# 9.0 APPENDICES

Appendix A. Capture data for grizzly bears using the McLeod Lake landfill, 2000 – 2002.

Table A1. Number of grizzly bears captured during each trapping session in spring and fall 2000 at the McLeod Lake landfill.

| | Spring | | | Fall | | | |
|---|---|---|---|---|---|---|---|
| ID | Session 1 | Session 2 | Session 3 | Session 4 | Session 5 | Session 6 | |
| No. | 25 Apr–5 May | 9 May- 9 May | 23 May-30 May | 29 Aug-8 Sep | 12 Sep-22 Sep | 25 Sep-5 Oct | Total |
| F01 | 1 | | 2 | 1 | | | 4 |
| F02 | 1 | | | 1 | 5 | 2 | 9 |
| M03 | | 1 | | | | | 1 |
| F04 | | 2 | | 1 | 2 | 2 | 7 |
| M05 | | | 1 | | 1 | | 2 |
| F06 | | | 1 | | | 3 | 4 |
| F07 | | | | 1 | 2 | 3 | 6 |
| M09 | | | | 2 | | | 2 |
| F09 | | | | 2 | | 2 | 4 |
| F10 | | | | 2 | | | 2 |
| F11 | | | | | 1 | 1 | 2 |
| F12 | | | | | | 1 | 1 |
| M13 | | | | | | 1 | 1 |
| Total | 2 | 3 | 4 | 10 | 11 | 15 | 45 |

Table A2. Capture dates and trap type for grizzly bears and wolves captured at or near the McLeod Lake landfill, 2000 – 2002. The majority of captures at the landfill occurred overnight; the Capture Date is the date of the trapping evening although processing usually occurred the following morning.

| ID | No. of | Capture Date and Trap Type[a] | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Captures | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | |
| F01 | 4 | 29-Apr-00 | S | 27-May-00 | C | 29-May-00 | CB | 5-Sep-00 | S | | | | | | | | | | | | |
| F02 | 10 | 30-Apr-00 | S | 6-Sep-00 | C | 13-Sep-00 | S | 16-Sep-00 | C | 17-Sep-00 | S | 20-Sep-00 | C | 21-Sep-00 | C | 26-Sep-00 | C | 29-Sep-00 | C | 19-Sep-01 | C |
| M03 | 1 | 9-May-00 | S | | | | | | | | | | | | | | | | | | |
| F04 | 7 | 9-May-00 | S | 14-May-00 | CB | 29-Aug-00 | C | 12-Sep-00 | S | 18-Sep-00 | C | 28-Sep-00 | C | 2-Oct-00 | CB | | | | | | |
| M05 | 3 | 23-May-00 | S | 14-Sep-00 | C | 8-May-01 | CB | | | | | | | | | | | | | | |
| F06 | 5 | 27-May-00 | C | 25-Sep-00 | C | 1-Oct-00 | C | 2-Oct-00 | C | 6-May-01 | CB | | | | | | | | | | |
| F07 | 6 | 31-Aug-00 | S | 17-Sep-00 | S | 20-Sep-00 | C | 27-Sep-00 | C | 30-Sep-00 | C | 2-Oct-00 | C | | | | | | | | |
| M08 | 3 | 25-May-00 | AD | | | 31-Aug-00 | C | 3-Sep-00 | S | | | | | | | | | | | | |
| F09 | 6 | 25-May-00 | AD | 1-Sep-00 | S | 7-Sep-00 | C | 28-Sep-00 | C | 1-Oct-00 | C | 25-May-01 | AD | | | | | | | | |
| F10 | 2 | 1-Sep-00 | C | 6-Sep-00 | S | 16-May-02 | C | | | | | | | | | | | | | | |
| F11 | 2 | 18-Sep-00 | C | 25-Sep-00 | C | | | | | | | | | | | | | | | | |
| F12 | 1 | 27-Sep-00 | S | | | | | | | | | | | | | | | | | | |
| M13 | 1 | 1-Oct-00 | S | | | | | | | | | | | | | | | | | | |
| F14 | 1 | 13-May-02 | C | | | | | | | | | | | | | | | | | | |
| M15 | 1 | 15-May-02 | C | | | | | | | | | | | | | | | | | | |
| W1[b] | 1 | 1-Sep-00 | S | | | | | | | | | | | | | | | | | | |
| W2[b] | 1 | 3-Sep-00 | S | | | | | | | | | | | | | | | | | | |
| W3[b] | 1 | 28-Sep-00 | S | | | | | | | | | | | | | | | | | | |

[a] C = Culvert trap, baited; S = Aldrich snare, trail set; CB = Aldrich snare, baited cubby set, AD = aerial darted by PGBP away from the landfill
[b] Wolves captured incidentally during grizzly bear trapping

Table A3. Drug dosages and immobilization sequences for grizzly bears captured at or near the McLeod Lake landfill, 2000 – 2002.

| | | | 1st Dose | | | | 2nd Dose | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ID No. | Capture Date | Weight (kg) | Method[a] | Dose (mg)[b] | Time | Comment | Method | Dose (mg) | Time | Comment |
| F01 | 29-Apr-00 | 38 | Dart | 340 | 629 | *only received 125 mg | Hand | K0.8cc | 653 | still movement |
| F01 | 29-May-00 | ~45 | Jab | 160 | ? | not down completely | Jab | 140 | ? | induction 2.0 min |
| F01 | 5-Sep-00 | 91 | Dart | 500 | 2105 | induction 5.0 min | | | | |
| F02 | 30-Apr-00 | 175 | Dart | 1500 | 700 | induction 3.5 min | | | | |
| F02 | 6-Sep-00 | 220 | Jab | 1455 | 838 | unknown amt received | Jab | 1000 | 858 | still active |
| F02 | 13-Sep-00 | ~225 | Dart | 1000 | 735 | moved head, pierced ear | Dart | 1315 | 808 | faulty charge |
| F02 | 17-Sep-00 | ~225 | Dart | 1500 | 715 | still alert | Dart | 1000 | 735 | induction 3.0 min |
| M03 | 9-May-00 | 117 | Dart | 675 | 741 | induction 2.0 min | | | | |
| F04 | 9-May-00 | 86 | Dart | 350 | 927 | induction 3.0 min | | | | |
| F04 | 12-Sep-00 | 148 | Dart | 1000 | 747 | unknown amt received | Dart | 775 | 804 | induction 4 min |
| F04 | 2-Oct-00 | ~155 | Dart | 960 | 819 | induction 9.0 min | | | | |
| M05 | 23-May-00 | ~ 383 | Dart | 1610 | 849 | induction 6.0 min | Hand | 500 | 909 | |
| M05 | 14-Sep-00 | 343.2 | Jab | 2000 | 1322 | unknown amt received | Dart | 2000 | 1329 | still head movement |
| F06 | 27-May-00 | 51 | Jab | 300 | 1957 | induction 2.0 min | Hand | K1.0cc | 2034 | lots of movement |
| F06 | 25-Sep-00 | 112 | Jab | 770 | 729 | still some movement | Jab | 410 | 751 | still head movement |
| F06 | 25-May-01 | 85 | Jab | 667 | 1007 | induction 3.0 min | | | | |
| F07 | 31-Aug-00 | 113 | Dart | 825 | 707 | still head movement | Hand | 500 | 743 | |
| F07 | 17-Sep-00 | ~120 | Dart | 775 | 2021 | induction 3.0 min | | | | |
| M08 | 31-Aug-00 | 145 | Jab | 870 | 1000 | unknown amt received | Jab | 555 | 1023 | induction 2.5 min |
| F09 | 1-Sep-00 | 177 | Dart | 1000 | 2117 | induction 5.0 min | Hand | 1000 | 2220 | into culvert for night |
| F09 | 25-May-01 | ~146 | Aerial dart | 1000 | 1248 | | Aerial dart | 1000 | 1302 | |
| F10 | 1-Sep-00 | 193 | Jab | 600 | 636 | still head movement | Hand | 400 | 654 | still active |
| F10 | 6-Sep-00 | 193 | Dart | 1000 | 701 | still head movement | Hand | 500 | 723 | still licking |
| F10 | 16-May-02 | 108 | Jab | 1230 | 1124 | may not have penetrated | Jab | 1250 | 1145 | |
| F11 | 18-Sep-00 | 117 | Jab | 500 | 722 | movement after 20 min | Hand | 415 | 751 | head move in 1/2 hr. |
| F12 | 27-Sep-00 | 165 | Dart | 1285 | 725 | still head movement | Jab | 500 | 748 | |
| M13 | 1-Oct-00 | 33 | Jab | 220 | 709 | induction 3.0 min | | | | |
| F14 | 13-May-02 | 31 | Jab | 70 | 1102 | unknown amt received | Jab | 160 | 1124 | partial induction 5.0 min |
| M15 | 15-May-02 | 36 | Jab | 160 | 1022 | probably got only 80 mg | Hand | 100 | 1043 | induction 5.0 min |

[a] Method: Dart (dart from CO2 pistol); Aerial dart (dart from dartgun); Jab (jabstick with syringe), Hand (hand inject with syringe)
[b] Dose: All dosages reported are milligrams ofTelazol®, except where preceded by letter K (Ketaset®)

Table A3 cont.

| | | 3rd Dose | | | | 4th Dose | | | | 5th Dose | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID No. | Capture Date | Method | Dose (mg) | Time | Comment | Method | Dose (mg) | Time | Comment | Method | Dose (mg) | Time | Comment |
| F01 | 29-Apr-00 | Hand | 170 | 714 | went down quickly | | | | | | | | |
| F01 | 29-May-00 | | | | | | | | | | | | |
| F01 | 5-Sep-00 | | | | | | | | | | | | |
| F02 | 30-Apr-00 | | | | | | | | | | | | |
| F02 | 6-Sep-00 | Jab | 1000 | 922 | movement w/in 3/4 hr. | | | | | | | | |
| F02 | 13-Sep-00 | Dart | 1000 | 859 | still some movement | Jab | 940 | 914 | induction 5.0 min | | | | |
| F02 | 17-Sep-00 | | | | | | | | | | | | |
| M03 | 9-May-00 | | | | | | | | | | | | |
| F04 | 9-May-00 | | | | | | | | | | | | |
| F04 | 12-Sep-00 | Hand | 225 | 903 | some movement | | | | | | | | |
| F04 | 2-Oct-00 | | | | | | | | | | | | |
| M05 | 23-May-00 | | | | | | | | | | | | |
| M05 | 14-Sep-00 | Jab | 1500 | 1349 | still head movement | Jab | 1500 | 1404 | | | | | |
| F06 | 27-May-00 | | | | | | | | | | | | |
| F06 | 25-Sep-00 | Jab | 320 | 806 | still head movement | Hand | 280 | 823 | still head movement | Hand | 220 | 835 | slow recovery |
| F06 | 25-May-01 | | | | | | | | | | | | |
| F07 | 31-Aug-00 | | | | | | | | | | | | |
| F07 | 17-Sep-00 | | | | | | | | | | | | |
| M08 | 31-Aug-00 | Hand | 370 | 1046 | could sit w/in 1 hour | | | | | | | | |
| F09 | 1-Sep-00 | Jab | 1000 | 1024 | Induction 3.0 min[3] | | | | | | | | |
| F09 | 25-May-01 | Hand | 250 | 1313 | | Hand | 250 | 1322 | | | | | |
| F10 | 1-Sep-00 | Hand | 500 | 709 | still active | Hand | 290 | 742 | still active | Hand | 390 | 829 | recovered quickly |
| F10 | 6-Sep-00 | Hand | 225 | 733 | movement w/in 1/2 hr. | | | | | | | | |
| F10 | 16-May-02 | | | | | | | | | | | | |
| F11 | 18-Sep-00 | | | | | | | | | | | | |
| F12 | 27-Sep-00 | | | | | | | | | | | | |
| M13 | 1-Oct-00 | | | | | | | | | | | | |
| F14 | 13-May-02 | Hand | 80 | 1147 | Induction 2.0 min | | | | | | | | |
| M15 | 15-May-02 | | | | | | | | | | | | |

[a] Method: Dart (dart from CO2 pistol); Aerial dart (dart from dartgun); Jab (jabstick with syringe), Hand (hand inject with syringe)
[b] Dose: All dosages reported are milligrams ofTelazol®, except where preceded by letter K (Ketaset®)

Table A4. Physical characteristics of grizzly bears captured at or near the McLeod Lake landfill, 2000 - 2002.

| ID No. | Capture Date | Foot Snared | Body Condition | Tooth Condition/Wear | Wounds |
|---|---|---|---|---|---|
| F01 | 29-Apr-00 | ? | Poor, no fat | No missing/broken teeth | Left hind leg wounded, broken at knee, appears 4 buckshot wounds, holes look fresh but leg appears set |
| F01 | 5-Sep-00 | R front | Good-Exc | Good teeth | Leg healed, was set and moveable, walks on front portion of hind pad only; replaced eartag transmitter, inside pussy, red, & swollen, circular knob of raw tissue visible on either side |
| F02 | 30-Apr-00 | ? | Good | No missing/broken teeth; wear low-med | |
| F02 | 6-Sep-00 | n/a | Good-Exc | More worn teeth than other bears; chip/wear on back of R canine | Sore patch inside left leg/groin area |
| M03 | 9-May-00 | ? | | Teeth older looking | |
| F04 | 9-May-00 | ? | | Teeth young, good | |
| F04 | 12-Sep-00 | R front | Good | Small/good/young, bit of wear, R PM missing | Large, round, hard abcess on left nose, above mouth 1"; ears very festered & raw from eartags |
| M05 | 23-May-00 | L front | Excellent | Old & worn | Bleeding from mouth; top left canine split 30% loss, fracture length of tooth; left front foot 3" laceration by teeth; claw missing right front foot |
| M05 | 14-Sep-00 | n/a | Good but thinner | Very poor condition, all canines broken off, many incisors missing | Eartags caused raw, soreness; ripped claw R front foot; thinner, collar was loose |
| F06 | 27-May-00 | n/a | | Teeth young, good, lower canines blunted | Injury mid back near spine, matted hair, blood, mucus at anterior end, possible buckshot wound |
| F06 | 25-Sep-00 | n/a | Good-Exc | Exc, appears to have regrown left PM | Wound on back very evident, lots pus, obvious angled puncture hole (buckshot?), smelled strong; ears not as swollen & raw as F04 but still matted blood/pus & raw |
| F06 | 25-May-01 | R front | Good | Minimal wear, young, good; left PM missing | Scabs and thin hair along neck |

Continued……

Table A4 cont.

| ID No. | Capture Date | Foot Snared | Body Condition | Tooth Condition/Wear | Wounds |
|---|---|---|---|---|---|
| F07 | 31-Aug-00 | R front | Good | 1st left molar hanging (removed), minor wear, front lower incisors slightly worn | 1st left molar; right front ankle severe injury, chewed through bone |
| F07 | 17-Sep-00 | L front | Fair-Good | | Right foot, more exposed flesh now almost to claw on inside, raw & bloody (possibly chewing on it) |
| M08 | 31-Aug-00 | - | | Lower L canine v. worn; no incisors lower jaw, upper L PM1 missing | Two claws bleeding, right front foot |
| F09 | 1-Sep-00 | R front | Good | Upper L PM1 missing (*prob. previous capture) | Small abrasion right front upper foot; puncture wound right side of tongue |
| F09 | 25-May-01 | - | Good | Tooth wear medium to high; none broken | None |
| F10 | 1-Sep-00 | - | Excellent | Minimal wear, canines good, incisor small & broken off | Fair amount soreness along neck (poss. Previous collar?); L front pad cut; sore on upper neck |
| F10 | 16-May-02 | | Fair-Good | Missing 1 top incisor and upper R PM | |
| F11 | 18-Sep-00 | - | Fair | Young good teeth | None |
| F12 | 27-Sep-00 | R front | Good | Good teeth, top R canine chipped & worn | 1 cm cut from snare cable, sm cut lower lip |
| M13 | 1-Oct-00 | L front | Fair | V. young, good clean teeth | Small wound inside upper left leg |
| F14 | 13-May-02 | | Fair-Good | Young, good, R top canine chipped | None |
| M15 | 15-May-02 | | Fair-Good | Young, good, 2 PM's | Inner claw on L front foot pulled off in trap |

Table A5. Physical measurements of grizzly bears captured at or near the McLeod Lake landfill, 2000 - 2002.

| | | | Body Measurements | | | | | | Foot Measurements | | | | | | | Dentition | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | Capture | | Weight | Length | Chest | Abdom | Neck | Head | Front Pad (cm) | | | | Rear Pad (cm) | | | Canine (cm) | | |
| No. | Date | Age | (kg) | (cm) | (cm) | (cm) | (cm) | (cm) | Width | Length | L w/toes | Claw | Width | Length | L w/toes | Length | Width | Intercanine |
| F01 | 29-Apr-00 | 1 | 38 | 135 | 74 | | | 31 | 11.5 | | 9.5 | | 9.5 | | 17.5 | | | 3.4 |
| F01 | 5-Sep-00 | 1 | 91 | 170 | 93 | 112 | 55 | | 12.3 | 7 | 12.4 | 7.3 | 11.2 | 16.4 | 22 | 2.1 | 1.5 | 5.4 |
| F02 | 30-Apr-00 | 8 | 175 | 204 | 122 | | | 36 | 15 | | 14 | 10 | | | | | | 6 |
| F02 | 6-Sep-00 | 8 | 220 | 198 | 134 | 162 | 74 | | 14.1 | 8.4 | 14.5 | 8.3 | 13.5 | 19.8 | 24.9 | 3 | 1.8 | ~6.6 |
| M03 | 9-May-00 | 2 | 117 | 182 | 104 | | 61 | | 14.5 | | 12 | 8.5 | 13.4 | | 24.6 | | | |
| F04 | 9-May-00 | 2 | 86 | 176 | 89 | | 53 | 34 | 12.5 | | 10.5 | 8.2 | 11.5 | 16.5 | | | | |
| F04 | 12-Sep-00 | 2 | 148 | 187 | 113 | 139 | 68 | | 13.1 | 7.5 | 13 | 10.2 | 12.7 | 17.4 | 22.6 | 2.5 | 1.6 | 5.7 |
| M05 | 23-May-00 | 17 | 383[a] | 235 | 157 | | | 44 | 16.3 | 9 | 15 | 7.8 | 15 | 23 | 29 | | | 7 |
| M05 | 14-Sep-00 | 17 | 343 | 231 | 152 | 195 | 90 | | 15.8 | 9.3 | 15.3 | 6.8 | 15.2 | 23 | 28.6 | 1.6 | 2.3 | ~6.5 |
| F06 | 27-May-00 | 1 | 51 | 140 | 80 | | | 31 | 11 | | 9 | 5.3 | 9.5 | 14 | 19 | | | |
| F06 | 25-Sep-00 | 1 | 112 | 164 | 110 | 128 | 60 | 38 | 12 | 6.2 | 11 | 6.8 | 11.8 | 16.5 | 21 | 2.8 | 1.7 | 5.4 |
| F06 | 25-May-01 | 2 | 85 | 185 | 95 | 105 | 54 | 41 | 12.9 | 5.9 | 12 | 7.2 | 11.7 | 17.1 | 21.6 | 2.8 | 1.6 | 6 |
| F07 | 31-Aug-00 | 3 | 113 | 191 | 96 | 117 | 63 | 38 | 12.8 | 7 | 13.2 | 7.3 | 11.6 | 17.5 | 22 | 2.7 | 1.7 | 5.7 |
| M08 | 31-Aug-00 | 3 | 145 | 200 | 106 | 127 | 64 | 40 | 14.5 | 8.8 | 14.8 | 7.5 | 13 | 17.6 | 23.5 | 3.4 | 2 | 5.9 |
| F09 | 1-Sep-00 | 10 | 177 | 201 | 122 | 139 | 68 | 39 | 13.5 | 8.5 | 14.5 | 8.4 | 11.5 | 18 | 24 | 3 | 2 | ~6.1 |
| F09 | 25-May-01 | 11 | 146[a] | 211 | | | | | 12.5 | | | | 12.5 | | | | | |
| F10 | 1-Sep-00 | 4 | 193 | 206 | 128 | 152 | 69 | 35 | 14.5 | 8 | 13.5 | 7.8 | 12.8 | 18.2 | 22.8 | 2.9 | 1.6 | 5.8 |
| F10 | 16-May-02 | 6 | 108 | 187 | 98 | 106 | 58 | 41 | 13.8 | 7.0 | 11.8 | 9.5 | 13.5 | 18.0 | 23.0 | 2.7 | 1.5 | 6.8 |
| F11 | 18-Sep-00 | 2 | 117 | 171 | 100 | 119 | 59 | 40 | 13 | 7 | 12.3 | 6.4 | 12.3 | 17 | 22.6 | 2.7 | 1.7 | 5.4 |
| F12 | 27-Sep-00 | 5 | 165 | 210 | 118 | 135 | 70 | 26 | 13.7 | 8.5 | 13.7 | 10.4 | 13.6 | 18.2 | 23.5 | 2.6 | 1.7 | 5.8 |
| M13 | 1-Oct-00 | 0 | 33 | 120 | 65 | 73 | 39 | | 9.4 | 5.3 | 9.3 | 5.2 | 8.6 | 11.7 | 16 | 1.2 | 0.6 | 4.1 |
| F14 | 13-May-02 | 1 | 31 | 117 | 59 | 64 | 36 | 25 | 9.5 | 4.8 | 9.2 | 4.8 | 8.9 | 12.7 | 17.1 | 1.7 | 1.0 | 5.0 |
| M15 | 15-May-02 | 1 | 36 | 115 | 66 | 76 | 42 | 29 | 9.8 | 5.3 | 10.0 | 6.3 | 9.4 | 13.0 | 17.0 | 1.7 | 0.8 | 5.8 |

[a] Estimated based on chest girth/weight relationship (Jonkel 1992)

## Appendix B. Evaluation of the efficacy of ear-tag transmitters and radio-collars.

We deployed 2 types of tracking devices on grizzly bears either signally or in combination for a total of 33 deployments: ear-tag transmitters ($n$ = 23; ATS, Isanti, Minnesota), and conventional VHF collars ($n$ = 10; Lotek Inc., Newmarket Ontario). One wolf captured at the McLeod landfill was also fitted with a VHF collar. In 2002, VHF collars on two bears were replaced with GPS collars for concurrent monitoring by the Parsnip Grizzly Bear Project.

*EVALUATION OF EAR-TAG TRANSMITTERS*

We employed the use of 4 ear-tag programs (see Methods) on 13 individual bears for a total of 23 deployments, with most bears receiving more than one transmitter and program:

Program 1 (9-5, Mon-Fri): 5 times on 5 bears
Program 2 (Delayed #1): 3 times on 3 bears
Program 3 (24 hrs): 6 times on 5 bears
Program 4 (Delayed #2): 9 times on 9 bears

Ear-tags had an "estimated battery life" of 2 years and 3 years, respectively. Three years was estimated for Programs 2 & 4 (i.e., delayed programs) that were programmed to turn on for one day in 2000, but not set to be fully operational until 2001 and 2002. We attempted to account for the stated battery life of the transmitters by shortening the transmission times (i.e., on 9 – 5) and length (on April to mid-Dec). We expected ear-tag transmitters to transmit for their specified battery length based on the premise that they would follow their programmed pattern until their batteries failed having achieved a minimum of 2 years of operation (Table B1). We evaluated transmitters using 2 years operational battery life based on a 9-5, April-Dec schedule. Since there is no exact end date (i.e., it is completely dependent upon battery life) we caution the reader that all our dates/days operational are approximate.

The primary problem we encountered with ear-tag transmitters was that they would fail/stop transmitting before they reached the estimated transmission time stated by the manufacture thereby failing prior to their programmed end date (52%; Table B2). Since the primary problem encountered with ear-tag transmitters was early failure and “removed” transmitters were taken off bears prior to their programmed end date we expected transmitters removed before their manufacturer end date to be functioning. Seven of 8 transmitters removed when the bear was recaptured or died, were working at the time while the remaining transmitter was removed before its programmed start date.

Excluding one ear-tag transmitter where it was unclear whether the transmitter failed coinciding with the bear’s death or was caused when the bear died (F14; Table B1), the remaining 22 ear-tag transmitters missed on average 185 days of available transmission time ($n$ = 22 ear-tags, $\bar{x}$ = 185 days missed, SE = 38, range 0 – 493) representing 41% (range 0 – 100; Table B3). It appears from Table B3 that the longer the delay the more likely the transmitter was to fail early. However, we are unable to definitively evaluate whether ear-tags that were programmed with a delayed start date (i.e., Programs 2 & 4) had an increased likelihood of early failure than those that were transmitting when placed on the bear (Programs 1 & 3) because the majority of ear-tags with Programs 1 and 3 were removed and replaced prior to their programmed end date (Tables B1, B2, B3). Therefore the reader should view the evaluation presented in Table B3 with caution. Regardless of shortening the transmission dates and times for ear-tag transmitters

our evaluation shows that these transmitters should be relied on only for the first year to year and a half. Transmitters usually did not remain operational through the end of the second year (Table B3).

