2/01	11:01	0	0	0	no	-18	light	on ground only
	15/2/01	11:42	0	0	0	no	-17	strong	partially covered
	16/2/01	11:43	swift fox entry	1	0	no	-12	none	on ground only
21	14/2/01	11:02	swift fox entry	3	2	no	-16	light	on ground only
	15/2/01	11:51	swift fox entry	0	1	no	-16	strong	on ground only
	16/2/01	11:51	0	0	0	no	-15	none	on ground only
22	14/2/01	11:14	0	0	0	no	-16	light	on ground only
	15/2/01	12:08	0	0	0	no	-17	strong	on ground only
	16/2/01	11:54	0	0	0	no	-16	none	on ground only
23	14/2/01	11:16	swift fox entry	3	2	no	-16	light	on ground only
	15/2/01	12:10	swift fox entry	1	2	no	-17	strong	on ground only
	16/2/01	11:57	swift fox entry	3	3	no	-17	none	on ground only
24	14/2/01	11:29	jack rabbit approach	0	0	no	-15	light	on ground only
	15/2/01	12:27	bird entry	0	0	yes	-16	strong	on ground only
	16/2/01	12:08	swift fox entry	0	0	yes	-10	none	on ground only
25	14/2/01	11:31	0	0	0	no	-15	light	on ground only
	15/2/01	12:30	swift fox entry	2	2	no	-16	strong	partially covered
	16/2/01	12:11	swift fox approach	0	0	no	-11	none	totally covered

Govenlock Community Pasture Hair Trap Data

Trap	Date	Time	Tracks	Hair samples	Scat samples	Bait taken	Temp. (°C)	Wind strength	Snow cover on trap
26	15/2/01	10:32	0	0	0	no	-16	Light	partially covered
	16/2/01	09:28	0	0	0	no	-25	light	partially covered
	17/2/01	09:03	0	0	0	no	-25	light	on ground only
27	15/2/01	10:37	0	0	0	no	-16	light	totally covered
	16/2/01	09:38	0	0	0	no	-25	light	totally covered
	17/2/01	09:05	0	0	0	no	-25	light	on ground only
28	15/2/01	10:42	0	0	0	no	-16	light	totally covered
	16/2/01	09:43	0	0	0	no	-25	light	totally covered
	17/2/01	09:09	0	0	0	no	-25	light	on ground only
29	15/2/01	10:45	0	0	0	no	-16	light	totally covered
	16/2/01	09:47	0	0	0	no	-25	light	totally covered
	17/2/01	09:13	0	0	0	no	-25	light	on ground only
30	15/2/01	10:50	0	0	0	no	-16	light	totally covered
	16/2/01	09:53	coyote – 10m away	0	0	no	-25	light	totally covered
	17/2/01	09:17	0	0	0	no	-25	light	on ground only
31	15/2/01	10:54	0	0	0	no	-15	light	totally covered
	16/2/01	10:00	swift fox approach	0	0	no	-25	light	totally covered
	17/2/01	09:21	0	0	0	no	-25	light	on ground only

January 2017

Swift Fox Hair Traps

32	15/2/01	11:59	0	0	0	no	-14	light	totally covered
	16/2/01	10:29	0	0	0	no	-25	light	totally covered
	17/2/01	09:49	0	0	0	no	-24	light	on ground only
33	15/2/01	11:29	0	0	0	no	-15	light	partially covered
	16/2/01	10:37	0	0	0	no	-25	none	partially covered
	17/2/01	09:53	0	0	0	no	-24	light	on ground only
34	15/2/01	11:33	0	0	0	no	-14	light	totally covered
	16/2/01	10:39	0	0	0	no	-25	none	totally covered
	17/2/01	09:57	0	0	0	no	-24	light	on ground only
35	15/2/01	11:41	0	0	0	no	-14	light	totally covered
	16/2/01	10:42	0	0	0	no	-25	none	totally covered
	17/2/01	09:59	0	0	0	no	-24	light	on ground only
36	15/2/01	11:41	0	0	0	no	-14	light	partially covered
	16/2/01	10:50	0	0	0	no	-24	none	partially covered
	17/2/01	10:02	0	0	0	no	-25	none	on ground only
37	15/2/01	11:49	0	0	0	no	-14	light	totally covered
	16/2/01	10:53	0	0	0	no	-24	light	totally covered
	17/2/01	10:05	0	0	0	no	-24	light	on ground only
38	15/2/01	12:08	0	0	0	no	-14	light	totally covered
	16/2/01	10:56	0	0	0	no	-23	none	totally covered
	17/2/01	10:07	0	0	0	no	-24	light	on ground only
39	15/2/01	SNOW PREVENTED VEHICLE FROM REACHING TRAP							
	16/2/01	11:22	0	0	0	no	-21	light	totally covered
	17/2/01	10:34	0	0	0	no	-23	light	on ground only
40	15/2/01	SNOW							
	16/2/01	11:26	0	0	0	no	-21	none	totally covered
	17/2/01	10:39	0	0	0	no	-24	light	on ground only
41	15/2/01	SNOW PREVENTED VEHICLE FROM REACHING TRAP							
	16/2/01	11:32	0	0	0	no	-22	light	totally covered
	17/2/01	10:45	0	0	0	no	-24	light	on ground only
42	15/2/01	SNOW PREVENTED VEHICLE FROM REACHING TRAP							
	16/2/01	11:35	0	0	0	no	-22	none	totally covered
	17/2/01	10:49	0	0	0	no	-25	light	on ground only
43	15/2/01	SNOW PREVENTED VEHICLE FROM REACHING TRAP							
	16/2/01	11:40	0	0	0	no	-21	none	totally covered
	17/2/01	10:52	0	0	0	no	-24	light	on ground only
44	15/2/01	SNOW PREVENTED VEHICLE FROM REACHING TRAP							
	16/2/01	11:50	0	0	0	no	-21	none	totally covered
	17/2/01	10:57	0	0	0	no	-23	light	on ground only
45	15/2/01	13:08	0	0	0	no	-13	moderate	totally covered
	16/2/01	11:54	0	0	0	no	-21	light	totally covered
	17/2/01	11:01	0	0	0	no	-23	light	on ground only
46	15/2/01	13:12	0	0	0	no	-13	moderate	partially covered
	16/2/01	11:58	0	0	0	no	-21	light	partially covered
	17/2/01	11:05	0	0	0	no	-23	light	on ground only
47	15/2/01	13:15	0	0	0	no	-13	moderate	totally covered
	16/2/01	12:01	0	0	0	no	-21	light	totally covered
	17/2/01	11:08	0	0	0	no	-23	light	on ground only
48	15/2/01	13:18	0	0	0	no	-12	moderate	partially covered
	16/2/01	12:04	0	0	0	no	-21	light	partially covered
	17/2/01	11:12	0	0	0	no	-23	light	on ground only
49	15/2/01	13:22	0	0	0	no	-12	light	totally covered
	16/2/01	12:07	0	0	0	no	-21	light	totally covered
	17/2/01	11:14	0	0	0	no	-23	light	on ground only
50	15/2/01	13:25	0	0	0	no	-12	light	partially covered
	16/2/01	12:10	0	0	0	no	-21	light	partially covered
	17/2/01	11:18	0	0	0	no	-22	light	on ground only