Only one ear-tag transmitter did better than expected (F06). This Program 3 transmitter was placed on the bear in fall 2000 with an expected battery life of 2 years (24 hrs/day in fall 2000, reverting in April 2001 to "9 – 5, Mon – Fri" , April – December). This transmitter turned on again in spring 2002 and was transmitting when the bear was found poached on 23 May 2002. All but 1 transmitter turned on the subsequent spring after placement, and transmitted for at least part of the following year (Table B2).

The multiple recaptures of bears at the landfill in fall 2000 also provided us with an opportunity to examine the bears and ear-tag transmitters at regular intervals during the fall. All ears that we examined exhibited raw swollen tissue underneath the transmitters; some appeared infected and emitted a pungent smell. In the more severe cases we removed the transmitter. The majority of these transmitters were placed on in May 2000 and re-examinations occurred during fall 2000 recaptures. We know of two ear-tag transmitters that were ripped from the bear's ear (dropped); however, unless a bear was recaptured, or shot and reported, we do not know whether or not some of the failed transmitters also ripped from the ear. Also, we did not monitor the long term effects of transmitters and it is likely that some of the ear transmitters were dropped after the completion of the study. We encountered 1 broken antenna which decreased the transmitters' transmission range but otherwise it functioned normally.

Overall ear-tag transmitters worked well to keep track of animals that were not dispersing. The transmitter placed on the young, dispersing male (M03) did not work well when attempting to track him likely because he made extensive movements throughout the year. Despite considerable efforts placed in attempting to locate this young male (who dropped his VHF collar) we were unable to locate him by his ear-tag transmitter until he moved back towards the landfill area during denning. Contrary to this male, we were able to keep track of a wide-ranging relocated bear in the Mackenzie area who was outfitted with on an ear-tag transmitter. However, we caution the reader that our study had the added advantage of flying to the area the bears would most likely be at (the landfill) and then searching outwards from that central location. For the most part, we found the ear-tag transmitters signal strength when located from the air to be somewhat equivalent to the VHF collars. In one case, we often picked up the transmission from the ear-tag transmitter before the collar, and on two occasions we heard the transmission clearly over a distance of more than 25 nautical miles. On the ground, the signal strength emitted from ear-tag transmitters appeared less than that of conventional VHF collars.

*EVALUATION OF VHF RADIO-COLLARS*

Lotek VHF collars had a 100% reliable transmission rate throughout the duration of the study. Ten VHF radio-collars were placed on grizzly bears and all were working when recovered (Table B1). The primary problem we encountered with VHF radio-collars was premature splitting of the rot-away spacers (7 of 10 collars). Despite using 4 layers (i.e., 2 complete layers overlapping each other) of canvas fire-hose spacers we still experienced early breakage of the canvas layers. We believe that the time taken for spacers to 'break' was related to the vegetation and moisture regime specific to the area, in combination with the animal's behaviour. Functioning ear-tag transmitters allowed for target trapping of bears that prematurely lost their collars.

Table B1. Evaluation of 23 ear-tag transmitters, 11 VHF radio-collars, and 2 GPS radio-collars placed on 14 grizzly bears and 1 wolf captured at the McLeod Lake landfill, 2000-2002. Bears captured multiple times were considered independently each time they received a new transmitter.

| Bear | Type[a] | Program | Spacer Layers | Start Date | Est. End Date | Est. Life (days) | Attached to Bear | Last Heard | # Days Worked | | | | Success Rate (%) | Reason |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Yr1 | Yr2 | Yr3 | Total | | |
| F01 | ET | 9 to 5 | n/a | 03-Apr-00 | 18-Dec-01 | 518 | 30-Apr-00 | 05-Sep-00 | 155 | | | 155 | 100 | ET working; removed at recapture |
| | ET | Delay #1 | n/a | 03-Apr-00 | 17-Dec-01 | 519 | 30-Apr-00 | 16-Aug-01 | 1 | 135 | | 136 | 26.2 | ET failed before end date |
| | ET | 24 hr | n/a | 28-Aug-00 | 16-Dec-01 | 371 | 05-Sep-00 | 15-Oct-01 | 112 | 196 | | 308 | 0 | ET working; removed when bear died |
| F02 | VC | 24 hr | 3 | 01-May-00 | n/a | 1095 | 01-May-00 | 06-Sep-00 | | | | 128 | 100 | Dropped collar |
| | VC | 24 hr | 4 | 07-Sep-00 | n/a | 1095 | 07-Sep-00 | 31-May-02 | | | | 631 | 100 | Dropped collar (spacer broke) |
| | ET | Delay #2 | n/a | 28-Aug-00 | 15-Dec-02 | 519 | 14-Sep-00 | 02-Nov-01 | 1 | 214 | 0 | 215 | 41.4 | ET failed before end date |
| M03 | VC | 24 hr | 2 | 10-May-00 | n/a | 1095 | 10-May-00 | 30-Aug-00 | | | | 112 | 100 | Dropped collar (spacer broke) |
| | ET | 9 to 5 | n/a | 03-Apr-00 | 18-Dec-01 | 518 | 10-May-00 | 18-Dec-00 | 259 | 0 | | 259 | 50 | Didn't turn on spring 2001, or bear left study area |
| F04 | ET | 9 to 5 | n/a | 03-Apr-00 | 18-Dec-01 | 518 | 10-May-00 | 13-Sep-00 | | | | 163 | 100 | ET working; removed at recapture |
| | ET | Delay #1 | n/a | 03-Apr-00 | 17-Dec-01 | 519 | 10-May-00 | 13-Sep-00 | 1 | | | 1 | 100 | ET working; removed at recapture & replaced |
| | VC | 24 hr | UK | 13-Sep-00 | n/a | 1095 | 13-Sep-00 | 18-Apr-01 | | | | 217 | 100 | Dropped collar (spacer broke) |
| | ET | Delay #2 | n/a | 28-Aug-00 | 15-Dec-02 | 519 | 13-Sep-00 | 27-Apr-01 | 1 | 25 | 0 | 26 | 5 | ET working, but bear ripped out of ear |
| M05 | VC | 24 hr | 3 | 24-May-00 | n/a | 1095 | 24-May-00 | 09-May-01 | | | | 350 | 100 | Collar working; removed when bear died |
| | ET | 9 to 5 | n/a | 03-Apr-00 | 18-Dec-01 | 518 | 24-May-00 | 09-May-01 | 259 | 36 | | 295 | 100 | ET working; removed when bear died |
| | ET | Delay #1 | n/a | 03-Apr-00 | 17-Dec-01 | 519 | 24-May-00 | n/a | 1 | 0 | | 1 | 0.2 | ET failed to turn on in spring 2001 |
| F06 | ET | 9 to 5 | n/a | 03-Apr-00 | 18-Dec-01 | 518 | 27-May-00 | 26-Sep-00 | 176 | | | 176 | 100 | ET working but broken antenna; ET removed |
| | ET | 24 hr | n/a | 28-Aug-00 | 16-Dec-01 | 371 | 26-Sep-00 | 23-May-02 | 112 | 259 | 52 | 423 | 100 | ET working; removed when bear died |
| | ET | Delay #2 | n/a | 28-Aug-00 | 15-Dec-02 | 519 | 26-Sep-00 | 08-Jun-01 | 1 | 67 | 0 | 68 | 13.1 | ET turned on spring 2001, then failed |
| | VC | 24 hr | UK | 07-May-01 | n/a | 1095 | 07-May-01 | 23-May-02 | | | | 381 | 100 | Collar working; removed when bear died |
| F07 | ET | 24 hr | n/a | 28-Aug-00 | 16-Dec-01 | 371 | 01-Sep-00 | 04-Jul-01 | 112 | 93 | | 205 | 55.3 | ET failed before end date |
| | ET | Delay #2 | n/a | 28-Aug-00 | 15-Dec-02 | 519 | 01-Sep-00 | 27-Nov-01 | 1 | 239 | 0 | 240 | 46.2 | ET transmitter failed before end date |
| M08 | VC | 24 hr | UK | 25-May-00 | n/a | 1095 | 25-May-00 | 03-Sep-01 | | | | 466 | 100 | Dropped collar (spacer broke) |
| | ET | Delay #2 | n/a | 28-Aug-00 | 15-Dec-02 | 519 | 01-Sep-00 | 08-Jun-01 | 1 | 67 | 0 | 68 | 13.1 | ET failed before end date |
| F09 | VC | 24 hr | 4 | 25-May-00 | n/a | 1095 | 25-May-00 | 25-May-01 | | | | 365 | 100 | Collar working; removed at recapture |
| | GC | 24 hr | 4 | 01-Apr-01 | 30-Nov-01 | 243 | 25-May-01 | 27-Aug-01 | 148 | | | 148 | 60.9 | Collar failed |
| F10 | VC | 24 hr | 3 | 02-Sep-00 | n/a | 1095 | 02-Sep-00 | 05-Oct-01 | | | | 398 | 100 | Dropped collar (spacer broke) |
| | ET | Delay #2 | n/a | 28-Aug-00 | 15-Dec-02 | 519 | 07-Sep-00 | 19-Nov-01 | 1 | 231 | 0 | 232 | 44.7 | ET turned on spring 2001, then failed |
| | GC | 24 hr | 4 | 04-Mar-02 | 15-Dec-02 | 286 | 17-May-02 | 25-Sep-02 | 205 | | | 205 | 100 | Dropped collar (spacer broke); 69% fixes |
| F11 | ET | 24 hr | n/a | 28-Aug-00 | 16-Dec-01 | 371 | 19-Sep-00 | 06-Sep-01 | 112 | 157 | | 269 | 72.5 | ET failed before end date |
| | ET | Delay #2 | n/a | 28-Aug-00 | 15-Dec-02 | 519 | 19-Sep-00 | 16-Aug-01 | 1 | 136 | 0 | 137 | 26.4 | ET failed before end date |
| F12 | VC | 24 hr | 4 | 28-Sep-00 | n/a | | 28-Sep-00 | 03-Jul-02 | | | | 643 | 100 | Dropped collar (spacer broke) |
| | ET | Delay #2 | n/a | 28-Aug-00 | 15-Dec-02 | 519 | 28-Sep-00 | 26-Oct-01 | 1 | 207 | 0 | 208 | 40.1 | ET failed before end date |
| F14 | ET | 24 hr | n/a | 03-Apr-02 | 17-Dec-02 | 258 | 13-May-02 | 08-Nov-02 | 219 | | | 219 | Unknown | Unknown |
| | ET | 24 hr | n/a | 03-Apr-02 | 17-Dec-02 | 258 | 13-May-02 | 05-Sep-02 | 155 | | | 155 | 60.1 | ET failed |
| M15 | ET | Delay #2 | n/a | 28-Aug-00 | 15-Dec-02 | 519 | 15-May-02 | 08-Nov-02 | 1 | 259 | 220 | 480 | 100 | ET working; removed when bear died |
| W-3 | VC | 24 hr | UK | 29-Sep-00 | n/a | 1095 | 29-Sep-00 | 14-Dec-01 | | | | 441 | 100 | Unknown; not monitored in 2002 |

[a] ET = ear-tag transmitter; VC = VHF radio-collar; GC = GPS radio-collar

Table B2. Evaluation of 23 ear-tag transmitters placed on grizzly bears captured at the McLeod Lake landfill, 2000-2002. Some bears had more than one type of ear-tag transmitter. Bears captured multiple times were considered independently each time they received a new ear-tag.

| | | Evaluation | | | | Cause | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Program Type | *n* | Turned on next spring | Did not turn on next spring | Removed prior to start date | Unknown | Failed Early | Removed[a] | Dropped | Unknown | Working[b] |
| Program #1 - On 9-5, M-F | 5 | 1 | | 3 | 1 | | 4 | 1 | | 3 |
| Program #2 - Delayed 1yr | 3 | 1 | 1 | 1 | | 2 | 1 | | | 1 |
| Program #3 - On 24 hrs | 6 | 4 | | 2 | | 3 | 2 | | 1 | 2 |
| Program #4 - Delayed 1yr | 9 | 8 | | 1 | | 7 | 1 | 1 | | 2 |
| Total | 23 | 14 | 1 | 7 | 1 | 12 | 8 | 2 | 1 | 8 |
| Percent | | 61 | 4 | 30 | 4 | 52 | 35 | 9 | 4 | 35 |

[a] Transmitter removed at recapture or when bear died. 7 of 8 transmitters were working when removed; 1 was removed prior to its activation date.
[b] Subset of the number of transmitters that were working when removed at recapture, when bear died, or when transmitter was dropped.

Table B3. Mean number of transmission days missed by ear-tag transmitter program type, and percent of days missed by program type for 23 ear-tag transmitters placed on grizzly bears captured at the McLeod Lake landfill, 2000-2002. Some bears had more than one type of ear-tag transmitter. Bears captured multiple times were considered independently each time they received a new ear-tag.

| Ear-tag Program | *n* | Mean no. days missed | SE (range) | Percent Missed |
|---|---|---|---|---|
| Program #1 - On 9-5, M-F | 5 | 52 | 52 (0-259) | 10 |
| Program #2 - Delayed 1yr | 3 | 161 | 115 (0-383) | 58 |
| Program #3 - On 24 hrs | 5 | 74 | 32 (0-166) | 22 |
| Program #4 - Delayed 1yr | 9 | 329 | 49 (0-493) | 63 |
| All transmitters | 22 | 185 | 38 | 41 |

## Appendix C. Success of different trap types for capturing grizzly bears at the McLeod Lake landfill, 2000 - 2002.

In 2000, baited cubby sets were most successful in spring, while baited culvert traps were most effective in fall. In spring, snare sets in the Landfill Area were 8 times (trail sets) and 12 times (baited cubby sets) more successful than baited culvert traps. The opposite was true in fall with baited culvert traps being 5 times more successful than trail sets and 13 times more effective than baited cubby sets (Table B1).

Only 2 grizzly bears (F02 and F07) were captured in greater than 1 trail snare-set within a trapping season (Table B1); both were caught twice in fall, each time in a different trail set location. Locations of trail snare-sets were not moved within a trapping season and it appeared that bears quickly learned to avoid the snares. We observed bears approaching trail snare-sets to stop, retreat and take an alternate route, or paw at and trip the set before continuing through.

Although culvert traps were also established at specific locations within the Landfill Area, avoidance was not observed. Six female grizzly bears were captured more than once in baited culvert traps in fall 2000 (Table B1). Bears F06 and F09 were never captured in the same culvert twice. Conversely, each of the other 4 bears was captured in the same culvert trap 2 or more times; F02 was caught in the same culvert trap 5 times over the course of a 23-day period in September 2000.

In spring 2001, we trapped with trail sets (18 trap-nights) and baited cubby sets (29 trap-nights), and recaptured 2 bears in cubby sets (F06, M05). In fall 2001, we trapped only with baited culvert traps (28 trap-nights) and recaptured one bear (F02).

We also set traps away from the landfill in the known vicinity of radio-tagged individuals (determined through aerial-telemetry flights or by incidental observation). Four cubby sets built in spring 2001 were unsuccessful in capturing 2 targeted individuals. Two culvert traps were set in spring 2002; one set near a den site in early April was unsuccessful, while the second was successful in recapturing F10 and her 2 unmarked yearling cubs.

Table C1. Number of grizzly bear captures and capture success rates for 4 different trap types used at the McLeod Lake landfill in spring and fall 2000. S = Aldrich snare, trail set; CBl = Aldrich snare, baited cubby set in immediate landfill area; CBg = Aldrich snare, baited cubby set on gasline 400 m from landfill; C = baited culvert trap.

| Bear | Spring | | | | | Fall | | | | No. of |
|---|---|---|---|---|---|---|---|---|---|---|
| ID no. | S | CBl | CBg | C | Total | S | CBg | C | Total | captures |
| *Adult female with 2 COY dependents* [a] | | | | | | | | | | |
| F12 | | | | | | 1 | | | | 1 |
| M13 | | | | | | 1 | | | | 1 |
| *Adult female with 2 3-year-old dependents* | | | | | | | | | | |
| F09 | | | | | | 1 | | 3 | | 4 |
| M08 | | | | | | 1 | | 1 | | 2 |
| F07 | | | | | | 2 | | 4 | | 6 |
| *Orphaned dependent yearling siblings* | | | | | | | | | | |
| F01 | 1 | 1 | | 1 | | 1 | | | | 4 |
| F06 | | | | 1 | | | | 3 | | 4 |
| *Adult female no dependents* | | | | | | | | | | |
| F02 | 1 | | | | | 2 | | 6 | | 9 |
| *Young adult female no dependents* | | | | | | | | | | |
| F10 | | | | | | 1 | | 1 | | 2 |
| *Subadult females* [b] | | | | | | | | | | |
| F04 | 1 | 1 | | | | 1 | 1 | 3 | | 7 |
| F11 | | | | | | | | 2 | | 2 |
| *Subadult male* [b] | | | | | | | | | | |
| M03 | 1 | | | | | | | | | 1 |
| *Adult male* | | | | | | | | | | |
| M05 | 1 | | | | | | | 1 | | 2 |
| Captures | 5 | 2 | 0 | 2 | 9 | 11 | 1 | 24 | 36 | 45 |
| Trap-nights | 46 | 13 | 30 | 149 | 238 | 176 | 56 | 78 | 310 | 548 |
| Success[c] | 10.9 | 15.4 | 0 | 1.3 | 3.8 | 6.3 | 1.8 | 30.8 | 11.6 | 8.2 |

[a] COY M13 captured and color-marked only, 2nd COY observed but not captured
[b] F04, F11, and M03 all independent siblings, and offspring of F02
[c] Success = number of captures per 100 trap-nights

## Appendix D. Potential parent-offspring relationships based on observations of mothers with cubs and genetic data for grizzly bears captured at McLeod Lake landfill, 2000-2002.

Family relationships largely determined on genetic information is influenced by the number of loci analyzed (in this case 15) and the variability of the markers because they will affect the number of mismatches; populations with low genetic diversity (i.e., high degree of genetic relatedness) can be problematic and results must be interpreted with caution. In populations with low genetic diversity potential parents often share a number of alleles with unrelated potential offspring. Mismatches of 0 loci may indicate a family relationship (e.g., mother-daughter-son-sibling-father) while mismatches of 1 or 2 loci may indicate relatedness or chance - "there is a high enough probability that unrelated individuals will have one allele in common at all-but-one, or all-but-two loci purely by chance" (J. Weldon, pers. comm.). Therefore the results presented in Table D1 should be viewed with caution.

Table D1. Potential parent-offspring relationships based on observations of mothers with cubs and genetic data for grizzly bears captured at McLeod Lake landfill, 2000-2002. Mothers followed by known offspring are grouped together; F01 and F06 are orphaned yearlings with no mother.

| ID No. | Nearest Father | No. Loci Mismatching | Nearest Mother | No. Loci Mismatching | Comments |
|---|---|---|---|---|---|
| F01 | No Candidate parental matches found | | | | **Mother:** poached. **Father:** Not M05 Thor. **Sibling:** F06. |
| F06 | M08[a] | 0 | DNA 6553-020 | 0 | **Father:** Unlikely M08 due to age; no other perfect matches. Two DNA samples differ at 1 locus, 3 at 2 loci including 6932-050. **Mother:** No other perfect matches. PGBP GF49 mismatches at 1 locus; F07 and PGBP GF24 mismatch at 2 loci. |
| F02 | DNA 6643-015 | 2 | DNA 6643-050 | 0 | **Father:** all mismatch at 2 loci including PGBP GM14 and GM23. **Mother:** 3 unknown DNA samples mismatch at 0 loci. M03, F04, F11, and F12 also mismatch at 0 loci but are known offspring (first 3) or siblings. F10 mismatches at 1 locus. |
| M03 | DNA 6889-055 | 0 | F02 | 0 | No other samples for mother or father with 0 loci mismatch. F10 has 2 loci mismatching. |
| F04 | DNA 6889-055 | 1 | F02 | 0 | **Father:** No perfect matches. PGBP males GM14, 19, 20 and 23 mismatch at 1 locus. **Mother:** DNA sample 6887-016 and sibling F11 also have 0 loci mismatch. |
| F11 | DNA 6632-004 | 1 | F02 | 0 | **Father:** No perfect matches found. Note: 6889-055 mismatches at 2 loci. PGBP GM14 mismatches at 2 loci. **Mother:** DNA sample #6887-016 and Nutmeg mismatch at 0 loci. PGBP GF27 mismatches at 1 locus. |
| F09 | M05 | 0 | DNA 6603-001 | 1 | **Father:** No other perfect matches, except son M08. **Mother**: No perfect matches, except daughter F07. F04 mismatches at 2 loci. |
| F07 | DNA 6932-050 | 0 | F09 | 0 | **Father:** brother M08 also matches at 0 loci. PGBP GM29 mimatches at 1 locus as with 2 DNA samples. **Mother:** No other perfect matches. PGBP GF41 mismatches at 1 locus. |
| M08 | DNA 6932-050 | 0 | F09 | 0 | **Father:** Mismatches M05 & 4 DNA samples at 1 locus. **Mother:** PGBP GF42, F06 and F07 all match at 0 loci. PGPB GF49 mismatches at 1 locus. |
| F12 | PGPB GM51 | 0 | DNA 6610-010 | 0 | **Father:** Son M13 mismatch at 0 loci. Note: 6889-055 mismatches at 1 locus. **Mother:** F02 also mismatch 0 loci but age indicates unlikely mother-daughter pair; likely sibling. |
| M13 | DNA 6889-055 | 1 | F12 | 0 | **Father:** No perfect matches identified. **Mother:** No other perfect matches except F12. PGBP GF12 mismatches at 2 loci. |
| F10 | DNA 6889-055 | 2 | DNA 6643-050 | 1 | **Father:** Unidentified, all potential matches have 2 or > loci mismatching, including M03. **Mother:** No perfect matches found. F02 mismatches at 1 locus; F04, F12, and PGBP GF34 mismatch at 2 loci. |
| F14 | DNA 6889-055[b] | 1 | F10 | | **Father**: Not M05 **Mother**: known from birth |
| M15 | DNA 6889-055[b] | 1 | F10 | | **Father**: Not M05 **Mother**: known from birth |
| M05 | DNA 6506-011 | 1 | F09[a] | 0 | **Father:** No perfect matches. M08 mismatch at 1 locus. **Mother:** PGBP GF40 and GF41 (mother & daugher) mismatch at 1 locus, GF13 mismatches at 2 loci. F09 cannot be M05's father due to age, but M05 could be F09's father. |

[a] These matches are not potential parents due to known bear ages but may indicate a degree of relatedness between bears.
[b] DNA sample #6889-055 was excluded as a candidate father of F14 and M15 when their known mother, F10, was included in the Parente program analysis.

Appendix E. Fixed-telemetry data gathered on radio-tagged grizzly bears at the McLeod Lake landfill, 2000 – 2002.

Table E1. Number of hours the fixed-telemetry datalogger station at the McLeod Lake landfill was operational and the bear's radio-tag was transmitting, and first and last dates each radio-tagged bear was recorded in the Landfill Area pre (2000) and post closure (2001 & 2002). The datalogger was operational between 30 May - 29 November 2000, 26 April - 16 November 2001, and 17 April - 15 November 2002.

| Bear | Date of 1st | Hours Datalogger Operational | | | Date of first record in Landfill Area | | | Date of last record in Landfill Area | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ID | Capture[a] | 2000 | 2001 | 2002 | 2000 | 2001 | 2002 | 2000 | 2001 | 2002 |
| F01 | 29-Apr-00 | 2,495 | 925 | | 31 May[b] | 26 Apr | | 15 Nov | 15 Oct | |
| F02 | 30-Apr-00 | 4,147 | 4,688 | 1,034 | 30 May[b,c] | 9 May | n/d | 27 Oct | 15 Oct | |
| M03 | 09-May-00 | 4,309 | | | | | | 9 May | | |
| F04 | 09-May-00 | 2,307 | | | 4 Jul[b] | | | 11 Nov | | |
| M05 | 23-May-00 | 4,269 | 301 | | 30 May[b] | 26 Apr | | 17 Sep | 8 May | |
| F06 | 27-May-00 | 2,098 | 4,461 | 803 | 2 Jun[b] | 26 Apr | n/d | 15 Nov | 17 Oct | |
| F07 | 31-Aug-00 | 1,946 | 1,116 | | 5 Sep | 28 Sep | | 5 Nov | 28 Sep | |
| M08 | 25-May-00 | 4,245 | 3,086 | | 13 Aug | 7 May | | 5 Nov | 7 May | |
| F09 | 25-May-00 | 4,244 | 1,353 | | 13 Aug | 7 May | | 5 Nov | 7 May | |
| F10 | 01-Sep-00 | 1,987 | 4,697 | 4,652 | 3 Sep | 6 May | 25 Jul | 16 Oct | 29 Oct | 1 Nov[d] |
| F11 | 18-Sep-00 | 1,599 | 780 | | 19 Sep | | | 14 Nov | | |
| F12 | 27-Sep-00 | 1,318 | 4,697 | 1,775 | 1 Oct | 12 May | n/d | 5 Nov | 12 Oct | |
| TOTAL | | 34,963 | 26,102 | 8,265 | | | | | | |

[a] Date of 1st capture was in McLeod Lake landfill for all bears except M08/F09, and F14/M15
[b] First visit to landfill after datalogger was operational on 30 May, and therefore after bear was initially captured in landfill earlier in spring
[c] Bear was likely on the west of McLeod Lake. First known visit to the actual landfill (after initial capture) was 24 August 2000
[d] F10 (Didgy) dropped her radio-collar between 21 - 25 September 2002 after which point she was monitored through her dependent cub F14 (Maggie); F14's transmitter was only active 16 hours/day between 07:45 - 23:45
n/d = no visits between datalogger start date of 17 April, and date of dropped collar (F02 – 31 May; F12 – 10 Jul) or mortality (F06 – 23 May)

Appendix F. Percentage of night-time hours bears wearing 24-hour transmitters spent at the McLeod Lake landfill pre- and post-landfill closure.

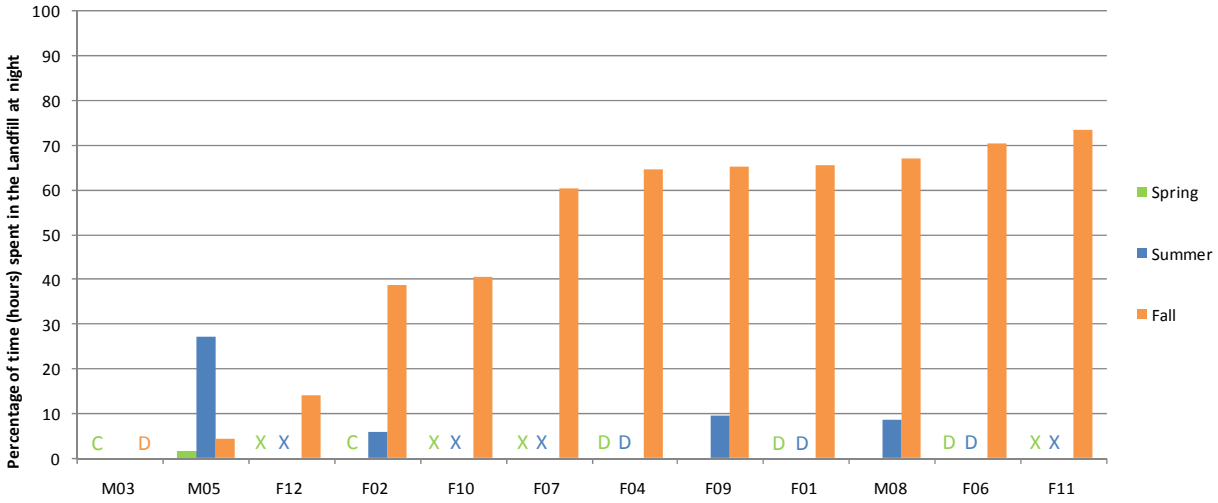


Figure F1. Percentage of night-time hours (sunset to sunrise) grizzly bears wearing 24-hour transmitters spent in the McLeod Lake Landfill pre-landfill closure in 2000: spring (datalogger start 30 May – 30 Jun), summer (1 Jul – 31 Aug), and fall (1 Sep – den arrival). "D" = bears wearing only "Daytime" transmitters operating between 9:00 – 17:00, Monday – Fridays. "C" = captures where bears were fitted with 24-hour radio-collars (all spring captures occurred before the datalogger was operational on 30 May). "X" = bears not yet captured thus no data available.

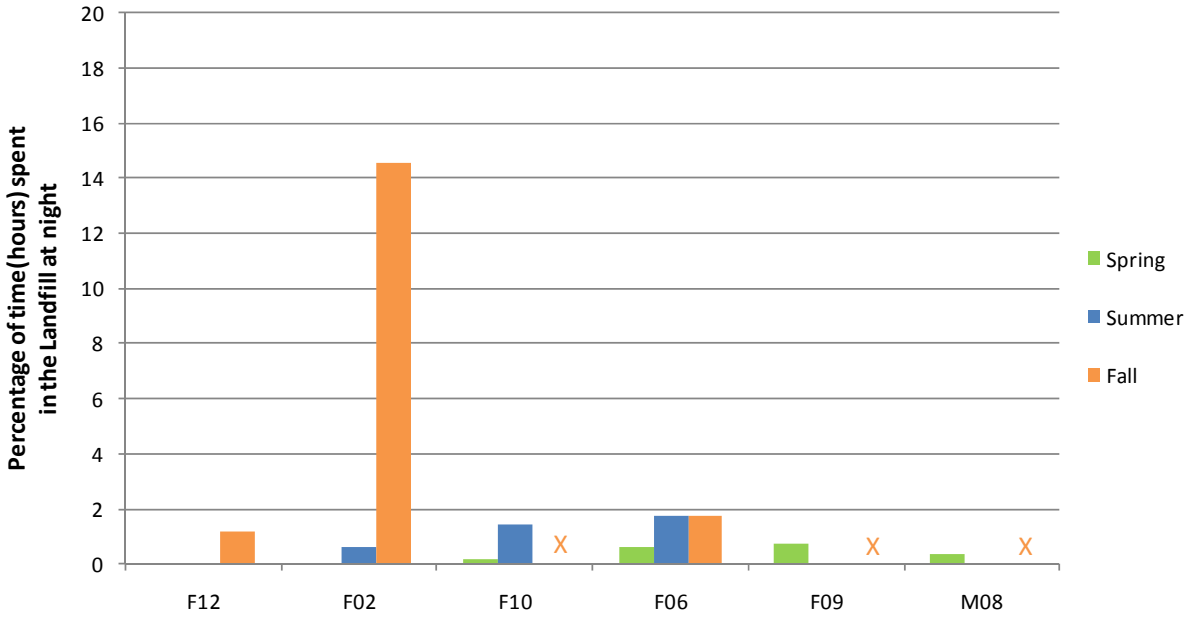


Figure F2. Percentage of night-time (sunset to sunrise) hours grizzly bears wearing 24-hour transmitters spent in the McLeod Lake Landfill post-landfill closure in 2001: spring (datalogger start 26 Apr - 30 Jun), summer (1 Jul - 31 Aug), and fall (1 Sep – den arrival). "X" denotes seasons when bears dropped their transmitters. (Note Y-axis scale of only 20%.)

Appendix G. Radio-telemetry locations obtained on radio-tagged grizzly bears at the McLeod Lake landfill, 2000 – 2002.

Table G1. Number of locations obtained per radio-tagged grizzly bear, 2000 – 2002. A maximum of only one capture and one landfill location per season are reported here; see Table A2 in Appendices for all captures, and Table 4 in report for all landfill visits. "Pre-den" is the previous winters' den site location if known; "Post-den" is the subsequent winters' den site location. "Repeat den" are additional aerial-telemetry locations obtained for the same "Post-den" den site location.

| | | Pre- | Spring | | | | Summer | | | | Fall | | | | Post- | | *Repeat* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | ID No. | Den | Captures | Aerial | Landfill | | Captures | Aerial | Landfill | | Captures | Aerial | Landfill | | Den | Total | *Den* |
| 2000 | F01 | | 1 | 6 | 1 | 8 | | 9 | 1 | 10 | 1 | 11 | 1 | 13 | 1 | 32 | *2* |
| | F02 | | 1 | 7 | 1 | 9 | | 13 | 1 | 14 | 1 | 17 | 1 | 19 | 1 | 43 | *10* |
| | F04 | | 1 | 7 | | 8 | 1 | 9 | 1 | 11 | 1 | 7 | 1 | 9 | 1 | 29 | *4* |
| | F06 | | 1 | 5 | 1 | 7 | | 9 | 1 | 10 | 1 | 10 | 1 | 12 | 1 | 30 | *2* |
| | F07 | | | 2 | | 2 | 1 | 2 | | 3 | 1 | 22 | 1 | 24 | 1 | 30 | *5* |
| | F09 | | 1 | 7 | | 8 | | 18 | 1 | 19 | 1 | 22 | 1 | 24 | 1 | 52 | *6* |
| | F10 | | | | | 0 | | | | 0 | 1 | 7 | 1 | 9 | 1 | 10 | *7* |
| | F11 | | | | | 0 | | | | 0 | 1 | 6 | 1 | 8 | 1 | 9 | *3* |
| | F12 | | | | | 0 | | | | 0 | 1 | 5 | 1 | 7 | 1 | 8 | *5* |
| | M03 | | 1 | 3 | | 4 | | 12 | | 12 | | 2 | | 2 | 1 | 19 | *2* |
| | M05 | | 1 | 5 | 1 | 7 | | 9 | 1 | 10 | 1 | 8 | 1 | 10 | 1 | 28 | *3* |
| | M08 | | 1 | 7 | | 8 | 1 | 15 | 1 | 17 | 1 | 22 | 1 | 24 | 1 | 50 | *6* |
| | Total | 0 | 8 | 49 | 4 | 61 | 3 | 96 | 7 | 106 | 11 | 139 | 11 | 161 | 12 | 340 | *55* |
| 2001 | F01 | 1 | | 10 | 1 | 11 | | 9 | 1 | 10 | | 6 | 1 | 7 | | 29 | |
| | F02 | 1 | | 18 | | 18 | | 18 | 1 | 19 | 1 | 17 | 1 | 19 | 1 | 58 | *12* |
| | F04 | 1 | | 2 | | 2 | | | | 0 | | | | 0 | | 3 | |
| | F06 | 1 | 1 | 10 | 1 | 12 | | 9 | 1 | 10 | | 9 | 1 | 10 | 1 | 34 | *3* |
| | F07 | 1 | | 17 | | 17 | | 16 | | 16 | | 21 | 1 | 22 | 1 | 57 | *1* |
| | F09 | 1 | 1 | 22 | 1 | 24 | | 16 | | 16 | | | | 0 | | 41 | |
| | F10 | 1 | | 8 | 1 | 9 | | 9 | 1 | 10 | | 9 | 1 | 10 | 1 | 31 | *1* |
| | F11 | 1 | | 10 | | 10 | | 8 | | 8 | | 1 | | 1 | | 20 | |
| | F12 | 1 | | 7 | | 7 | | 8 | | 8 | | 10 | | 10 | 1 | 27 | *3* |
| | M05 | 1 | 1 | 4 | 1 | 6 | | | | 0 | | | | 0 | | 7 | |
| | M08 | 1 | | 14 | 1 | 15 | | 11 | | 11 | | 1 | | 1 | | 28 | |
| | Total | 11 | 3 | 122 | 6 | 131 | 0 | 104 | 4 | 108 | 1 | 74 | 5 | 80 | 5 | 335 | *20* |
| 2002 | F02 | 1 | | 7 | | 7 | | | | 0 | | | | 0 | | 8 | |
| | F06 | 1 | | 3 | | 3 | | | | 0 | | | | 0 | | 4 | |
| | F10 | 1 | 1 | 10 | | 11 | | 10 | 1 | 11 | | 13 | 1 | 14 | | 37 | |
| | F12 | 1 | | 12 | | 12 | | 2 | | 2 | | | | 0 | | 15 | |
| | Total | 4 | 1 | 32 | 0 | 33 | 0 | 12 | 1 | 13 | 0 | 13 | 1 | 14 | 0 | 64 | *0* |
| All Years | | 15 | 12 | 203 | 10 | 225 | 3 | 212 | 12 | 227 | 12 | 226 | 17 | 255 | 17 | 739 | *75* |

*AERIAL-TELEMETRY LOCATIONS ON FAMILY GROUPS AND DEPENDENT BEARS*

F01 and F06 were orphaned yearlings that were dependent in 2000 and independent 2-year-olds in 2001. They were located together 20 times in 2000 (59% of F01's locations; 63% of F06's), and 4 times in 2001 (12.5% of F01's locations; 14% of F06's), excluding capture and landfill locations. These siblings began becoming independent from each other by late spring in 2001.

In 2000, 3-year old dependent offspring F07 and M08 were located with their mother F09 and/or sibling 83% (29 of 35) and 84% (46 of 55) of their locations respectively, excluding capture and datalogger locations. F09 was located in the presence of 1 or both of her offspring on 46 of 57 occasions (81%). In spring 2001, the 4-year-old siblings F07 and M08 began to separate from their mother being located together on only 5 (9%) and 8 (30%) occasions respectively that season. In mid-May, M08 began frequently separating from and rejoining the family group and was not located on several occasions in May, July and August, therefore his actual percentage of locations in the presence of 1 or both of his family members over-represents his actual number of lone locations since the missing locations were not accounted for.

Before her presumed GPS collar failure in 2001, F09 was in the presence of her offspring 9 of 40 (22.5%) locations, excluding capture and datalogger locations. Over the entire monitoring period (capture in 2000 to collar failure in 2001), F09 was located alone with M08 24% of the time (23 of 97 locations; 10 of these were prior to radio-tagging of F07), alone with F07 only once, and with both offspring 32% of the time (31 of 97 locations), for a total of 57% (55 of 97) of locations (excluding capture and datalogger locations). When in the presence of their mother, the offspring were within 100 m of her location 78% of the time (43 of 55 locations) followed by 100 – 500 m 18% of the time (10 of 55), and on 2 occasions 1 offspring was within 100 m while the other was within 500 m.

F10 gave birth to 2 cubs (F14 and M15) during the same winter that the landfill was closed (2000/01). They were subsequently trapped and outfitted with ear-tag transmitters as yearlings in spring 2002. With the exception of 1 location on M15's dropped ear-tag transmitter, which likely occurred in the presence of the family group but could not be confirmed, these offspring were dependent and always located in the company of their mother until their death in late November 2002. Therefore only F10's radio-locations are reported, but all locations in 2001 and 2002 represent the family group.

## Appendix H. Home range, movements, and landfill use by radio-collared wolf W3 at the McLeod Lake landfill, 2000 – 2001.

Three wolves that appeared to be part of a larger pack were incidentally captured at the McLeod Lake landfill using Aldrich snare trail sets on 1, 3 and 28 September 2000 respectively. The male wolf captured on 28 September (W3) was fitted with a VHF radio-collar. His visits to the landfill were monitored by remote data-logger, and his movements from fall 2000 through to summer 2001 were monitored by fixed-wing aerial telemetry (Figure H1). We obtained 13 aerial locations on W3 representing a very minimum area/range of 241 $km^2$ ($n$ = 9, fall 2000; $n$ = 3, spring 2001; $n$ =1, summer 2001). W3's transmitter was heard but no specific location was obtained on an additional 4 flights (1 in spring, 3 in summer). His signal was last heard on 10 August 2001 though he was scanned for on the subsequent 6 flights.

We believe W3 was a member of a wolf pack containing at least 6 individuals. We obtained visuals during 3 telemetry flights: 4 October 2000 - 4 wolves seen slowly moving into the forested cover/trees; 9 November 2000 - 6 wolves seen lying down in a cutblock; 11 December 2000 - one wolf seen standing in an opening surrounded by spruce forest. We identified a possible den site on 18 May 2001 telemetry flight: an opening on the bank of a slope located within an early regeneration spruce (<10m) cutblock approximately 13 km from the landfill (Figure H1). This wolf pack appeared to regularly use both clearcuts and mature spruce forest.

On average, W3 was located 13 km from the landfill ($n$ = 13, SE = 1.9, range 0 – 25 km). In fall 2000, he averaged 13.5 km from the landfill (SE = 2.7, range 0 – 25 km) and 10 km in spring 2001 (SE = 1.9, range 7 – 13 km). The one location obtained in summer 2001 was 12.5 km from the landfill.

In fall 2000, prior to landfill closure, W3 visited the landfill on 20 nights between the date of his capture (28 September) and the end of monitoring by the landfill datalogger (29 November): 2 nights in September, 10 in October and 8 in November. After landfill closure in 2001, W3 visited the landfill on 25 nights: 11 in spring (6 in May, 5 in June), 9 in summer (5 in July, 4 in August), and 5 in fall (4 in September, 1 in October).

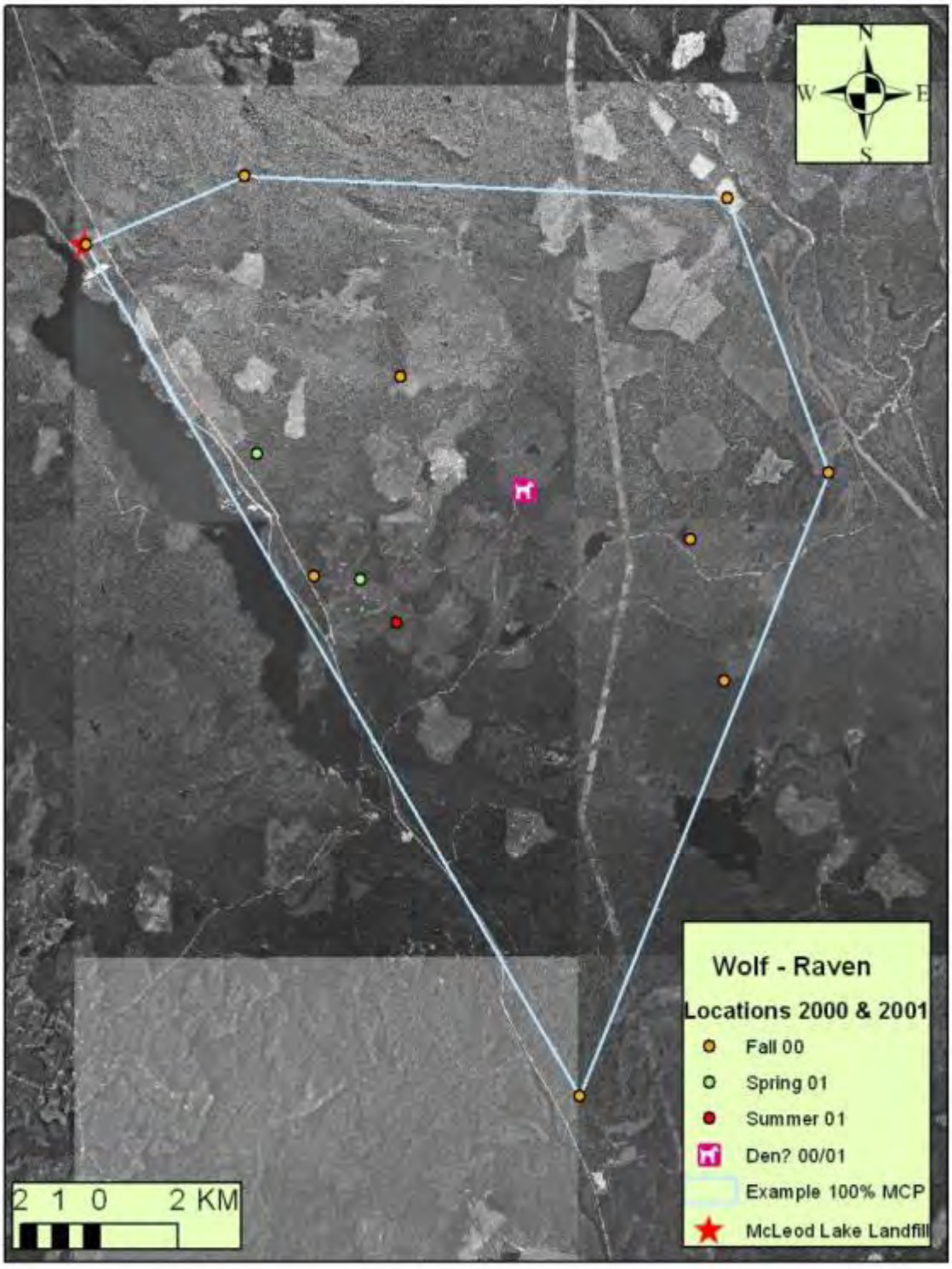


Figure H1. Aerial radio-telemetry locations for wolf W3 captured and radio-collared at the McLeod Lake landfill on 28 September 2000 for fall 2000 (pre) and spring and summer 2001 (post) landfill closure.

## Appendix I. Annual and seasonal home range sizes for radio-tagged grizzly bears at the McLeod Lake landfill, 2000 – 2002.

We further examined annual and seasonal home range sizes for all bears (regardless of the number of aerial-telemetry locations obtained) pre (2000) and post (2001 and 2002) landfill closure to evaluate whether home range sizes appeared to increase after closure of the landfill, or whether bears appeared to shift their home ranges away from the landfill.

### METHODS

We calculated 100% Minimum Convex Polygon (MCP) seasonal, annual, and multi-year home ranges for radio-tagged grizzly bears using aerial-telemetry locations, as well as 1 fixed-telemetry location for each season that the bear visited the landfill (spring, summer and fall; maximum 3 per year), capture/re-capture locations, and den site location. For purposes of calculating seasonal home ranges for bears wearing daytime/weekday transmitters operating from 9:00 – 17:00, Monday to Friday for which no night visits to the landfill could be obtained, we included 1 fixed-telemetry landfill location for each season that the bear was detected in the Landfill Area during the daytime because a review of bears wearing 24-hour transmitters revealed that the majority of times a bear was recorded in the Landfill Area during the daytime it also subsequently visited the landfill at night. Three seasons were used in the primary seasonal analysis: spring (den emergence – 30 Jun), summer (1 Jul – 31 Aug), and fall (1 Sep – den arrival). We further examined fall home range sizes to determine if bears exhibited smaller ranges during the peak period of landfill use, particularly in 2000 (pre-closure). We examined home range sizes for 2 sub-sets of time within fall: 1 October – last landfill visit ("core" landfill use period), and 1 October – den arrival.

MCP home ranges were calculated using the program HawthTools (Beyer 2004) as an extension in ArcMap™ 9.2 (ESRI® Environmental Systems Research Institute, Redlands, CA). Home range images were generated in ArcMap™ 9.2 using 120-metre resolution orthophotos underlay obtained from British Columbia Imagery WMS layer (bc_bc_xb1m_bcalb_1995-2003). These years most closely resemble the years when the study was conducted.

We used a 3x3 [Year (2000, 2001, 2002), Season (spring, summer, fall)] and 2x3 [Year (2000 Pre-closure, 2001 Post-closure), Season (spring, summer, fall)] main effects analysis of variance (ANOVA) to determine if differences existed between the primary seasonal home range sizes pre-and-post landfill closure. For comparisons, we removed the annual home ranges of dependent bears, and the home range of a young bear dependent upon its' sibling in summer 2000. We also removed bears with partial home ranges due to missing locations or dropped transmitters. Statistical differences between males and females, and between fall (1 Sep – den arrival) and annual home ranges, were calculated using Mann-Whitney U-tests $\alpha \leq 0.05$. Statistical tests were performed using Statistica Version 5.0 (StatSoft, Tulsa, OK). We also examined whether the differences within and between years during the fall period and 2 subsets of fall periods were significant. We used a *t*-test to determine if differences in ranges sizes occurred within the same year but between the different fall periods, and a Mann Whitney U-test to further examine if differences existed between the same periods by comparing between 2000 (pre-closure) and 2001 (post-closure).

## RESULTS

### *ANNUAL AND SEASONAL HOME RANGE SIZES*

There was no significant difference in the mean annual home range size for female grizzly bears before landfill closure in 2000 ( $\bar{x}$ = 399 km$^2$, SE = 189, $n$ = 4) than after closure in 2001 ( $\bar{x}$ = 444 km$^2$, SE = 133, $n$ = 5; $P$ = 0.81; Table I1). Pre-closure (2000), 2 orphaned females F01 and F06 remained close to the landfill and had the smallest home ranges (30 and 32 km$^2$ respectively), while F09 accompanied by her 3-year-old dependent offspring F07 and M08 had the largest female home range of 958 km$^2$ (Table I2, Figure I1). In the first year after the landfill closed (2001), orphaned female F01 again had the smallest annual home range size although it did increase from 30 km$^2$ to 96 km$^2$ (Figure I2). Her fall range was considered incomplete because she was destroyed as problem wildlife in mid-October. The largest female home range size post-closure again belonged to F09 whose now 4-year-old offspring F07 and M08 had largely dispersed, and her range size increased to a minimum of 1,032 km$^2$ (up until fall, at which point she dropped her collar).

Only 1 family group (F10 with dependents F14 and M15) was monitored in the second year post-landfill closure (2002). Her annual home range size increased from 161 km$^2$ in 2001 when her cubs were cubs of the year, to 341 km$^2$ in 2002 when her cubs were yearlings. Although this increase could reflect a need for increased food resources due to landfill closure, it also may be due to the older status of the cubs.

Table I1. Mean seasonal home range sizes for male and female grizzly bears pre (2000) and post (2001 & 2002) landfill closure. Bears with multiple years/seasons of data were treated as independent ($n$ = 46 home ranges on 9 female and 3 male bears). Dependent bears (F01, F07 and M08 in 2000) and bears with multiple missing locations (M03 spring & fall 2000) were omitted from the analysis. Spring (den emergence – 30 Jun), summer (1 Jul – 31 Aug), fall (1 Sep – den arrival).

| | | HR Size – ALL | | | HR Size – Females | | | HR Size – Males | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Season | $\bar{x}$ | SE | $n$ | $\bar{x}$ | SE | $n$ | $\bar{x}$ | SE | $n$ |
| | Spring | 164 | 46 | 5 | 146 | 54 | 4 | 235 | n/a | 1 |
| 2000 | Summer | 722 | 536 | 6 | 207.5 | 88 | 4 | 1752 | 1634 | 2 |
| | Fall | 119 | 46 | 8 | 95 | 45 | 7 | 284 | n/a | 1 |
| | Spring | 496 | 218 | 9 | 303 | 117 | 8 | 2035 | n/a | 1 |
| 2001 | Summer | | | | 147 | 20.5 | 8 | | | |
| | Fall | | | | 147 | 47.5 | 6 | | | |
| | Spring | | | | 212 | 171 | 2 | | | |
| 2002 | Summer | | | | 172 | n/a | 1 | | | |
| | Fall | | | | 184 | n/a | 1 | | | |

Table I2. Spring (den emergence – 30 Jun), summer (1 Jul – 31 Aug), fall (1 Sep – den arrival), and annual home range sizes (100% Minimum Convex Polygon) for radio-tagged grizzly bears captured at the McLeod Lake Landfill, pre (2000) and post (2001 & 2002) landfill closure.

| | Pre-landfill closure | | | | Post-landfill closure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bear | 2000 home ranges ($km^2$) | | | | 2001 home ranges ($km^2$) | | | | 2002 home ranges ($km^2$) | | | | Multi-year |
| ID No. | Spring | Summer | Fall | Annual | Spring | Summer | Fall | Annual | Spring | Summer | Fall | Annual | Annual |
| *Adult female with 2 COY dependents 2000 (dependent yearlings 2001, 2-year-olds 2002)* | | | | | | | | | | | | | |
| F12 | | | 286[a] | | 484 | 206 | 262 | 714 | 383 | | | | 781 |
| *Adult female with 2 radio-tagged 3-year-old dependents 2000 (all independent 2001)* | | | | | | | | | | | | | |
| F09 | 120 | 442 | 250 | 929 | 1,032 | 151 | | 1,032[a] | | | | | 1,112 |
| M08 | 121 | 797 | 250 | 1633 | 2,035 | 501[a] | | 2,896[a] | | | | | 4,065 |
| F07 | | | 295 | | 360 | 165 | 258 | 796 | | | | | 826 |
| *Orphaned dependent yearling siblings 2000 (independent 2-year-olds 2001)* | | | | | | | | | | | | | |
| F01 | 5 | 16 | 16 | 30 | 53 | 52 | 17[a] | 96[a] | | | | | 105 |
| F06 | 6 | 16 | 18 | 32 | 153 | 91 | 87 | 182 | 6[a] | | | | 192 |
| *Adult female no dependents 2000 (3 dependent COY 2001, yearlings 2002)* | | | | | | | | | | | | | |
| F02 | 255 | 169 | 55 | 288 | 106 | 185 | 230 | 367 | 33[a] | | | | 452 |
| *Young adult female no dependents 2000 (2 dependent COY 2001, radio-tagged yearlings 2002)* | | | | | | | | | | | | | |
| F10 | | | 39 | | 45 | 110 | 26 | 161 | 41 | 172 | 184 | 341 | 529 |
| *Subadult females no dependents 2000, 2001* | | | | | | | | | | | | | |
| F04 | 202 | 203 | 5 | 346 | | | | | | | | | 346 |
| F11 | | | 15[a] | | 193 | 216 | | 569[a] | | | | | 704 |
| *Subadult male* | | | | | | | | | | | | | |
| M03 | | 3,386 | | | | | | | | | | | 3,386 |
| *Adult male* | | | | | | | | | | | | | |
| M05 | 235 | 118 | 284 | 562 | 232[a] | | | | | | | | 607 |

[a] Partial home ranges size only due to missing locations, dropped collar, or bear mortality

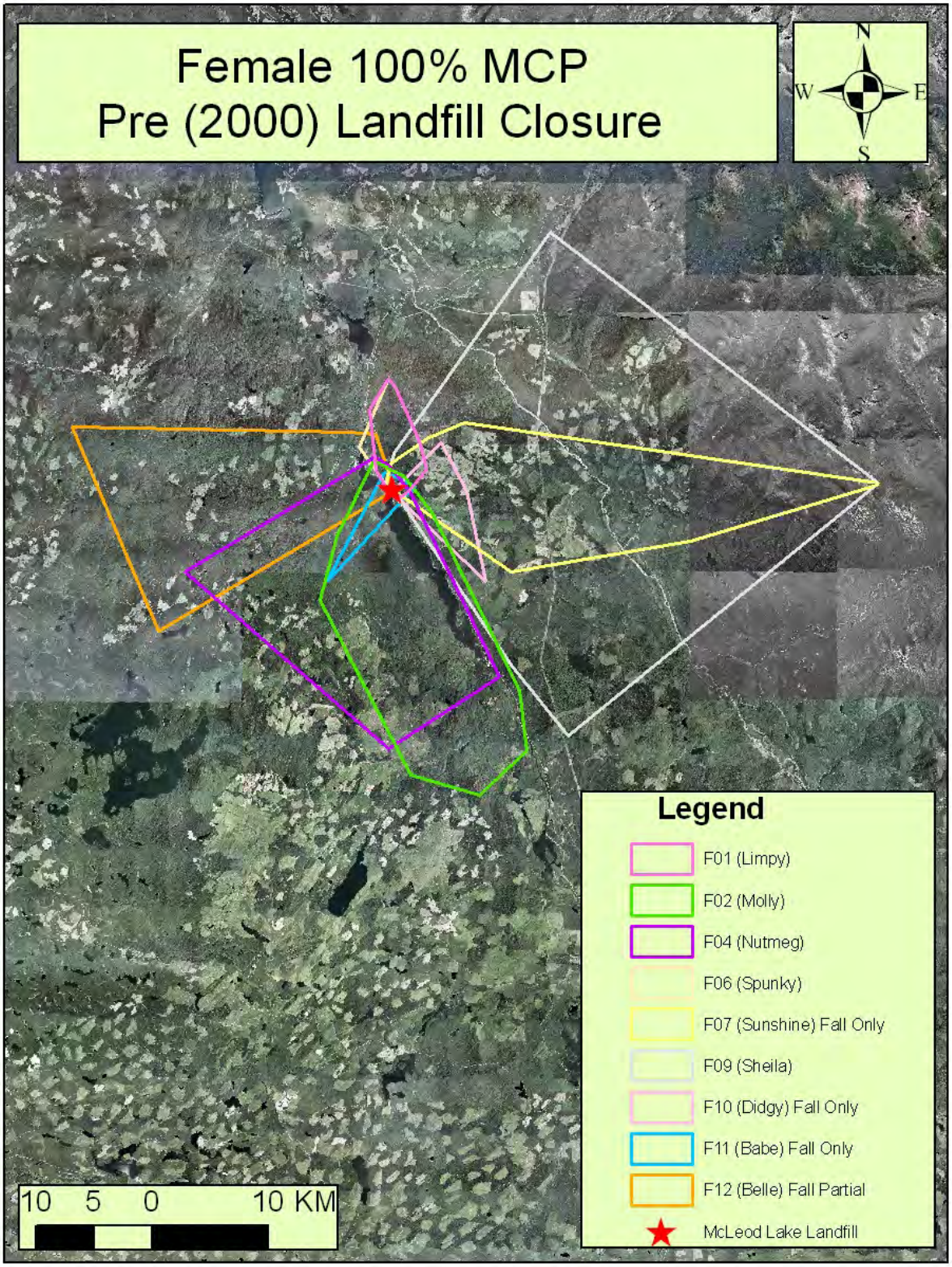


Figure I1. 100% MCP annual or seasonal home ranges for radio-tagged female grizzly bears in 2000, prior to closure of the McLeod Lake Landfill.

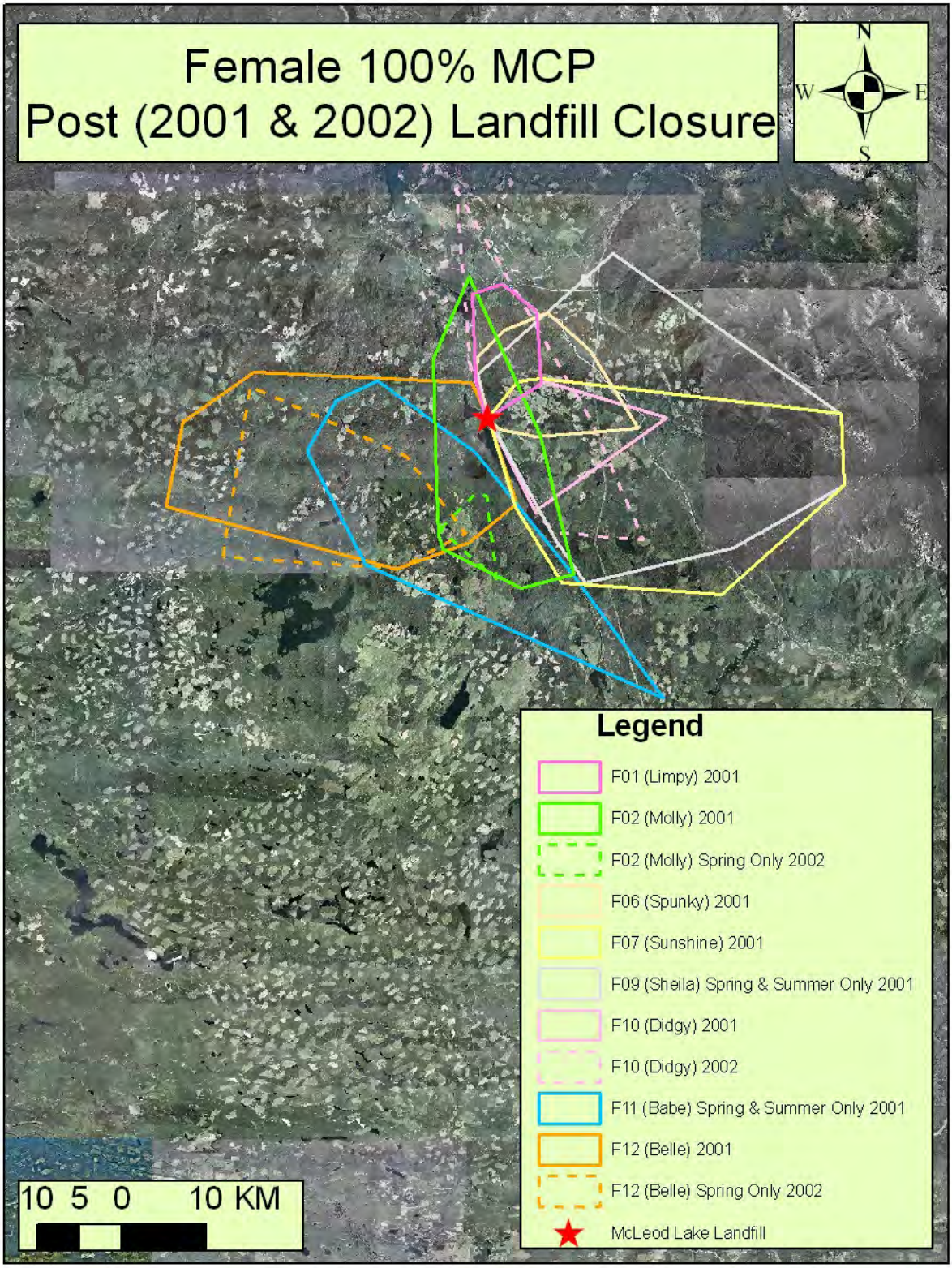


Figure I2. 100% MCP annual or seasonal home ranges for radio-tagged female grizzly bears post-landfill closure, 2001 & 2002.

Pre-landfill closure (2000), 17-year-old adult male M05 had a smaller home range size at 562 km$^2$ than dispersing subadult male M03 at 3,386 km$^2$ (Figure I3). Post-closure (2001), M03 was never located, M05 died in late spring, and only a partial home range was calculated for M08 (F09's now independent offspring) of 2,896 km$^2$ until fall at which point he dropped his collar; he also had many missing locations throughout spring and summer.

Pre-landfill closure, the mean annual 100% MCP home range size in 2000 for female grizzly bears ( $\bar{x}$ = 399 km$^2$ , SE = 189, $n$ = 4) was much smaller than for males ( $\bar{x}$ = 1,974 km$^2$, SE = 1,412 km$^2$, $n$ = 2), although the difference was not statistically significant ($P$ = 0.16) likely due to the small sample sizes.

We did not detect any significant differences between seasonal home range sizes pre (2000) and post (2001 & 2002) landfill closure for male and female bears combined (ANOVA $F$ (2, 41) = 0.17, $P$ [year] = 0.84, $F$ (2,41) = 0.91, $P$ [season] = 0.41; Table I1, I2). We omitted 2002 due to low sample sizes but were still unable to detect significant differences in seasonal home range size pre (2000) and post (2001) landfill closure, although home range sizes appeared to slightly increase in spring and fall (ANOVA $F_{1,38}$ = 0.18, $P$ [year] = 0.67, $F_{2,38}$ = 0.91, $P$ [season] = 0.41).

We then omitted male bears to test whether differences in home range sizes between seasons and years could be detected for our subset of females. M03 in 2000 and M08 in 2001 were dispersing subadult males and therefore had home range sizes and movements that were likely independent of the existence of the landfill.

*FALL HOME RANGE SIZES*

We examined fall home range sizes of bears pre- and post-closure because we expected that bears would have smaller home ranges closer to the landfill when the landfill was open than when it was closed. We also examined home ranges sizes for 2 shorter time periods within fall (1 October – den arrival, and 1 October – last landfill visit ["core" fall range]) because prior to landfill closure, bears tended to concentrate on and remain in the landfill area primarily in October, before moving off to den sites. These time periods were also examined for comparison to the landfill use data.

All bears in both years, except F02 in 2000 and F10 in 2001, exhibited larger home ranges for periods ending with den arrival, than the "core" period ending with the last landfill visit (Table I3). Mean home range sizes for all bears were approximately 3 times larger in fall, than in the subsets of fall starting in October (Table I4).

In 2000, the mean home range size for 6 female bears in fall (1 September – den arrival; $\bar{x}$ = 105 km$^2$, SE = 52, range 5 – 286 km$^2$) was not significantly different than in the "core" period (1 October – last landfill visit; $\bar{x}$ = 5.4 km$^2$, SE = 3.5, range 0.4 – 23 km$^2$; $P$ = 0.087). Although the lack of detection may be considered somewhat marginal, overall, all bears increased their home range size (Table I4). We believe that there was no significant difference in range size between these fall periods because we grouped all bears together due to low sample sizes. We removed bears with low or moderate degrees of landfill use (F02, F12) but still could not detect a significant difference in range size ($P$ = 0.28). However, after removing the 1 remaining adult female (F09), we determined that the 3 subadult female heavy landfill-users (F04, F06, F11) had significantly larger home range sizes during the fall ( $\bar{x}$ = 12.7

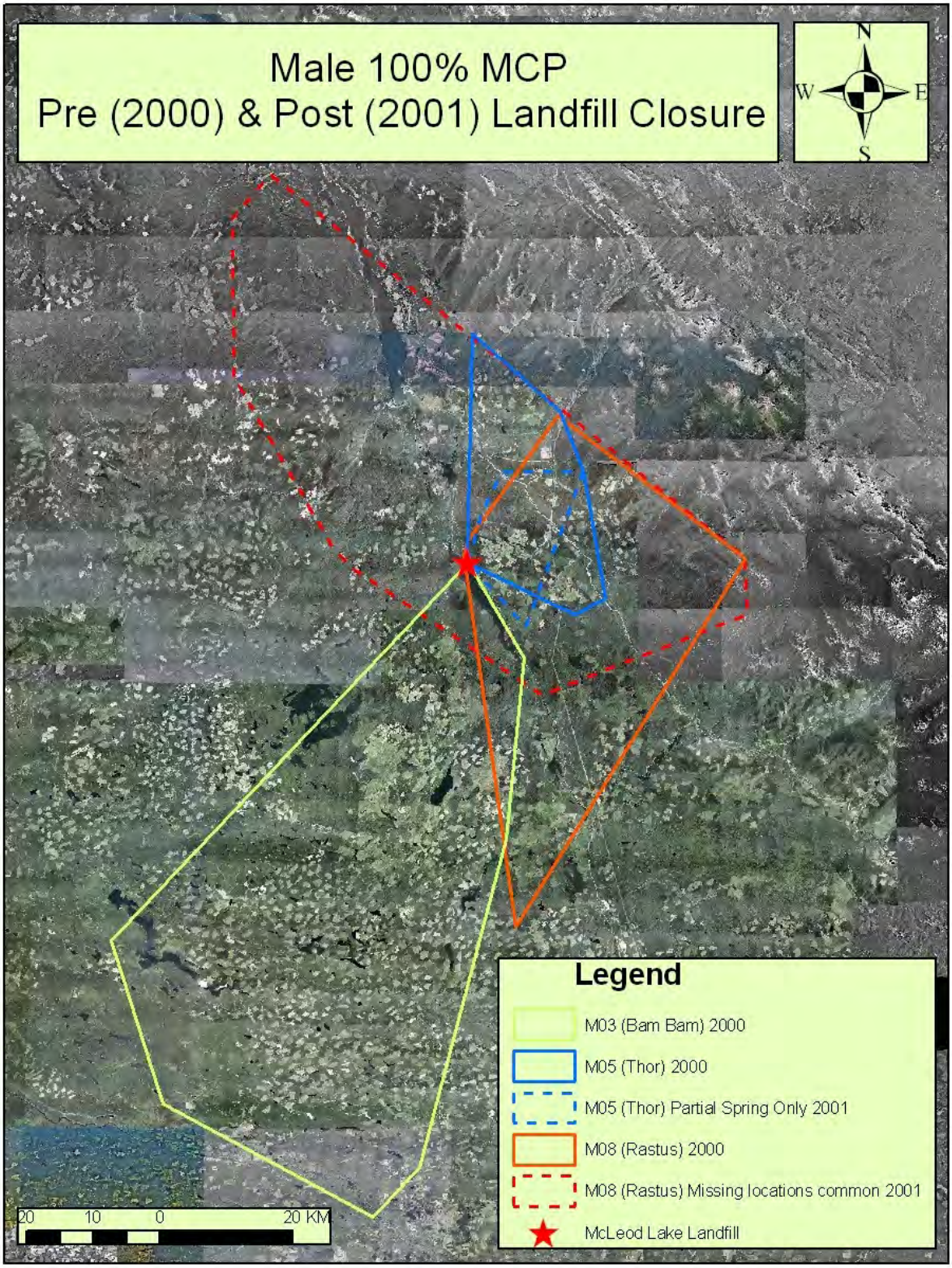


Figure I3. 100% MCP annual or seasonal home ranges for radio-tagged male grizzly bears pre (2000) and post (2001) closure of the McLeod Lake Landfill.

km$^2$, SE = 3.9, $n$ = 3, range 5 – 18 km$^2$) than they did during the "core" landfill use period ( $\bar{x}$ = 0.97 km$^2$, SE = 0.31, $n$ = 3, range 0.4 – 1.5 km$^2$; $P$ = 0.04).

Post-closure 2001, there was again no significant difference in mean home range size for 4 female bears between fall ( $\bar{x}$ = 151 km$^2$, SE = 56, range 26 - 262 km$^2$) and the "core" landfill use period ( $\bar{x}$ = 34 km$^2$, SE = 13, range 7 – 62 km$^2$; $P$ = 0.09), but similar to 2000, the lack of detection may be considered marginal and may be a result of grouping bears of differing ages and degrees of landfill use into 1 sample. Unlike 2000, only 1 heavy landfill-using subadult bear continued transmitting during both periods in 2001 (F06). We omitted this individual, leaving 3 low or moderate landfill-users (F02, F10, F12; note that this is opposite to 2000 where we omitted the low to moderate landfill-users), but the difference remained non-significant ($P$ = 0.16).

In pre-closure 2000, home range sizes for 6 female bears (all Landfill-use levels) were larger in the 1 October – den arrival period ( $\bar{x}$ = 76 km$^2$, SE = 46, range 5 – 286 km$^2$) than in the "core" landfill use period (1 October – last landfill visit; $\bar{x}$ = 5.4 km$^2$, SE = 3.5, range 0.4 – 23 km$^2$) though the difference was not significant ($P$ = 0.15). The difference was only marginally insignificant for the 3 heavy landfill-using subadult females ($P$ = 0.06). We attribute this to heavy landfill-using subadults generally denning within closer proximity to the landfill than adults or less dependent bears. Therefore, heavy landfill-using subadult bears tended to range in a smaller area throughout the entire October to den arrival period than bears that used the landfill less and/or older bears; we believe that the significant difference in range sizes during the September to den arrival period may in part be due to their movements to the Landfill Area in late summer through early fall (August/September). Further, when we added back in heavy landfill-user adult F09 the difference in home range sizes between periods was not significant ($P$ = 0.25).

During post-closure 2001, there was no significant difference in mean home range size for 4 bears (all landfill-use levels) between 1 October – den arrival, and the "core" landfill use period ($P$ = 0.11). The difference was still insignificant for the 3 low and moderate landfill-using bears (F02, F10, and F12; excluding F06; $P$ = 0.24).

On average, range sizes appeared to increase between pre- and post-closure years although the sample of bears decreased and very few heavy landfill-using subadult bears were transmitting by the post-closure fall of 2001. The mean range size for the "core" landfill use period significantly increased from pre (2000) to post (2001) landfill closure ($n$[pre] = 6; $n$[post] = 4; $P$ = 0.03); bears ranged over larger areas during the "core" period in 2001 after the landfill was closed, than they did in 2000 when the landfill was open although physiological differences could have in part accounted for the difference. Only 1 of the bears categorized as a heavy landfill-user (F06), had home ranges for the "core" period in both 2000 and 2001. heavy landfill-using subadult F07 did not visit the landfill in October 2001 (thus a "last date of landfill visit" for this period could not be determined). F07 was wearing a "9-5, Mon-Fri" transmitter, therefore night visits may have been missed due to her transmitter being off during night-time hours.

Table I3. Comparison of home range sizes (km2) of radio-tagged grizzly bears pre (2000) and post (2001) landfill closure for fall (1 September – den arrival) and 2 time periods within fall: 1 October – den arrival ("core" landfill use period), and 1 October – den arrival.

| Bear | Sep-den arrival | | Oct-den arrival | | Oct-last landfill visit | |
|---|---|---|---|---|---|---|
| ID no. | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 |
| *Adult female with 2 COY dependents 2000 (dependent yearlings 2001, 2-year-olds 2002)* | | | | | | |
| F12 | 286 | 262 | 286 | 177 | 23 | 62[a] |
| *Adult female with 2 radio-tagged 3-year-old dependents 2000 (all independent 2001)* | | | | | | |
| F09 | 250 | | 126 | | 2 | |
| M08 | 250 | | 127 | | 2 | |
| F07 | 295 | 258 | 145 | 151 | 2 | n/v |
| *Orphaned dependent yearling siblings 2000 (independent 2-year-olds 2001)* | | | | | | |
| F01 | 16 | | 6 | | 1 | n/d |
| F06 | 18 | 87 | 7[a] | 79 | 1 | 7 |
| *Adult female no dependents 2000 (3 dependent COY 2001, yearlings 2002)* | | | | | | |
| F02 | 55 | 230 | 20 | 143.5 | 5 | 50 |
| *Young adult female no dependents 2000 (2 dependent COYs 2001, yearlings 2002)* | | | | | | |
| F10 | 39 | 26 | 2 | 17.5 | n/d | 17.5 |
| *Subadult females no dependents 2000, 2001* | | | | | | |
| F04 | 5 | | 5 | | 0.4 | |
| F11 | 15 | | 15 | | 1.5 | |
| *Adult male* | | | | | | |
| M05 | 284 | | 120 | | n/v | |

[a] Only 3 locations obtained on bear during this period, including 1 landfill location
n/v = no visits to the landfill in October (M05 last visit17 Sep 2000; F07 last visit 28 Sep 2001)
n/d = indicates too few locations to calculate a home range (2 locations or less)

Table I4. Comparison of mean home range sizes ($km^2$) for all radio-tagged grizzly bears pre (2000) and post (2001) closure of the McLeod Lake Landfill for fall (1 September – den arrival), and 2 periods within fall: 1 October – den arrival ("core" landfill use period), and 1 October – den arrival. (Excludes dependents F01, F07, and M08 in 2000, and any bears with too few locations to calculate a home range. Results presented may vary from those used in the statistical comparisons because some bears did not have ranges in both years and were therefore omitted from certain analyses.)

| | 2000 home ranges | | | | 2001 home ranges | | | |
|---|---|---|---|---|---|---|---|---|
| Fall Period | $\bar{x}$ | SE | Range | *n* | $\bar{x}$ | SE | Range | *n* |
| Sep–den arrival | 119 | 45 | 5 - 286 | 8 | 173 | 49 | 23 - 262 | 5 |
| Oct–den arrival | 73 | 35.5 | 2 - 286 | 8 | 114 | 29 | 18 - 177 | 5 |
| Oct–last landfill visit | 5 | 3.5 | 0.4 - 23 | 6 | 34 | 13 | 7 - 62 | 4 |

There was no significant difference in mean range sizes pre (2000; $n = 8$) and post (2001; $n = 5$) landfill closure in fall ($P = 0.46$) or in the 1 October – den arrival period ($P = 0.14$) (Table I4). For October to den arrival, we removed the 3 bears that were only monitored during pre-closure 2000 (F04, M05 & F11) and compared home range sizes between the remaining 5 bears (note: we used F09's pre-closure home range size as a comparison for her offspring F07's post-closure home range size since F07 was considered dependent in 2000) and again the difference in range sizes from October to den arrival was not significant ($P = 0.35$). We believe that closure of the landfill did not affect the location of den sites; bears denned within similar areas both years therefore the overall range size remained similar.

With the exception of F10, all bears left the landfill for den sites earlier in fall 2001 than when the landfill was open in fall 2000, although it is possible that night visits by some bears wearing only "9-5, Mon-Fri" transmitters in 2001 were missed (see Appendix L). Although F10 left the landfill earlier in 2000 (16 October) than in 2001 (29 October), she also arrived at her den site much earlier (18 October 2000 vs. 8 November 2001); the earlier denning time in 2000 likely reflects her reproductive status as a pregnant female, due to give birth to her first set of cubs in the den that winter. The 2 heavy landfill-using subadult bears that continued transmitting into the fall 2001 (F06 and F07) both had last landfill visits that ended approximately 1 month earlier than when the landfill was open in 2000, though F07 was fitted with only a "9-5, Mon-Fri" transmitter.

## DISCUSSION

We examined the data to see if we could detect increases in bear home range size as well as spatial shifts in seasonal ranges pre-versus-post landfill closure. Although females increased their home range size post-closure the increase was not significant. We also could not detect changes in home range size when examining male bears or subadults. We hypothesized that bears would increase their home range size post-closure in search of alternate forage items. The lack of a detectable difference in home range size pre-versus-post closure may be due to our sample of animals which was small and contained mixed levels of social and reproductive status as well as degree of use of the landfill; however, it is also possible that range sizes post-closure were already sufficient to incorporate failure of a food source, such as landfill closure, and/or that only the fall range of bears would be affected since use of the landfill peaked in fall, and/or our use of 100% MCP was too broad a measure to detect subtle differences at the individual level. We believe that for some bears we were able to detect subtle changes at the individual level. For example, F09 increased her spring range pre- to post-closure as well as her average distance to the landfill but she did not spatially shift her home range. F09 also became independent from her 3-4 year old offspring at this time and therefore the exact mechanism (landfill closure vs. independence from offspring vs. food supply variability, etc.) remains unclear although it is likely that the closure of the landfill contributed in part to her increased spring range post-closure. In 2001, after the landfill had been closed, F01 increased her annual home range size 3-fold; however, social factors other than closure of the landfill, such as increased independence from her sibling, F06, her older status, and potentially healing of her broken leg may have contributed to this increase. F06's annual home range size increased almost 6-fold, but again increased independence from her sibling (F01) and her older status in combination with closure of the landfill may have contributed to this increase. The only bear in which the increase in home range size was considered likely due to landfill closure was F02. F02 was a lone bear pre-closure (2000)

and accompanied by 3 cubs of the year post-closure (2001) and despite her reproductive status her annual home range size increased (288 vs. 367 $km^2$). Females with cubs of the year typically have smaller home ranges than lone females and females with older dependent offspring (Lindzey and Meslow 1977; Dahle and Swenson 2003) and it is possible that the increase in range size was due to a need to use a larger area to obtain the necessary food. This is supported by a decrease in her post-closure 2001 (with cubs of the year) spring and summer range sizes and a large increase in her fall range size (55 vs 230 $km^2$) when landfill use was highest and bears enter hyperphagia. F02's visits to the landfill also decreased during the fall of 2001 compared with pre-closure when she was consistently located at the landfill. In fall 2001, she visited the landfill 8 times in September; however, her mean distance from the landfill increased by approximately 2 km. Although the open pit landfill was closed F02's repeated visits in fall possibly suggest that bait associated with our trapping influenced visitations although it is also possible she remained to repeatedly check the area for available non-natural attractants. F02 was relocated from the landfill site 7 years after its closure indicating that she did indeed return to check on the availability of this potential food source, particularly since her core non-landfill home range was on the west side of McLeod Lake and therefore to access the landfill she likely swam the tapered northern tip of the Lake. F10 also had cubs of the year in 2001 however she was not captured until fall 2000 and unlike F02 her fall range size slightly decreased between pre- to post-closure in 2001; however, F10 was monitored both years post-closure and she increased her annual range size 2-fold from the first year after landfill closure (2001) as compared with the second year (2002). This increase may reflect a need for increased food resources but could also reflect a maturing of the cubs.

We further examined whether bears had smaller "core/foraging" ranges during the time they used the landfill ("early" fall) versus the time away from the landfill to denning ("late" fall because the fall season had the highest use of the landfill by bears and also was used to assign a degree of use of the landfill by bear. For pre-closure 2000 when comparing subsets within the same year (e.g., traditional fall period (1 Sep – den arrival) with the "core" (1 Oct – last landfill visit for each bear)) we typically found that grouping bears of different ages and landfill-use levels resulted in a poor estimator of the population mean and as such we were unable to detect a significant difference in range sizes until we reduced our sample of animals to include only heavy landfill-using subadults. For both within-year seasonal range comparisons when we added back in the heavy landfill-using adult female (F09) we could not detect a difference which may suggest that age may be a better predictor than degree of use of the landfill. Post-closure, we did not have a sufficient sample of radio-tagged transmitting subadults and therefore we used bears with moderate and low levels of landfill-use; we could not detect differences in range sizes between these periods and sample of bears which may suggest low to moderate bears are better at naturally foraging while away from the landfill thereby generally increasing their distance from the landfill.

Differences in fall range sizes were detected between the pre (2000) and post (2001) closure years when comparing the "core" fall period (1 Oct – last landfill visit) for all available animals. Bears ranged in a larger area during the "core" fall period (1 Oct – last landfill visit) in 2001 when the landfill was closed, than they did in 2000 when the landfill was open. Interestingly, bears did not range over a larger area when comparing the entire fall period (1 Sep – den arrival) supporting our results that home range size did not necessarily change, but shifts in seasonal ranges may have occurred.

## Appendix J. Complete summaries of the home range, movements, and landfill use of each radio-tagged bear at the McLeod Lake landfill, 2000 – 2002.

Bears are listed in the same order as all tables within the report, based on their status in 2000: adult females with dependent offspring (F12, F09 followed by cubs M08 & F07), orphaned yearlings (F01, F06), lone adult females (F02, F10), subadult females (F04, F11), subadult males (M03), adult males (M05). Degree of landfill use in 2000 (Light, Moderate, High) is noted after each bear number. See Appendix I for references to home range sizes, and Appendix K for references to distances from landfill.

**F12 - Light**

*Young adult female: 2000 (2 COY's including M13), 2001 (2 yearlings)* *Figure J1*

After her initial capture at 5-years-old in late September 2000, F12 visited the landfill 5 more times, for periods of 1 to 5 days. One of her COY (M13) was captured in the landfill 3 days after her initial capture, but marked only with a non-transmitting ear-tag. When not at the landfill, she moved to locations within 10 km north and west of the landfill averaging 7 km from the landfill in fall. Her furthest non-denning location from the landfill occurred on 9 November when she travelled 24 km south-west. She then moved north-west through Carp Lake Provincial Park to den near Reed Creek, 28 km north-west of the landfill. Aerial-telemetry indicated that she crossed Highway 97 at least 5 times before leaving the Landfill Area in early November. Although she likely swam across McLeod Lake to reach her 9 November location, she appeared to primarily travel to the landfill around the north end of the Lake.

F12 generally ranged west of McLeod Lake and the landfill. F12 and her 2 yearlings did not emerge from their den site until mid-to-late May 2001. The family unit did not visit the landfill in the spring and summer 2001 post-closure, and visited only on 10 and 11 October that fall. During spring 2001, she frequented areas 2 – 10 km east of Carp Lake and ~20 km west of the landfill. Towards the end of spring 2001 she travelled to the Turner Lake area, north-west of Carp Lake. She remained north of Carp Lake until the end of July when she travelled to west Agnes Point 13 – 15 km from the landfill. In mid-August, she travelled to the McDougall River headwaters 36 km from the landfill and remained there through early October; she was then recorded at the landfill on 10 October. She remained at the landfill on the 11$^{th}$ then travelled back to the McDougall River headwaters 29 km from the landfill by 19 October. She returned to within 9 km of the landfill on 2 November but then moved west away from the landfill to den west of Reed Creek and Lignite Lake, 28 km from the landfill.

In spring 2002, F12 returned to the south branch of the McDougall River exhibiting a very similar spatial range area as spring 2001. She was located on average 23 km from the landfill during spring 2001 and 19 km in spring 2002. From the end of May to mid-June she again frequented the Hammett Creek area, and from mid-June through July she remained west of the landfill (average 19 km) and east of Carp Lake. Similar to 2001, F12 did not visit the landfill in spring or early summer of 2002 and subsequently dropped her radio-collar on 12 July, 7 km east of Carp Lake. DNA from F12's marked offspring M13 was located in the Nations Grid in early July 2003, 74 km north-west of the landfill. He would have been 3 years of age and likely recently separated from his mother.

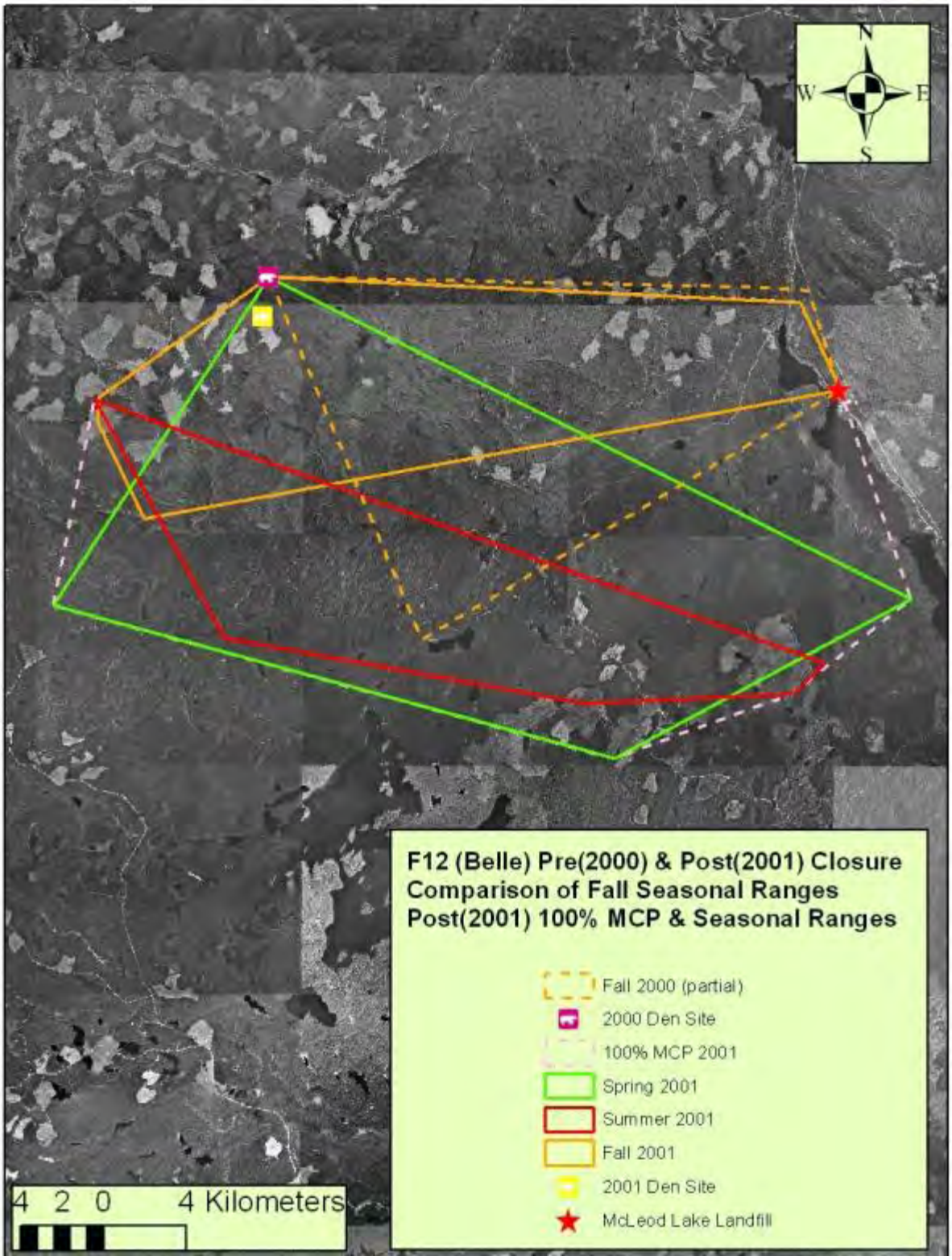


Figure J1. Comparison of pre (2000) fall & post (2001)100% MCP with seasonal ranges for female grizzly bear F12 and her 2 COY's. F12 did not visit the landfill site in spring or summer 2001.

Pre- and post-closure home range data was only available for the fall season for F12. She averaged 7 km from the landfill in fall 2000, and 24 km from the landfill in fall 2001. Her fall ranges overlapped but she travelled further south pre-closure and further west post-closure. However, her fall home range size remained similar between years however (286 $km^2$ in 2000; 262 $km^2$ in 2001).

**F09 – Heavy**

*Adult female: 2000 (two 3-year-old dependents F07 & M08), 2001 (no dependents)* *Figure J2*

Pre-landfill closure, the annual home range for this family unit included the area between McLeod Lake west to the Parsnip River, and from Firth Lake in the south to the Misinchinka River in the north. F09 and her male offspring M08 (both initially captured in the Firth Lake area in late May by the PGBP, and subsequently captured in the landfill in late August along with her second offspring F07) used the area between Hodda Lake, Isadore Creek, and the Parsnip River throughout the spring averaging 16 km from the landfill. F09's 2 offspring spent the majority of 2000 in the company of their mother, although M08 was located greater than 500 m from F09 on a few occasions.

The range of this family unit increased in 2000 as summer progressed, expanding north of Kennedy Siding to the Misinchinka River and south-west to the southern end of McLeod Lake. The family unit began to concentrate their movements around the landfill in mid-August with their first landfill visit on 13 August 2000. They visited the landfill for 1 – 2 days at a time in late August, and throughout fall 2000 the core area for the family unit focused on the landfill and areas within 6 km north of the landfill. The family unit's average distance to the landfill in fall dramatically decreased to 4 km, compared to 16 km in spring and 11 km in summer. The family unit increased their number of landfill visits through September to daily use of the landfill between late September and early November after which they moved to den in the mountains 42 km east of the landfill. They crossed the Parsnip River a minimum of 3 times.

In spring 2001, the family unit moved west from their den site in the mountains using the Anzac River drainage back to the sub-boreal spruce plateau. F09 and M08 visited the landfill on 7 May; it is likely that F07 accompanied them but she was wearing a "9-5, Mon-Fri" transmitter. The family unit appeared to stay in close proximity to each other in spring until their last shared location on 14 May 2001. By mid-May, F09 had travelled west to Hodda Creek remaining in the Isadore Creek – Hodda Lake area until being recaptured by the PGBP on 25 May 2001 to replace her conventional VHF collar with a GPS collar for their study purposes. At the time of F09's recapture she was accompanied by a large male (identified as GM51 from the PGBP) and was assumed to be breeding. She then moved northwards and was located on a branch of Misinchinka River 24 km from the landfill on 19 June. Towards the end of June she returned to the south end of Firth Lake approximately 7 km east of the Crooked River. In early summer she travelled north-west back to her core home range in the Reynolds Creek, Hodda Creek, and Firth Lake areas. She did not visit the closed landfill in July, and by 30 July her GPS collar began to malfunction. She was last located 3 km west of Mt. Chingee on 28 August 2001.

F09's average distances from the landfill increased only slightly pre- to post-closure in spring (16 to 20 $km^2$) and summer (11 to 14 $km^2$). However, her spring pre-closure range (120 $km^2$) was much smaller than in spring post-closure (1,032 $km^2$). Comparison of F09's pre- and post-closure annual home ranges show little spatial shift.

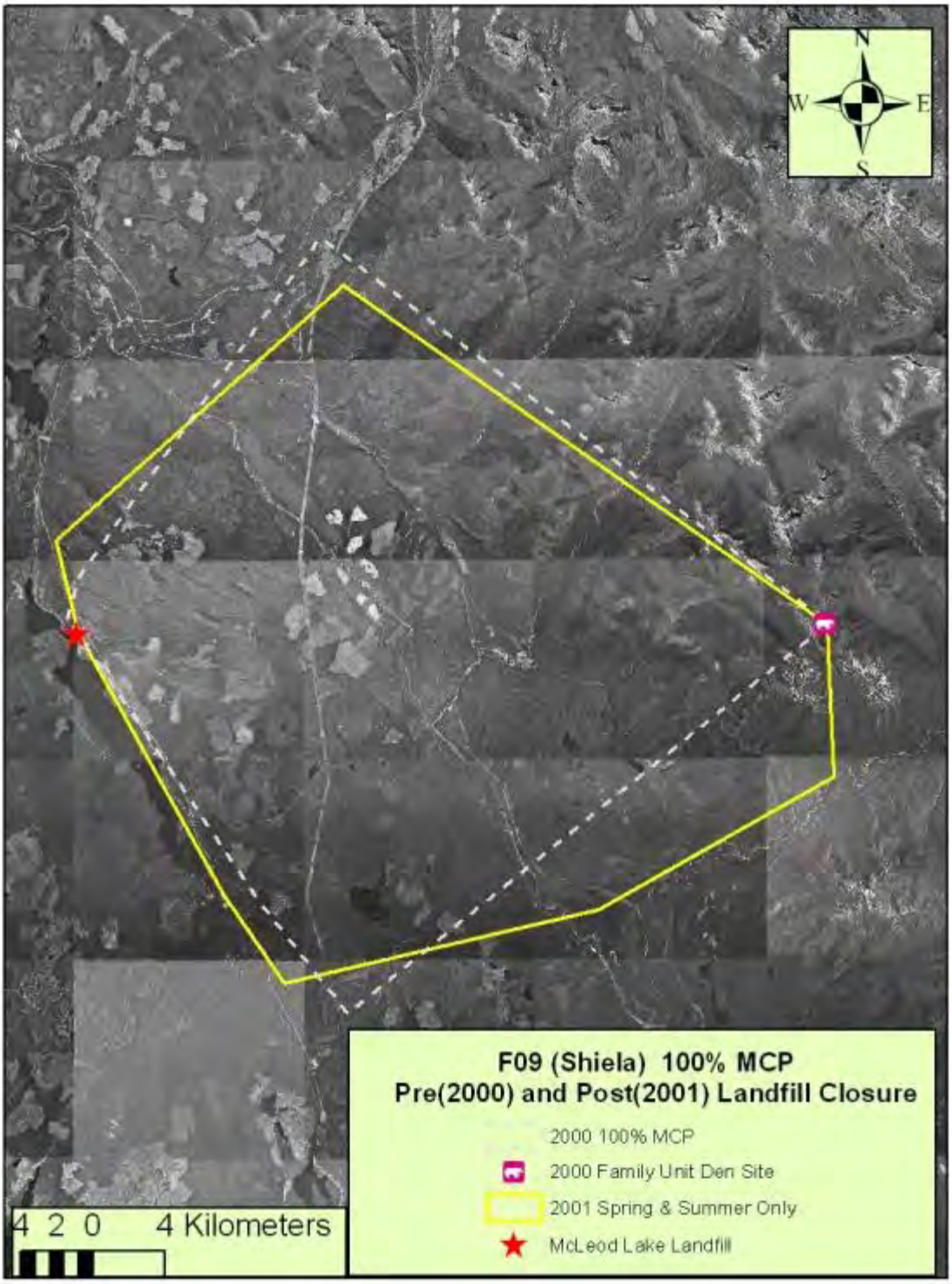


Figure J2. Comparison of 100% MCP annual home range size pre- and post-closure of the McLeod Lake landfill for female grizzly bear F09. Post closure 2001 home range is for spring and summer only due to GPS collar failure. Although a spatial shift in home range was not noted pre-to-post closure her average distance to the landfill increased in both seasons.

**M08 – Heavy**

*Subadult male: 2000 ( dependent offspring of F09, sibling F07), 2001 (independent)* *Figure J3*

Pre-landfill closure, 3-year old M08 and his female sibling F07 were primarily dependent on their mother (see summary for F09). In spring, M08 was located in the company of his mother or sister on 7 of 8 aerial-locations, but separated from them between 15 July and 8 August, crossing Highway 97 at least twice to the area west of Bear Lake. He was not located at all during some aerial-telemetry flights, suggesting he may have travelled further west outside the main study area. M08 rejoined the family unit for the remainder of 2000 except on 1 location.

Post-landfill closure, M08 began to separate from his mother and sibling, with 53% of his locations in the company of F09 or F07 in spring (i.e., within 500 m), and none by summer. M08's only visit to the landfill in 2001 was with F09 on 7 May. In spring 2001, he averaged 30 km from the landfill, moving further away from the landfill as he ranged widely in summer (41 km). In May, he crossed the Parsnip River and ranged west around the Houston and Firth Lake areas. He continued south-west to the Crooked River area then north to Didche Creek in early June. Between 6 – 12 June he ranged the furthest north to the Nation Arm of Williston Reservoir. M08 spent June and July north of the landfill in the Tsedeka Creek, Phillip Creek, and Tseditla Lake areas (43 – 58 km from the landfill) then moved southwards to the lower Reed Creek area, 21 km west of the landfill by 16 August. He remained in this general area throughout August until he dropped his collar around Boot Jack Lake on 3 September. M08 was confirmed alive in mid-June 2003, when his DNA was identified in the Nations DNA Grid 53 km north of the landfill. Overall, M08's average distance to the landfill almost doubled in spring pre- to post-closure.

**F07 – Heavy**

*Subadult female: 2000( dependent offspring of F09, sibling M08), 2001( independent)* *Figure J4*

Pre-landfill closure 2000, 3-year-old F07 and her male sibling M08 were primarily dependent on their mother (see F09 summary). F07 was not captured and radio-tagged until early September 2000, but she was observed with F09 and M08 on 5 aerial-telemetry flights occasions throughout spring and summer.

In spring 2001, F07 began to separate from her mother and sibling with only 29% of her locations in the company of her mother that spring, and none in summer. F07 was not recorded to visit the landfill in spring or summer 2001, however, she was wearing only a "9-5, Mon-Fri" transmitter. F09 and M08 did visit the landfill one night on 7 May and it is possible F07 accompanied them. In May she ranged west around Firth Lake, eventually moving to the gas pipeline at the south end of McLeod Lake. She returned to the Firth Lake area where she remained through late May to mid-June. In early summer she ranged from the Goose Lake area (West of Anzac camp) to Firth Creek travelling just south of the Mt. Chingee area. In fall she moved south-west of Mt. Chingee ending 6.3 km south-east of the landfill on 25 September, and made her first and only known visit to the landfill on 28 September. She then moved north-east of Firth Lake and was recorded on the gas pipeline on 8 October. She moved to her denning area near Hodda Creek on 14 November and denned by the 19$^{th}$. Her ear-tag transmitter did not turn on in the spring of 2002 and efforts to recapture her near her densite were unsuccessful. F07's average distance to the landfill increased substantially between pre-landfill closure (with the family unit) and post-landfill closure, when she was on her own.

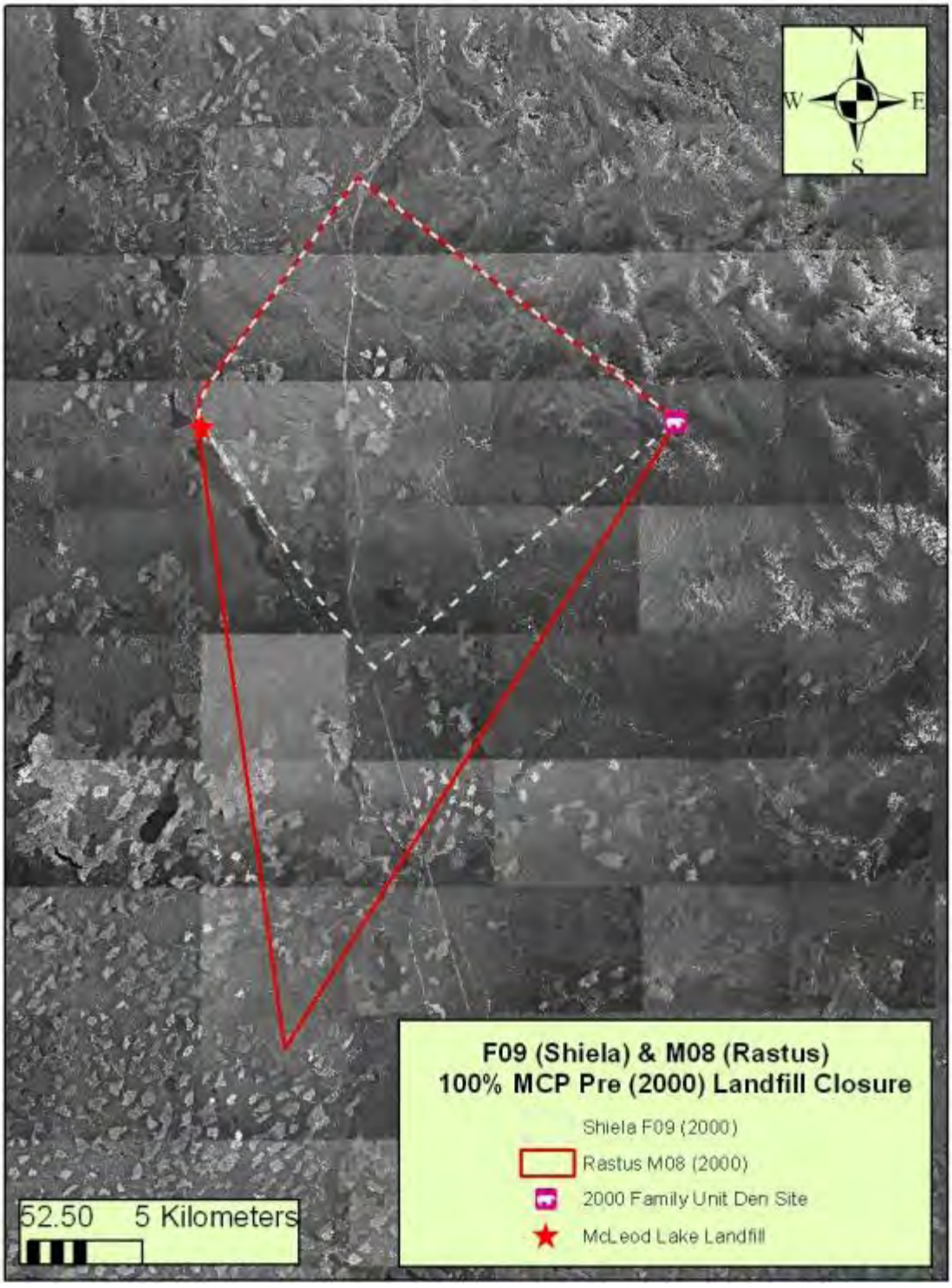


Figure J3. Comparison of pre-landfill closure 100% MCP home range for adult mother F09 and her mostly dependent 3 year old male offspring, M08. In summer 2000, M08 separated from F09 and sibling F07 travelling south across the plateau until his return to the family unit around 8 August 2000.

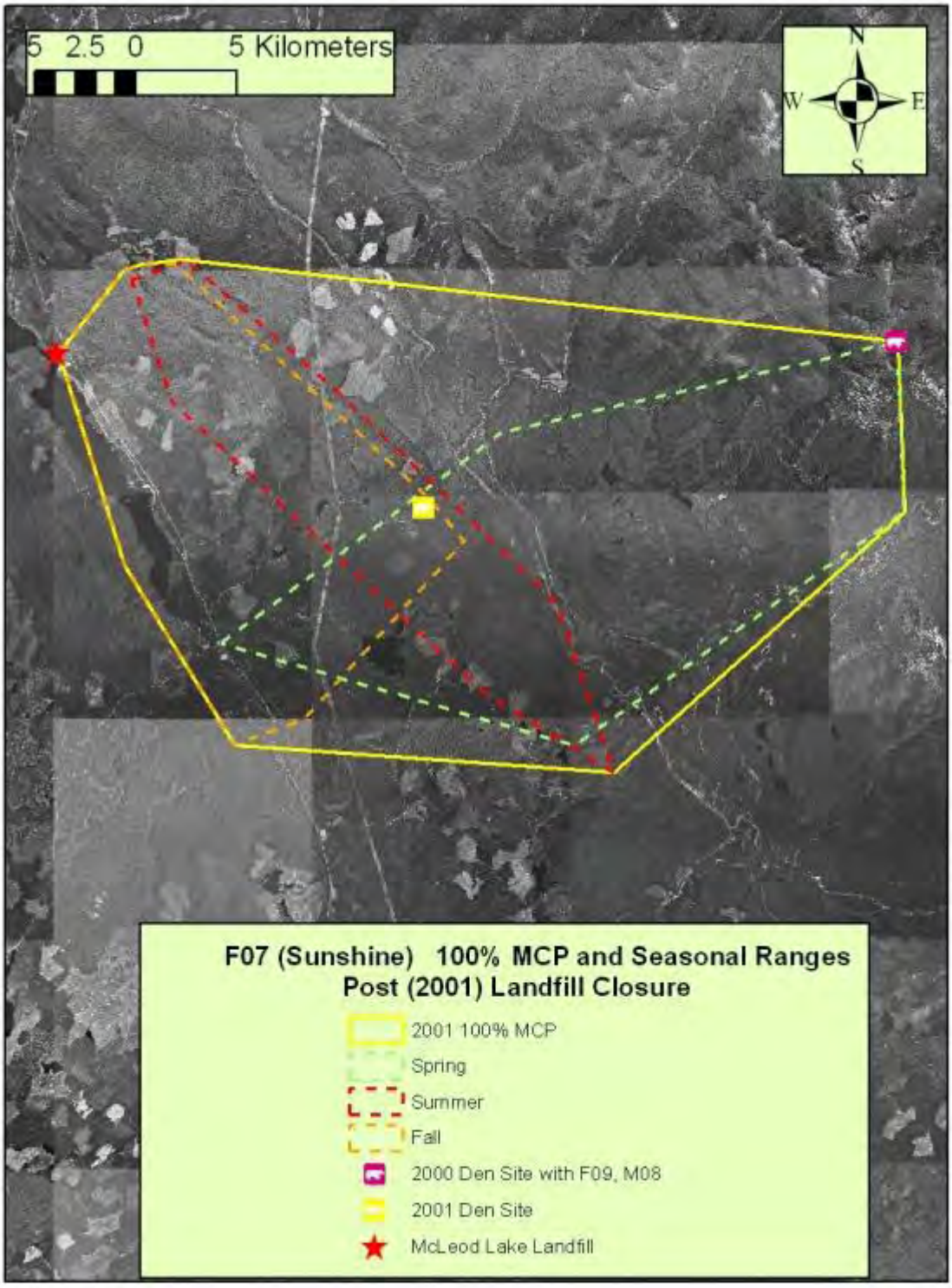


Figure J4. 100% MCP annual and seasonal post-landfill closure home range sizes for female grizzly bear F07. Pre-landfill closure, F07 was the dependent offspring of F09 but was not radio-tagged until 30 August (see Figures J2 and J3 for pre-closure family unit home ranges).

**F01 – Heavy**

*Orphaned yearling female: 2000 - dependent sibling F06; 2001 – independent* *Figure J5*

F01 was orphaned as a COY in fall 1999 together with sibling F06. Their mother, along with a 3rd COY, were shot and killed along the natural gas pipeline north of the community of McLeod Lake. The two orphaned COY's denned together their first winter, and were first observed in the landfill on 9 April 2000. F01 remained in close proximity to the landfill throughout most of 2000 (mean distance from landfill 2 km) as did her sibling F06. In spring 2000, F01 and F06 frequented areas to the north and north-east of the landfill, visiting the landfill periodically for 1 – 4 days at a time. They were the only bears sighted by residents in the community of McLeod Lake that spring. During summer 2000, they remained within 10 km and visited the landfill periodically. Throughout all seasons they averaged less than 3 km from the landfill. F01 and F06 increased their frequency of visits to the landfill area in late August, visiting almost daily from mid-September until mid-November (last landfill detection was on 15 November 2000) after which they left the area to den together 9 km north of the landfill.

In 2001, F01 increased her annual home range size 3-fold from 30 $km^2$ (2000) to 92 $km^2$ (up until her death in mid-October 2001) however, additional factors other than closure of the landfill likely contributed to this increase such as increased independence from her sibling and increased maturity. Although F01 visited the closed landfill during all seasons in 2001, she more than doubled her mean distance from the landfill. Shifts in range size and area were most apparent during spring and summer when she travelled further north and east than what she did in 2000. In fall 2001 F01 frequented the closed landfill, eventually climbing inside one of the "bear-resistant" dumpsters that had its lid left open by public user; F01 was destroyed by the COS as 'problem wildlife' while trapped inside the dumpster.

**F06 – Heavy**

*Orphaned yearling female: 2000 - dependent sibling F0; 2001 – independent* *Figure J6*

Similar to her sibling (see summary account for F01), F06 also remained in close proximity to the landfill throughout most of 2000 (mean distance to landfill 3 km).

After the landfill was closed, F06 increased her annual range 6-fold (from 32 $km^2$ in 2000 to 182 $km^2$ in 2001), in comparison to the only 3-fold increase exhibited by her sibling F01. Additional factors other than closure of the landfill likely contributed to this increase, such as increased independence from her sibling and increased maturity. Although F06 returned to the closed landfill site during all seasons she more than doubled her mean distance to the landfill during spring, summer, and fall 2001. Shifts in range size and area were apparent for all 3 seasons when she travelled further north, east, and south than before landfill closure. F06 continued to visit the landfill during all seasons, however, she appeared to become less dependent upon it as a food source and began increasing her movements and using natural habitats for foraging. F06 was found dead in a clearcut on approximately 20 May 2002 where she appeared to have been naturally foraging. She appeared to have been shot, and had likely been mistaken for a black bear during the spring hunting season.

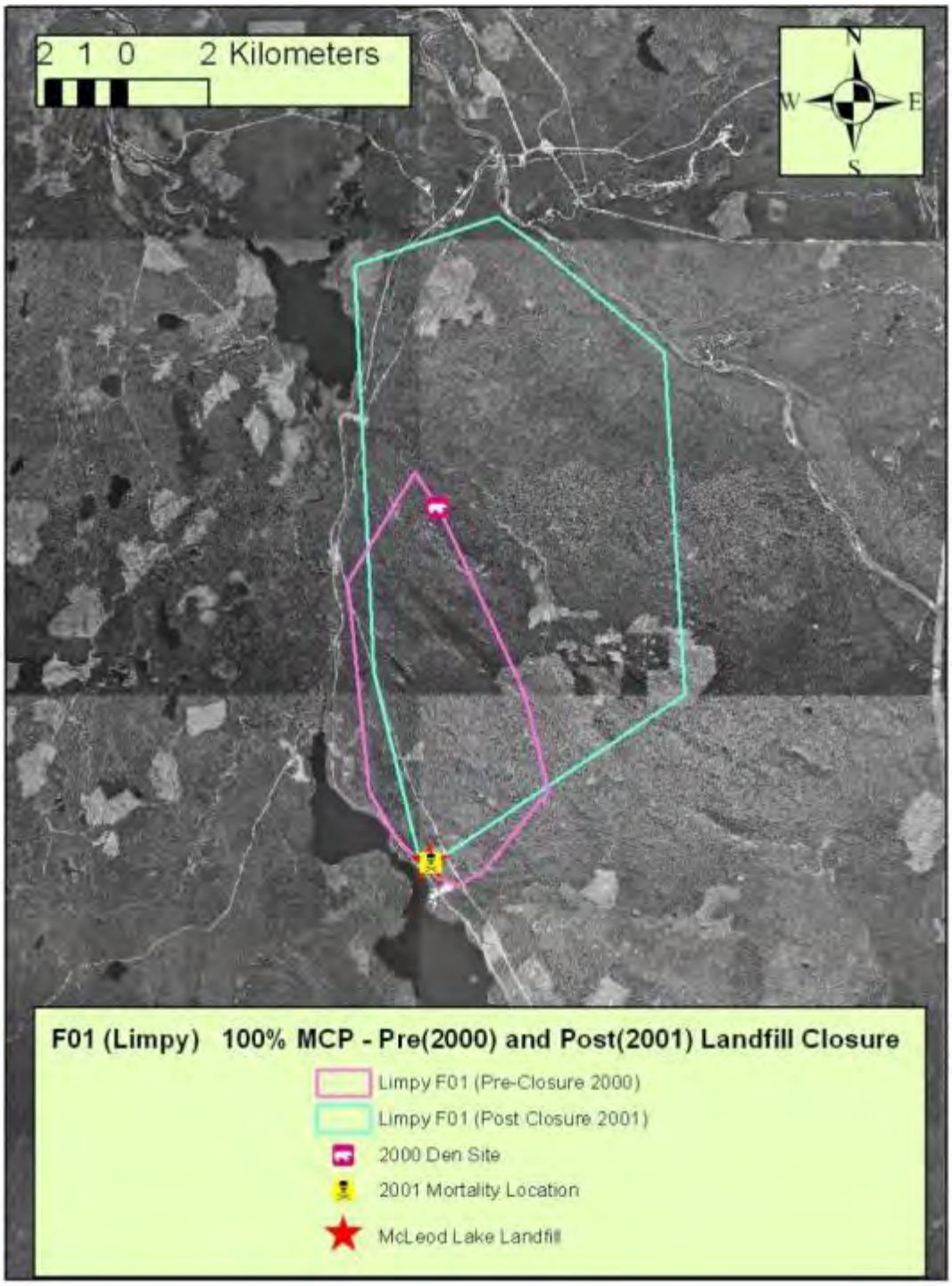


Figure J5. Comparison of 100% MCP annual home range size pre- and post-closure of the McLeod Lake landfill for subadult orphaned female F01. F01's home range size increased after landfill closure, although factors in combination with closure of the landfill may also have contributed to the increase.

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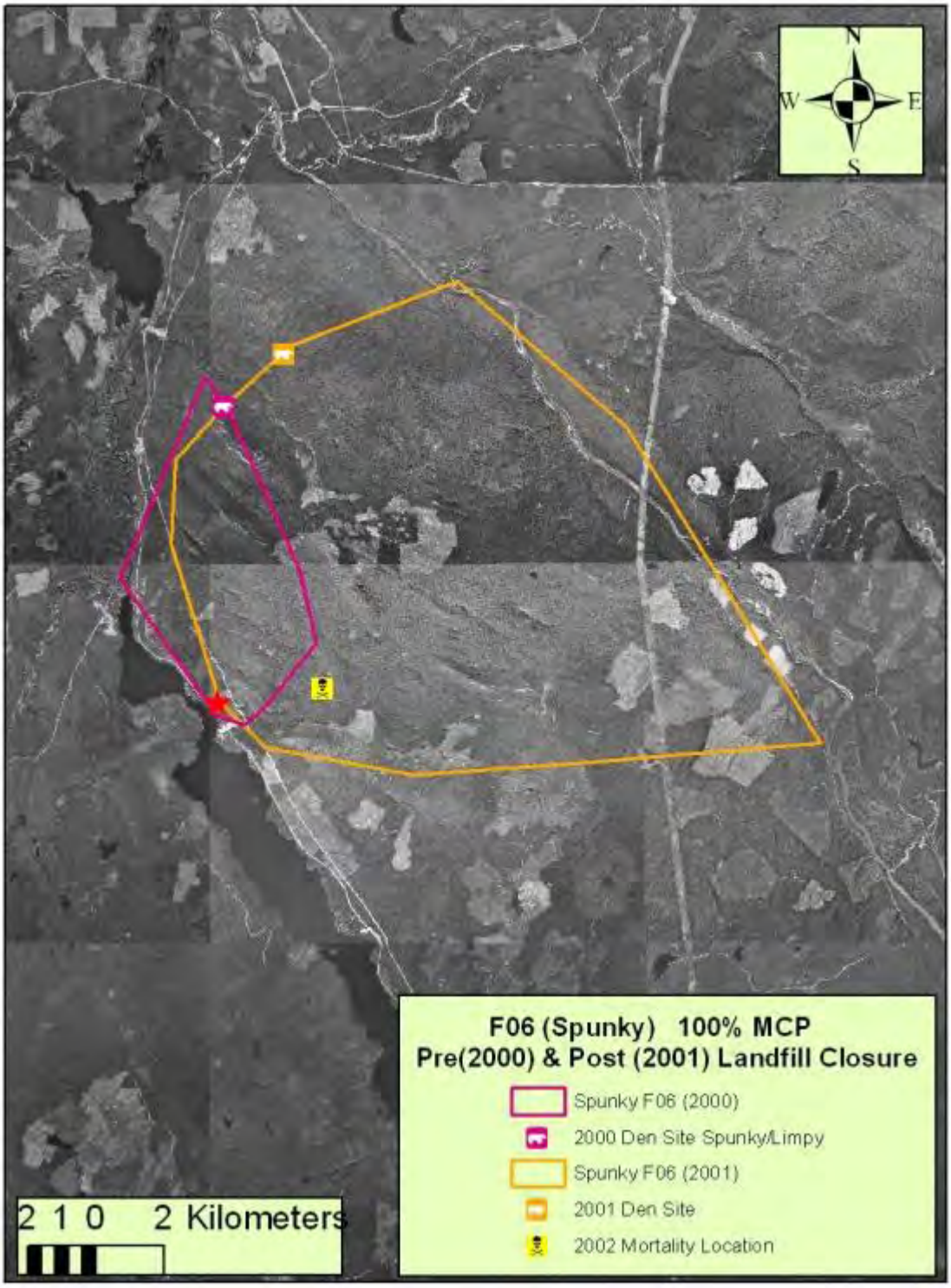


Figure J6. Comparison of 100% MCP annual home range size pre- and post-closure of the McLeod Lake landfill for subadult orphaned female F06). F06's home range size increased after landfill closure, although factors in combination with closure of the landfill also may have contributed to the increase.

**F02 – Heavy**

*Adult female: 2000 - 3 independent young (M03, F04, F11); 2001 - 3 COY's* *Figure J7*

After her initial capture at the landfill in spring 2000, F02 moved from the landfill and ranged south-west of McLeod Lake, in the Weedon Creek – Crooked River area. She spent the first few weeks of summer along Hammett Creek, roughly 5 km west of McLeod Lake, before returning to Weedon Creek – Crooked River. She did not visit the landfill again until late summer (24 August), returning to the Weedon Creek area for short (single day) periods at least 3 times before the end of September. F02's landfill use dramatically increased in the fall with almost nightly visitations from 24 August onwards. She returned to the Hammett Creek area to den in early November. She crossed the Crooked River and Highway 97 a minimum of 7 times in 2000.

F02's annual home range size increased from pre (2000) to post (2001) landfill closure (288 vs. 367 km2) even though she was alone in 2000 and accompanied by 3 COYs in 2001. Although she ranged further south pre-landfill closure, her range increased to the north post- landfill closure. Her overall mean distance to the landfill was similar between pre-and-post closure years (10 km and 11 km respectively).

F02 did not visit the landfill in spring 2001 which may have been due to the presence of her 3 COYs, yet she came as close as 1 km away (on the west side of McLeod Lake). F02 first visited the closed landfill site in 2001 on 31 August. Although F02's visitations to the landfill decreased from pre-to-post closure, her mean distance to the landfill was closer in spring and summer post-closure than pre-closure. The most pronounced seasonal shift occurred during the fall of 2001 when she ranged 14 km further north than in fall 2000. F02's visits to the landfill also decreased during the fall of 2001 compared to 2000 when she was consistently located at the landfill. In fall 2001, she visited the landfill 8 times in September and her mean distance from the landfill increased by approximately 2 km. Although the landfill was closed, some natural (beaver, moose) food rewards were available due to trapping efforts. We located F02 on a number of occasions in the riparian area on the west bank of McLeod Lake during all 3 seasons. It appeared that F02 would swim from this area across the narrow portion of McLeod Lake, cross Highway 97 and access the landfill. F02 was not detected in the landfill area during the early spring of 2002, and by the end of May 2002 she had dropped her radio-collar. In the fall of 2007, F02, along with one of her 2 COYs, climbed into one of the McLeod landfill transfer stations (that had its lid left open by a public user). Since this was the only known time that F02 had accessed human foods since the landfill closed, a decision was made to remove her from the transfer station and release her in the approximate area of her previous den sites, rather than destroying her.

**F10 – Heavy**

*Young adult female: 2000 (lone), 2001 (2 COY's F14, M15)* *Figure J8*

F10 was first captured at the landfill in early September 2000 at the age of 4. She frequented the landfill from mid-September through mid-October, and when not at the landfill, was located with 8 km east or south-east. In late October, she moved 6 km east of the landfill to den.

The first year after landfill closure F10 was accompanied by 2 COY. She visited the landfill once in spring 2001 (13 Jun) but remained close to the landfill averaging only 7 km away east of McLeod Lake.

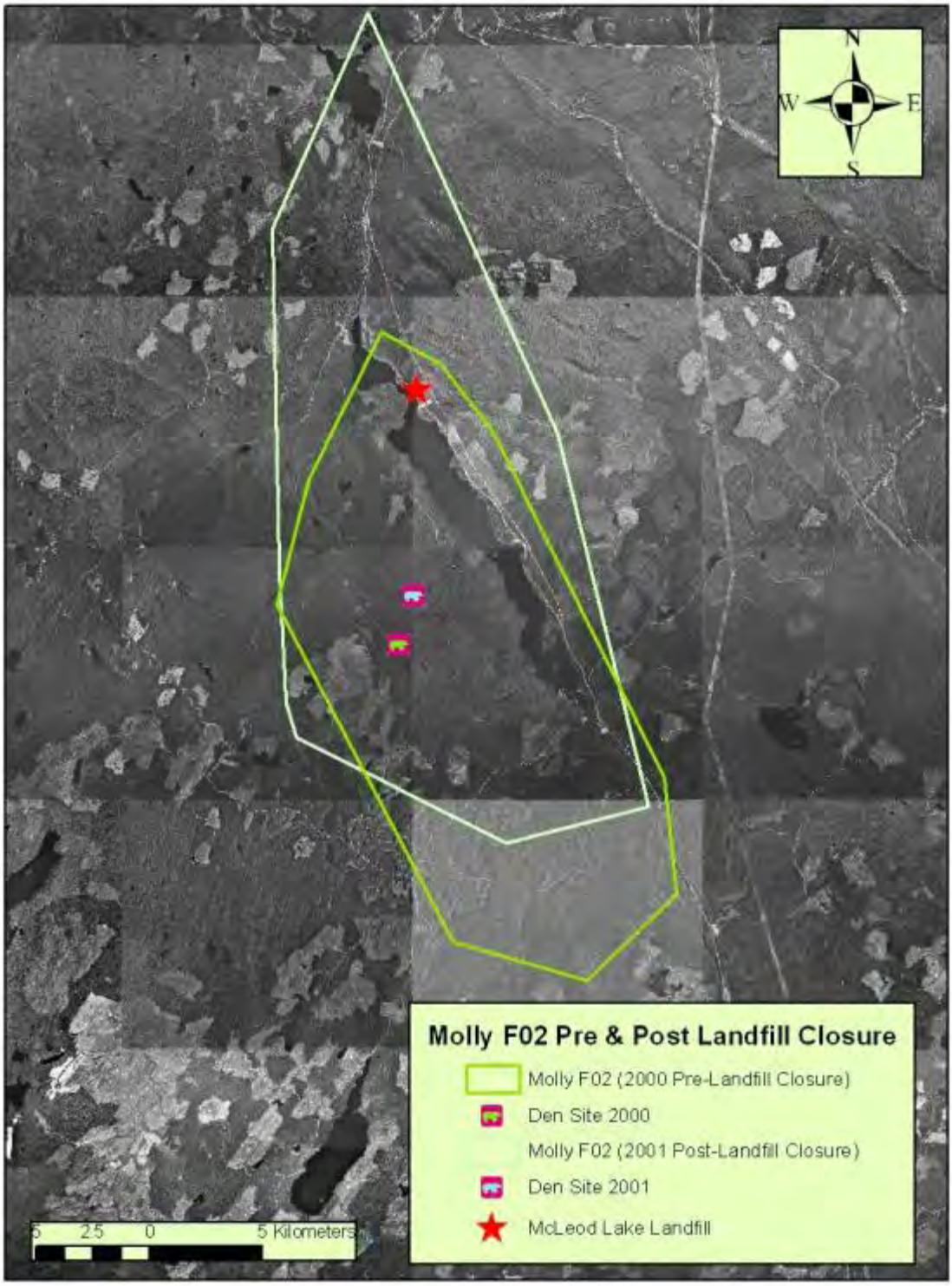


Figure J7. Comparison of 100% MCP annual home range size pre- and post-closure of the McLeod Lake landfill for adult female grizzly bear F02. F02 was alone in 2000 and accompanied by 3 COYs in 2001.

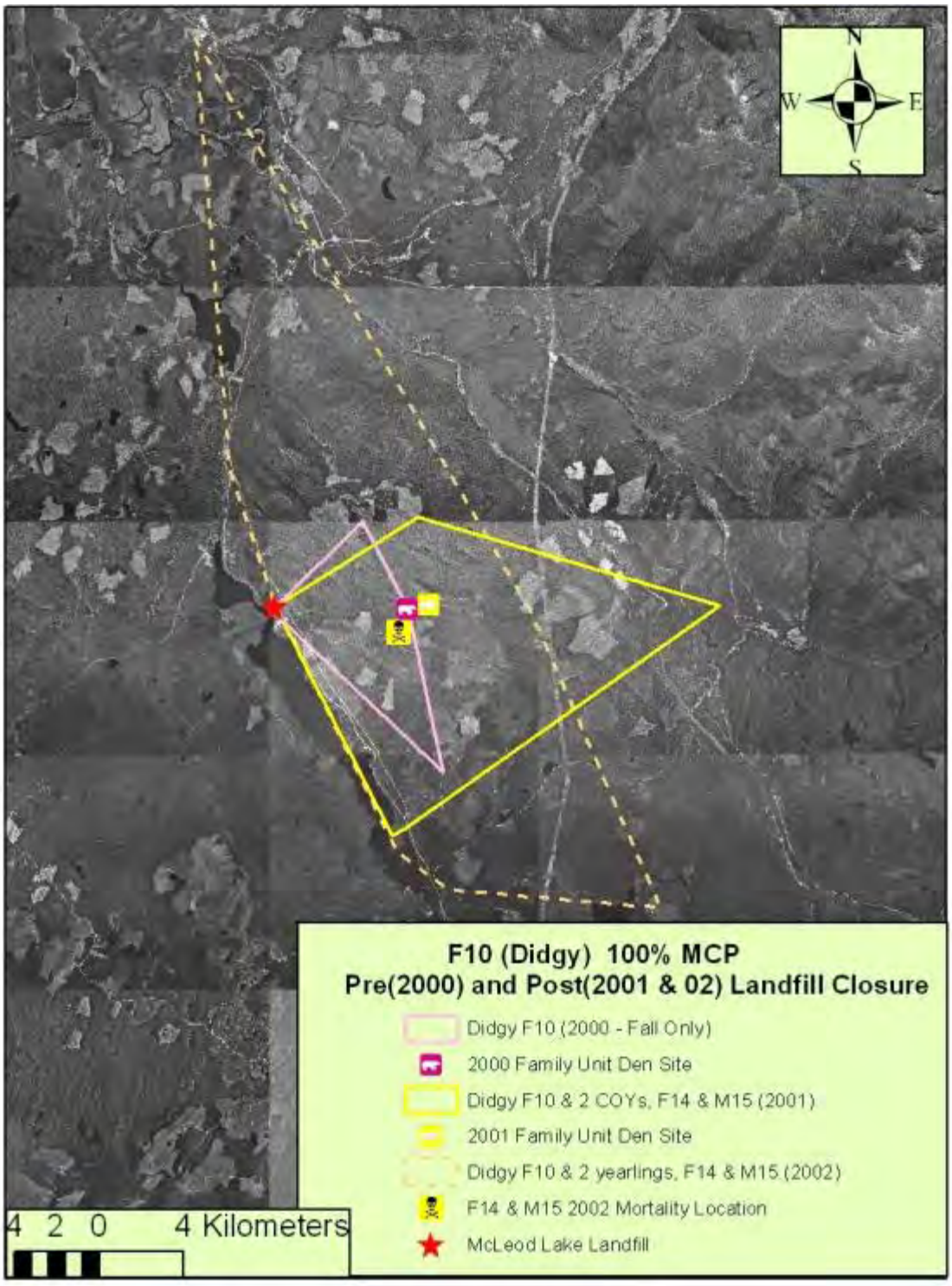


Figure J8. Pre-landfill closure fall seasonal range and post-closure (2001 & 2002) 100% MCP annual home range for young adult female grizzly bear F10. F10 was alone in 2000, and accompanied by 2 COY's (F14 & M15) in 2001.

The family unit crossed Highway 97 to Agnes Point but did not cross the Lake itself. In summer 2001, the family unit ranged east of the Parsnip River to Reynolds Creek, but returned west again within 10 days to the Whisker's Creek area. The bears were located at the landfill on the 18 and 23 August, and then moved 6 km south-east of the landfill, eventually making their way north-east to the south side of Mt Chingee. The family unit was not recorded to visit the landfill itself in fall 2001 since F10 dropped her radio-collar and was monitored only through her "9-5, Mon-Fri" transmitter, though she was recorded in Landfill Area.

The spring 2002 range of the family unit was similar to 2001 with the bears ranging east of McLeod Lake to Tsatchuka Creek, 4 km east of Highway 97. Between 14 – 17 May, F10 and both her yearling offspring were captured along the gasline approximately 1 km south of the landfill. F10's VHF collar was replaced with a GPS collar for the PGBP, while the 2 yearlings (F14 and M15) were fitted with ear-tag transmitters. The family unit again frequented the Whisker's Creek area from the end of May to early June, and the Agnes Point area until summer. In summer, the bears were located their furthest south-east being 1 km east of north end Firth Lake and 23 km from the landfill, however, they visited the landfill on 25 July and 30 August. The family unit was consistently located at the closed landfill beginning 23 September 2002, with 8 additional landfill visits occurring throughout October. The bears visited the landfill primarily in the evening hours and then traveled significant distances (up to 27 km) away from the landfill between visits. Their last recorded visit to the landfill was on 1 November 2002. On 5 November, the family group moved to Tsatchuka Creek, 8 km east of Upper McLeod Lake. During an aerial tracking flight 3 days later, a moose kill-site was observed from the air and one large bear (likely F10) running from the site. A ground investigation conducted the following spring found the 2 yearlings F14 and M15 had been killed (see section 4.6 Mortalities).

Comparison of the family's post-closure monitoring years (2001 and 2002) shows their spring ranges were similar spatially and in size (45 $km^2$ versus 41 $km^2$); however, the bears did not visit the landfill in spring 2002 and their overall distance to the landfill increased. Their summer ranges post-closure increased from 110 $km^2$ to 172 $km^2$. The bears crossed to the west side of Highway 97 a few times in spring 2001 & 2002, and at least once during summer 2002.

The largest spatial and size shift in ranges occurred during the fall. F10's fall range size decreased from 39 $km^2$ in 2000 to 13 $km^2$ in 2001 when she was accompanied by COYs, then noticeably increased to 184 $km^2$ in 2002 when she was accompanied by yearlings. Her average distance to the landfill increased from 3 km pre-closure, to 8 km post-closure (in both 2001 and 2002). F10 dropped her GPS radio-collar on the 25 September 2002 and the family group was monitored through the yearling's ear-tag transmitters with a number of visual locations on all 3 bears. Post-closure, F10's annual home range size doubled from 2001 to 2002 (161 $km^2$ to 341 $km^2$); however, the increase in size is likely due to the increased age of her offspring (COY in 2001, yearlings in 2002) and not solely due to landfill closure.

**F04 – Heavy**

*Subadult female: 2000 - independent offspring of F02; siblings M03 and F11* *Figure J9*

F04 left the landfill after her initial capture in mid-May 2000 spending the spring in the Weedon Creek, Crooked River, and Hammett Creek areas. She returned to the landfill for 2 days in early summer

then travelled south-west to the Carp Lake area, approximately 20 km west of mid-McLeod Lake. In early August, she returned to the landfill again for 2 days before venturing approximately 12 km west of southern McLeod Lake. She returned to the landfill area in late August and was consistently located by aerial telemetry within 2 km of the landfill from mid-September through early November. The landfill datalogger recorded her presence at the landfill site daily during the same time. F04's average distance from the landfill was largest in spring at 12 km, and averaged only 5 km during the summer. She constricted her movements in fall to centre on the landfill area, averaging less than 1 km from the landfill. She denned west of McLeod Lake in mid-November, 3 km from her mother (F02), and 9 km from the landfill. The aerial telemetry and datalogger data indicated that she crossed Highway 97 at least 7 times in 2000.

F04 dropped her collar upon den emergence on 18 April 2001. On 10 October 2001, F04 was shot and killed by a resident of McLeod Lake in defence of life and property. F04 had been visiting the residence frequently for a few days in the attempt to access a moose carcass hanging in a shed.

**F11 – Heavy**

*Subadult female: 2000 - independent offspring of F02; siblings M03 and F04* *Figure J10*

F11 was first captured in the landfill in mid-September 2000 as a 2 ½ year old. She remained within 2 km of the landfill during the fall season and used the landfill nightly. She left the area in mid-November and after crossing Highway 97 she denned in the Hammett Creek area, 6 km from her mother (F02) and 10 km from the landfill.

F11 was not recorded to use the landfill (through either aerial telemetry or the datalogger) during the spring or summer of 2001, although she wore only a "9-5, Mon-Fri" transmitter, so it is possible night visit(s) to the landfill were missed. In early spring, F11 remained near her Hammett Creek den site (averaging 15 km west of the landfill) then moved further west by the end of April. In mid-May she travelled to her most southerly location 7 km east of Kerry Lake, 39 km from the landfill. She then returned north to the Crooked River, 4 km south of McLeod Lake where she remained to range around the McLeod River, Swamp Grass Lake (tributary to McLeod River) and Hammett Creek. In summer, she returned to an area near her den site on Hammett Creek and ranged further west to the east side of Carp Lake 23 km from the landfill. The closest she was recorded to the landfill that summer (16 August) was west of McLeod Lake 4 km from the landfill. We last located F11 on 6 September 2001 at McDougall River north of Carp Lake, 22 km from the landfill. We believed that F11's ear-tag transmitter stopped working, and her fate remained unknown until her DNA was twice located in the Nations Grid between 7 - 21 July, and 20 July – 3 August, 2003. The sites were 19 and 27 km from the landfill, respectively.

**M03 – Light**

*Subadult male: 2000 - independent offspring of F02; siblings F04 and F11* *Figure J11*

M03 was never located at or near the landfill after his initial capture at the landfill in early spring 2000 as a 2.5-year-old subadult male. After capture, he travelled extensively, moving south across the sub-boreal plateau area with locations ending just north of Prince George. He initially moved west to Great Beaver Lake (25 May) and then south to the Hoodoo Lakes area north-west of Prince George,

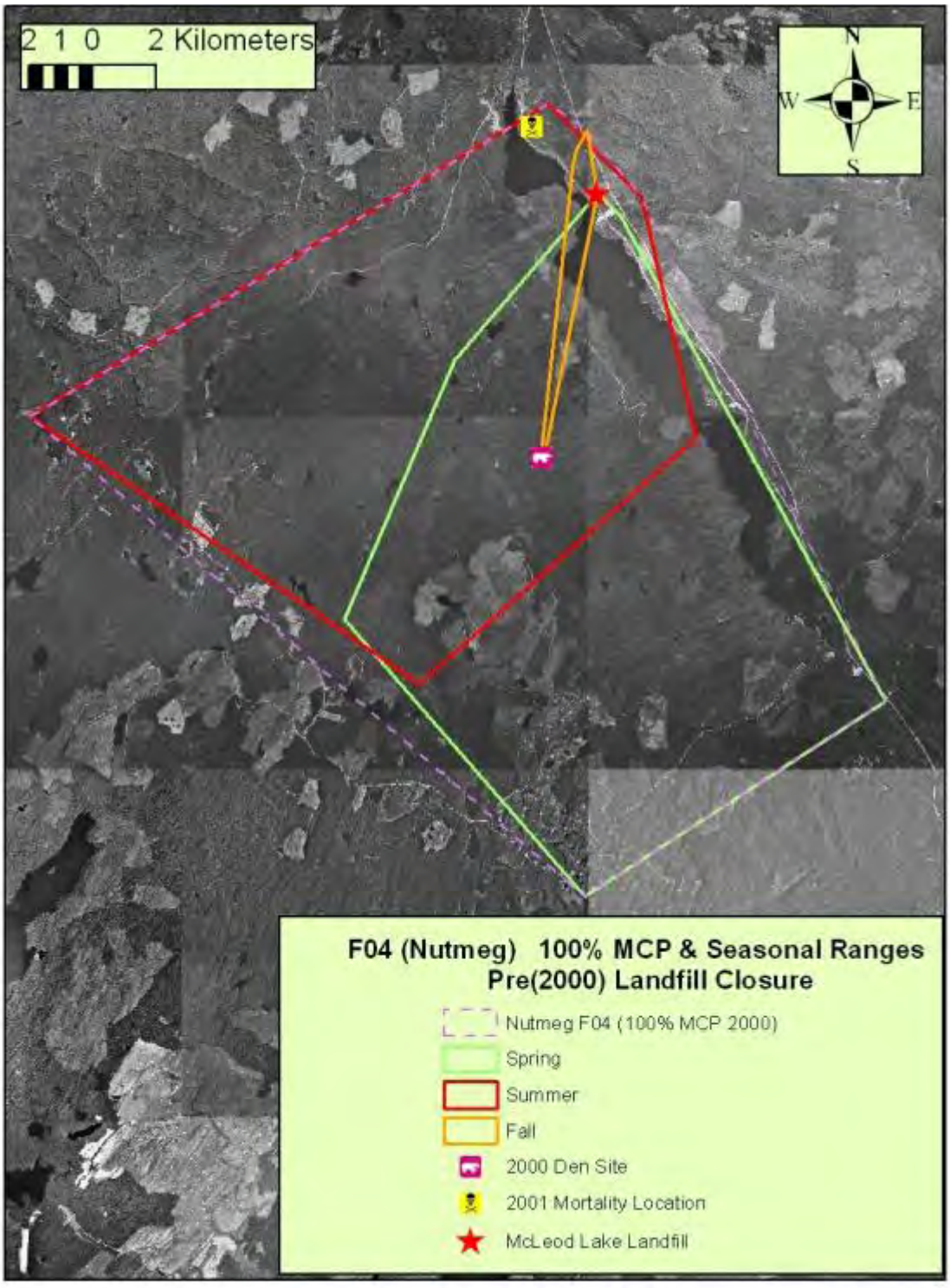


Figure J9. 100% MCP annual home range size pre-landfill closure for subadult female grizzly bear F04. F04 was the 2 ½ year old independent subadult offspring of F02 in 2000. F04 was heavily dependent upon the landfill and her fall 2001 mortality location was <3 km from the landfill in the town of McLeod Lake.

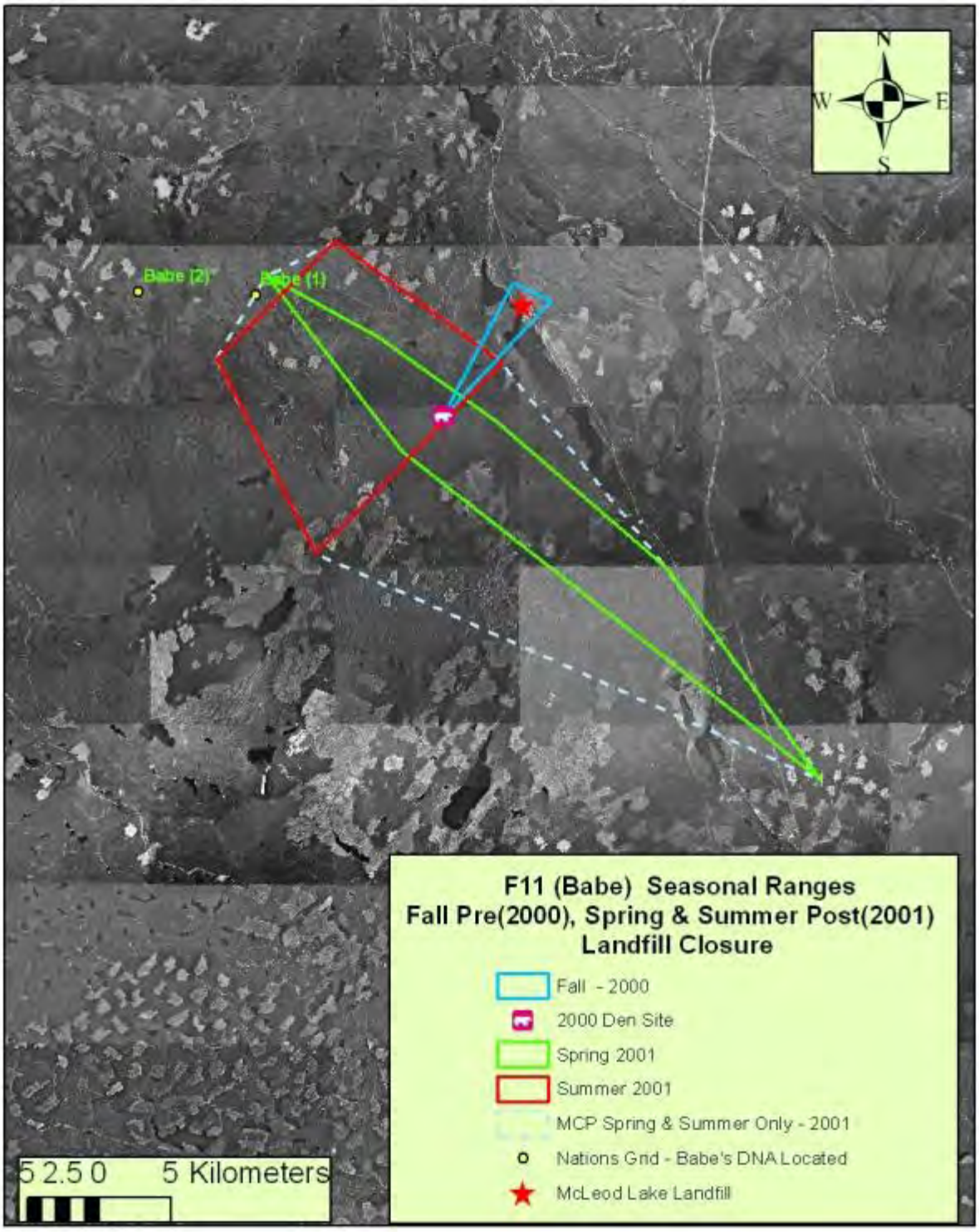


Figure J10. Pre-closure fall, and post-closure spring and summer seasonal ranges for subadult female grizzly bear F11. F11 was the 2 ½ year old independent subadult offspring of F02 in 2000. F11 did not visit the landfill site in spring or summer 2001. Although we lost contact with F11 in early fall 2001, she was located through DNA at 2 sites in the Nations DNA Grid in 2003.


Figure J11. Partial 100% MCP annual home range pre-landfill closure for subadult male grizzly bear M03. M03 was the 2½ year old independent subadult offspring of F02 in 2000. He ranged widely south and west of the landfill resulting in a number of missing aerial-telemetry locations. M03's mortality location was approximately 120 km west of the landfill.

where he remained for most of the summer (14 Jul – 16 Aug). In late August, M03 forayed north to the west side of McLeod Lake. The datalogger recorded M03 west of McLeod Lake on 4 occasions beginning 15 September but he did not appear to return to the landfill. However, since he was wearing only a "9-5, Mon-Fri" transmitter, it is possible that he visited the landfill at night but was not detected.

On average, M03 remained 46 km from the landfill. In late September 2000, he was located north-west of Prince George (north of Chief Lake). Despite extensive searching thereafter, M03 was not located again until 22 November when he was observed preparing a den west of McLeod Lake, only 1.4 km from his mother (F02) and 12 km west of the landfill.

Due to his large range and extensive movements M03 was not consistently located throughout the monitoring period. His summer range represents the season when he was most consistently located, although he could not be located on some flights. In spring 2001, M03's ear-tag transmitter either malfunctioned or he moved out of the monitoring area after den emergence (and before the landfill datalogger was activated). Despite extensive aerial searching, M03 was not located in 2001 until it was reported that he was shot and killed in self-defence after charging a person hunting grouse in fall (4 October 2001). His mortality location was approximately 120 km south-west of the landfill and well outside the typical monitoring area.

**M05 – Light**

*Mature adult male: 2000 (independent)* *Figure J12*

Adult male M05 ranged widely in spring 2000 after his capture at the landfill, travelling north to the Mischinsinlika River (approximately 34 km from the landfill), then returning to the north end of McLeod Lake before moving north-west to sites along the Misinchinka River (north of Kennedy Siding, toward the Pine Pass). He visited the landfill on 2 more occasions (after capture) in spring, 1 prior to moving north to the Mischinsinlika River, and the second upon his return to McLeod Lake. M05 returned to the Landfill Area in early summer, and contrary to the other radio-tagged bears, remained closer to the landfill on average and used the landfill more frequently during the summer than in spring or fall. We recorded 3 periods of continuous use of the Landfill Area (i.e. remaining in close proximity to the landfill) during this time, lasting 9, 17, and 7 days in July, July/August, and September respectively. After being captured again at the landfill in mid-September, he subsequently left the Landfill Area and never returned, crossing the Parsnip River and moving north to lower Colbourne Creek. He returned west near Hodda Creek (crossing the Parsnip River again), then crossed the Parsnip River a final time eastwards to den in the Braathen Creek valley approximately 22 km from the landfill. In 2000, he swam across the Parsnip River at least 7 times, and crossed Highway 97 at least twice.

On the first monitoring flight in spring 2001 (13 Apr), M05 had moved approximately 16 km south-west of his den site to 4 km west of Mt. Chingee. He then moved back northwards to the east bank of the Parsnip River, between Colbourne Creek and Misinchinka River, crossed the Parsnip River west again and arrived at the landfill on 27 April. He was recorded in the Landfill Area on 3 different days, but did not visit the landfill itself until 7 May. He was recaptured along the natural gas pipeline near the landfill on 8 May, and died from asphyxiation during immobilization.

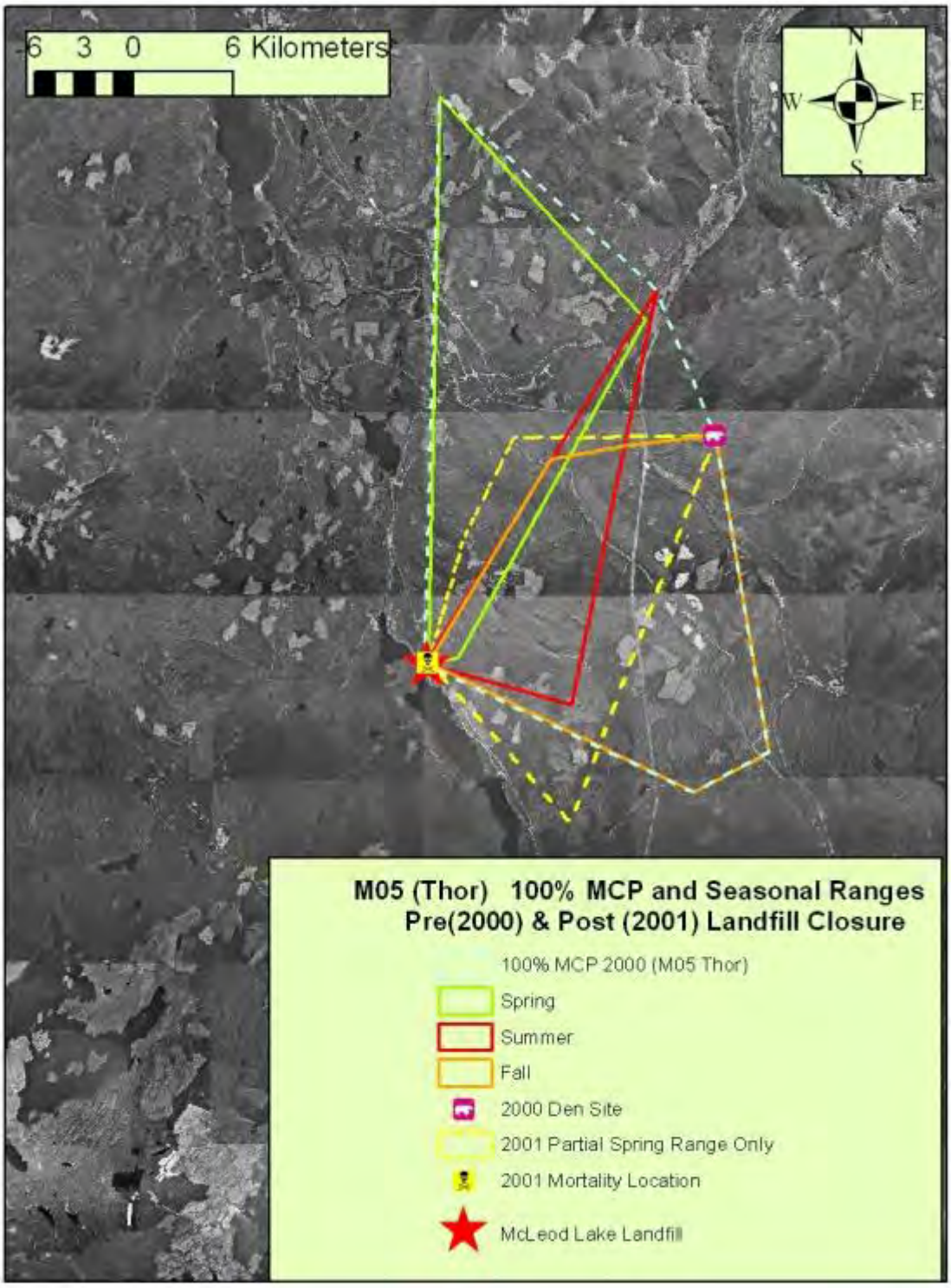


Figure J12. 100% MCP annual and seasonal home ranges pre-landfill closure for adult male grizzly bear M05. His partial (due to his mortality) 2001 spring range was similar to his fall pre-closure range.

Appendix K. Seasonal distances of radio-tagged grizzly bears to the McLeod landfill based on aerial-telemetry locations, 2000 – 2002.

Table K1. Average distance of aerial-telemetry locations to the landfill (km) by bear by season pre (2000) and post (2001 & 2002) landfill closure . Spring = den emergence – 30 June; Summer = 1 July – 31 August; Fall = 1 September - den arrival.

| | | 2000 | | | | 2001 | | | | 2002 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID No. | Season | Mean | SE | *n* | Range | Mean | SE | *n* | Range | Mean | SE | *n* | Range |
| F01 | Spring | 2.2 | 0.9 | 8 | 0-7 | 8 | 1.7 | 12 | 0-16 | | | | |
| | Summer | 2.4 | 1 | 10 | 0-10 | 6.1 | 1.3 | 10 | 0-15 | | | | |
| | Fall | 1.8 | 0.6 | 13 | 0-8 | n/c | | | | | | | |
| | Den | 8.7 | 0 | 3 | 8.7 | | | | | | | | |
| | Annual | 2.1 | 0.5 | 34 | 0-10 | 5.9 | 1 | 22 | 0-16 | | | | |
| F02 | Spring | 16.6 | 3.1 | 9 | 0-27 | 13.1 | 1.5 | 18 | 1-21 | 13 | 1.3 | 7 | 9-19 |
| | Summer | 15.9 | 2.2 | 14 | 0-25 | 12.7 | 1.5 | 19 | 0-21 | | | | |
| | Fall | 4.6 | 1.5 | 19 | 0-19 | 6.4 | 1.1 | 19 | 0-17 | | | | |
| | Den | 11.4 | 0 | 11 | 11.3 | 9.3 | 0 | 13 | 9-9.5 | | | | |
| | Annual | 11 | 1.2 | 53 | 0-27 | 10.4 | 0.7 | 69 | 0-21 | | | | |
| M03 | Spring | 47 | 22.8 | 4 | 0-93 | | | | | | | | |
| | Summer | 73.5 | 9.3 | 12 | 7.5-99 | | | | | | | | |
| | Fall | 46.3 | 33.9 | 2 | 12-80 | | | | | | | | |
| | Den | 11.6 | 0 | 3 | 11.7 | | | | | | | | |
| | Annual | 57 | 8.4 | 21 | 0-99 | | | | | | | | |
| F04 | Spring | 11.5 | 2.9 | 8 | 0-22 | n/c | | | | | | | |
| | Summer | 4.9 | 2.1 | 11 | 0-19 | | | | | | | | |
| | Fall | 0.8 | 0.2 | 9 | 0-2 | | | | | | | | |
| | Den | 8.5 | 0 | 5 | 8.5 | | | | | | | | |
| | Annual | 5.9 | 1.2 | 33 | 0-22 | | | | | | | | |
| M05 | Spring | 8.9 | 5.4 | 7 | 0-34 | 6.1 | 2.7 | 6 | 0-15 | | | | |
| | Summer | 5.6 | 2.6 | 10 | 0-26 | | | | | | | | |
| | Fall | 10.4 | 2.8 | 10 | 0-21 | | | | | | | | |
| | Den | 22.2 | 0 | 4 | 22.2 | | | | | | | | |
| | Annual | 10 | 1.9 | 31 | 0-34 | | | | | | | | |
| F06 | Spring | 2.5 | 0.8 | 7 | 0-5 | 6.5 | 1.7 | 12 | 0-18 | 4 | 0.4 | 3 | 3-5 |
| | Summer | 2.4 | 1 | 10 | 0-10 | 9.1 | 1.3 | 10 | 0-14 | | | | |
| | Fall | 1.7 | 0.7 | 12 | 0-8 | 8 | 1.3 | 10 | 0-15 | | | | |
| | Den | 8.7 | 0 | 3 | 8.7 | 10.4 | 0.1 | 4 | 10.4 | | | | |
| | Annual | 2.7 | 0.5 | 32 | 0-10 | 8.1 | 0.8 | 36 | 0-18 | | | | |

n/c = not calculated since only partial seasonal data obtained
blank cell = no data, bear transmitter lost or stopped working, or bear dead

Table K1 *cont*.

| | | 2000 | | | | 2001 | | | | 2002 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID No. | Season | Mean | SE | *n* | Range | Mean | SE | *n* | Range | Mean | SE | *n* | Range |
| F07 | Spring | 15.1 | 2.8 | 2 | 12-18 | 26.9 | 1.7 | 17 | 17-43 | | | | |
| | Summer | 3.3 | 1.7 | 3 | 0-5 | 16.9 | 2.5 | 16 | 5-35 | | | | |
| | Fall | 4.4 | 1.6 | 24 | 0-33 | 11.4 | 1.6 | 22 | 0-22 | | | | |
| | Den | 41.7 | 0 | 6 | 41.7 | 19.8 | 0 | 2 | 19.8 | | | | |
| | Annual | 11.3 | 2.7 | 35 | 0-42 | 17.9 | 1.3 | 57 | 0-43 | | | | |
| M08 | Spring | 15.7 | 1.7 | 8 | 12-26 | 29.5 | 4.3 | 15 | 0-65 | | | | |
| | Summer | 12.2 | 3.3 | 17 | 0-55 | 41.3 | 5.7 | 11 | 18-63 | | | | |
| | Fall | 4.5 | 1.6 | 24 | 0-33 | n/c | | | | | | | |
| | Den | 41.7 | 0 | 6 | 41.7 | | | | | | | | |
| | Annual | 12.5 | 2 | 55 | 0-55 | 33.9 | 3.5 | 27 | 0-65 | | | | |
| F09 | Spring | 15.6 | 1.7 | 8 | 11-26 | 19.7 | 2.4 | 24 | 0-43 | | | | |
| | Summer | 11.1 | 1.8 | 19 | 0-26 | 13.6 | 1.1 | 16 | 8-21 | | | | |
| | Fall | 4.4 | 1.6 | 24 | 0-33 | | | | | | | | |
| | Den | 41.7 | 0 | 6 | 41.7 | | | | | | | | |
| | Annual | 12.1 | 1.7 | 57 | 0-42 | 17.2 | 1.5 | 40 | 0-43 | | | | |
| F10 | Spring | | | | | 7 | 1.4 | 9 | 0-12 | 8.7 | 1.5 | 11 | 2-16 |
| | Summer | | | | | 8 | 1.8 | 10 | 0-21 | 9 | 1.8 | 11 | 0-23 |
| | Fall | 3 | 1.3 | 9 | 0-11 | 7.8 | 0.5 | 9 | 5-9 | 8.3 | 2.2 | 11 | 0-27 |
| | Den | 6.3 | 0 | 8 | 6.3 | 7.4 | 0.1 | 2 | 7.33 | | | | |
| | Annual | n/c | | | | 7.6 | 0.7 | 30 | 0-21 | 8.6 | 1 | 33 | 0-27 |
| F11 | Spring | | | | | 15.4 | 3 | 10 | 8-39 | | | | |
| | Summer | | | | | 12.7 | 2.4 | 8 | 4-23 | | | | |
| | Fall | 1.1 | 0.3 | 8 | 0-2 | n/c | | | | | | | |
| | Den | 9.5 | 0 | 4 | 9.5 | | | | | | | | |
| | Annual | n/c | | | | 14.6 | 1.9 | 19 | 4-39 | | | | |
| F12 | Spring | | | | | 23 | 4 | 7 | 11-39 | 19.2 | 2.1 | 12 | 11-35 |
| | Summer | | | | | 24.3 | 3.5 | 8 | 13-36 | 20.9 | 0 | 2 | 21 |
| | Fall | 6.7 | 3 | 7 | 0-24 | 23.5 | 4.4 | 10 | 0-36 | | | | |
| | Den | 28.1 | 0 | 6 | 28.1 | 28.1 | 0 | 4 | 28.1 | | | | |
| | Annual | n/c | | | | 24.2 | 2 | 29 | 0-39 | | | | |

n/c = not calculated since only partial seasonal data obtained
blank cell = no data, bear transmitter lost or stopped working, or bear dead

## Appendix L. Movements to, and habitat characteristics of, winter den sites used by radio-tagged grizzly bears during the McLeod Lake landfill study, 2000 – 2002.

### METHODS

Dens used by radio-tagged grizzly bears over winter 2000/01 were accessed by helicopter or truck and hiking using the co-ordinates obtained during radio-telemetry flights the previous fall. Data were collected on the den's location (aspect, slope, elevation, forest cover type, canopy closure) and den characteristics (den type, measurements, bedding material, general description). Dens were categorized into 1 of 4 types: excavated, cave, nest/vegetation, or tree cavity. Den locations were plotted on VRI, DEM, and forest cover maps, and distance to nearest road (Euclidean distance) was calculated by amalgamating GIS layers obtained from FCM, TRIM, Canfor East, Canfor West, the Pas Lumber, and Slocan Forests Products Limited.

We used data obtained during site visits for analysis of all attributes except land-cover, stand age, and distance to roads, which we obtained from GIS. If an attribute was missing for a particular den site, we used information obtained from GIS, followed by information obtained during aerial telemetry. We used ground site visit information for most attributes because we think it was the most accurate representation of the micro-site characteristics, particularly for attributes such as aspect which we calculated immediately at the den entrance. Land-cover types and stand age were double checked with notes taken at the site, and for the most part matched the GIS database.

Statistical differences between distance of den sites to landfill pre- and post-closure, and differences in den site selection such as canopy closure, elevation and slope pre- and post-closure, were calculated using Mann-Whitney U-tests with a significance level of $\leq 0.05$. Statistical tests were performed using Statistica Version 5.0 (StatSoft, Tulsa, OK).

### RESULTS - MOVEMENTS TO DEN SITES

We located 14 den sites (9 in 2000/01, and 5 in 2001/02) representing 14 radio-tagged grizzly bears (10 females, 4 males), 1 marked COY (M13), and 4 unmarked cubs of the year (Figure L1). In 2000/01, 5 of the 9 dens were occupied by family units or were maternal den sites (female gave birth in the den): (1) orphaned yearling siblings, F01 and F06; (2) F09 and her 3-year-old dependent offspring F07 and M08; (3) F12 and her 2 COY including M13 and an unmarked cub; (4) F02 who birthed 3 COY in the den that winter; and (5) F10 who birthed 2 COY in the den that winter. In 2001/02, 3 of the 5 dens were occupied by family units (F02, F10 and F12).

Twelve den sites were located on the plateau (86%) and 2 (14%) were on the western slopes of the Hart Ranges of the Rocky Mountain to the east of the landfill (Figure L1). These latter 2 (both in 2000/01) were occupied by large male M05, 22 km north-east of the landfill in the Braathen Creek valley, and family unit F09, M08, and F07, 42 km east of the landfill near the Anzac River.

Lone adult females were the first bears to reach den sites in 2000/01, followed by the lone adult male, females with dependent offspring, subadult females, and the lone subadult male (Table L1). Lone adult female F10 was observed within 400 m of her den site on 18 October and lone adult female F02 was estimated to reach her den site by 29 October. Both gave birth to cubs in their dens that winter. Adult

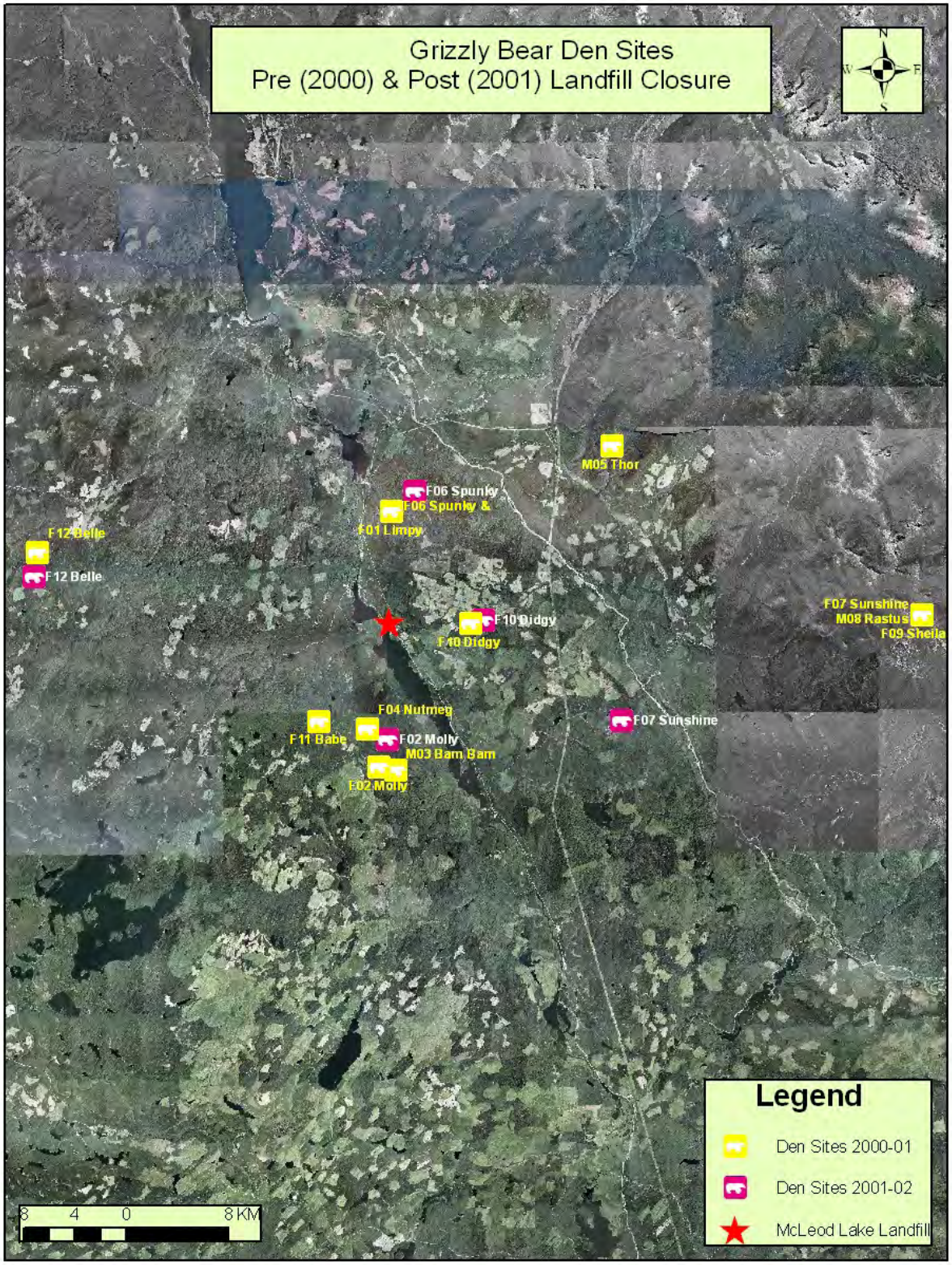


Figure L1. Location of 14 den sites (n = 9 in 2000/01, n = 5 in 2001/02) representing 17 grizzly bears (12 females, 2 males, 2 dependent females, 1 dependent male) captured at the McLeod Lake Landfill, 2000 – 2002.

male M05 reached a den site by approximately 5 November; he was observed digging at the site on 9 November, and appeared to be in the same location by 18 November. F09 and her 3-year-old dependent offspring F07 and M08, F12 and her 2 COY M13 and an unmarked cub, and lone subadult female F04 were estimated to reach their den sites by 14 November. Lone subadult female F11 reached her den site by 16 November. The orphaned yearlings F01 and F06 reached their den site together by 18 November. The last bear to reach his den site was subadult male M03 by 27 November.

The 2-year-old independent offspring (M03, F04, and F11) that gained independency in spring 2000, all denned in close proximity to their mother (F02) on the west side of McLeod Lake at 1.3, 3.1, and 5.9 km from their mother's den, respectively.

Bears averaged 5.2 months ($\bar{x}$ = 160.8 days, SE = 9.8, $n$ = 4) in their dens in 2000/01 (Table L1). Duration in the den could only be calculated for 4 of the 9 independent bears with known dates when they left their dens in spring. This is likely similar for the remaining bears since bears that were awake by the first flight on 13 April had only moved distances of less than 2 km from their den sites and, for some, tracks could still be seen at their denning areas.

Post-landfill closure 2001/02, F02 with 3 cubs of the year were the first bears to reach their den site location by 29 October (Table L1). F12 with 2 yearlings (M13 and an unmarked cub), F10 with 2 cubs of the year, and the lone subadult F06 were located at their respective den sites on 13 November, with an approximate den arrival date of 8 November. F07 denned alone in 2001 with an estimated date of arrival at her den site of 17 November. Most differences in den site arrival between years appear to be attributable to physiology and sexual status. Duration in the dens could only be calculated for 2 individuals, and was similar to their 2000/01 denning durations (Table L1).

There was no significant difference between the mean distance of den sites to the landfill before closure in winter 2000/01 ($\bar{x}$ = 16.4 km, SE = 3.96, $n$ = 9, range 6.3 – 41.7) and after closure in winter 2001/02 ($\bar{x}$ = 15 km, SE = 3.92, $n$ = 5, range 7.3 – 28.1; $P$ = 0.84; Table L1).

## RESULTS - DEN SITE HABITAT CHARACTERISTICS

We visited all 9 pre-closure den sites (2000/01 winter), and 1 of the 5 post-closure den-sites (2001/02 winter). The majority of den sites were excavated into the sides of slopes using tree roots as the stabilizing material. Female F09 with her large 3-year-old offspring, F07 and M08, denned in an old growth spruce/subalpine-fir forest under the base of a very large Englemann spruce tree (71 cm dbh). F04, in her first year denning alone in 2000/01, used a limestone cave den. The tunnel descended downward through bedrock to a chamber, at the end of which was a small opening excavated through old hardpacked dirt and small roots which lead at least another 10 feet, presumably to a final chamber Mid-winter logging activities occurred in the immediate vicinity of F10's den, but she did not abandon the den site possibly due to the birth of her 2 new COY. F10 denned under the root of a mature spruce which was cut down during harvesting.

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Table L1. Timing of movements and distances between the McLeod Lake Landfill and 2000/01 and 2001/02 den sites for radio-tagged grizzly bears captured at the McLeod Lake Landfill.

| Bear ID no. | Accompanied by offspring | Year | Last date at or within 2km of landfill | Last location before den site | First date at or within 400m of den site | Estimated date of arrival at den site[a] | Estimated timing of den entry | First date moved from den site | Total days denning | Distance to landfill (km) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Adult female with 2 COY dependents 2000 (dependent yearlings 2001)* | | | | | | | | | | |
| F12 | 2 COYs | 2000 | 5 Nov | 9 Nov | 18 Nov | 14 Nov | 22 Nov – 1 Dec | 26 Apr | 151 | 28.1 |
| F12 | 2 yearlings | 2001 | 12 Oct | 2 Nov | 13 Nov | 8 Nov | 13 Nov – 19 Nov | 28 Apr | 163 | 28.1 |
| *Adult female with 2 radio-tagged 3-year-old dependents 2000 (all independent 2001)* | | | | | | | | | | |
| F09 | M08, F07 | 2000 | 5 Nov | 9 Nov | 18 Nov | 14 Nov | 22 Nov – 28 Nov | 13 Apr | 138 | 41.7 |
| *Orphaned dependent yearling siblings 2000 (independent 2-year-olds 2001)* | | | | | | | | | | |
| F01, F06 | | 2000 | 15 Nov | | 18 Nov | 18 Nov | 22 Nov – 1 Dec | prior to 13 Apr | | 8.7 |
| *Adult female no dependents 2000 (3 dependent COY 2001)* | | | | | | | | | | |
| F02 | none | 2000 | 27 Oct | | 1 Nov | 29 Oct | 1 Nov – 8 Nov | 27 Apr | 174 | 11.3 |
| F02 | 2 COYs | 2001 | 15 Oct | 27 Oct | 29 Oct | 28 Oct | 6 Nov – 12 Nov | 1 May | 173 | 9.2 |
| *Young adult female no dependents 2000 (2 dependent COY 2001)* | | | | | | | | | | |
| F10 | none | 2000 | 16 Oct | | 18 Oct | 18 Oct | 18 Oct – 1 Nov | 23 Apr | 180 | 6.3 |
| F10 | 2 COYs | 2001 | 29 Oct | 2 Nov | 13 Nov | 8 Nov | after 19 Nov | prior to 16 May | | 7.4 |
| *Subadult females, no dependents* | | | | | | | | | | |
| F04 | none | 2000 | 10 Nov | | 18 Nov | 14 Nov | 22 Nov – 1 Dec | prior to 13 Apr | | 8.5 |
| F11 | none | 2000 | 14 Nov | | 18 Nov | 16 Nov | 22 Nov – 1 Dec | prior to 13 Apr | | 9.5 |
| F06 | none | 2001 | 17 Oct | 2 Nov | 13 Nov | 8 Nov | after 13 Nov | 28 Apr | | 10.4 |
| F07 | none | 2001 | 28 Sep | 14 Nov | 19 Nov | 17 Nov | after 27 Nov | unknown | | 19.7 |
| *Subadult male* | | | | | | | | | | |
| M03 | | 2000 | 9 May | 22 Nov | 1 Dec | 27 Nov | 1 Dec – 11 Dec | unknown | | 11.5 |
| *Adult male* | | | | | | | | | | |
| M05 | | 2000 | 19 Sep | 1 Nov | 9 Nov | 5 Nov | 18 Nov – 22 Nov | prior to 13 Apr | | 22.2 |

[a] Date determined as the exact date the bear was first within 400 m of the den site, or estimated as halfway between the last aerial telemetry location or landfill location and first date confirmed at den site.

Seven of 14 den sites (4 of 9 in 2000/01, and 3 of 5 in 2001/02) were located in the SBSwk1 while 2 (2000/01) and 1 (2001/02) were located in the ESSF zone (Table L2). One of these dens was in the mountains, and 2 (F12's pre- and post-closure dens) were on high elevation ridges of the plateau west of the landfill. All of the den sites located in 2000/01 ($n$ =9) and 3 of the 5 den sites in 2001/02 were located in coniferous forests stands; the remaining 2 dens were in mixed-wood stands. These 2 den sites were occupied by subadult females F06 and F07, and were the first time these bears had denned alone. Den sites were primarily located in stands with spruce as the leading tree species ($n$ = 7 in 2000/01; $n$ =3 in 2001/02) although sites were also located in Douglas fir, subalpine fir and lodgepole pine-dominated stands (Table L2). These stands were primarily old-growth age classes ($\geq$100 year; $n$ = 10 of 14 den sites); only 1 den site occupied by one of the lone subadult females (F07), was located in a young, regenerating cutblock logged in 1972 (~29-year-old stand at the time of denning). The den was excavated under a large spruce tree within a spruce/balsam retention patch in the old cutblock.

The mean elevation of den sites was not significantly different pre-closure ($\bar{x}$ = 956 m, SD = 150.5, $n$ = 9) versus post-closure ($\bar{x}$ = 980 m, SD = 150 m, $n$ = 5; $P$ = 0.46). Typically, den sites were located at higher elevations than other sites used throughout the year (all den sites $\bar{x}$ = 965 m, SD = 145 m, $n$ = 14). There was no significant difference in the mean slopes of den sites used pre-closure ($\bar{x}$ = 24˚, SE = 2˚, $n$ = 9, range 14 – 31˚) versus post- closure ($\bar{x}$ = 17˚, SE = 3˚, $n$ = 5, range 15 - 22˚). Although all aspects were used, bears appeared to select cooler aspects and moderate to steep slopes for their den sites: 9 of the 14 den sites were on aspects ranging from NW to NE and 2 faced due east, while only 3 were on warmer south-facing aspects (Table L2). Unlike the non-denning/active seasons, no bear dens were located in the 0 – 10% canopy closure range. In 2000/01, 55% of den sites were located in land-cover types with canopy closure values greater than 50%, while only 20% of dens fell into this category in 2001/02 though sample sizes were too low to detect any significant differences.

Table L2. Den site characteristics for radio-tagged grizzly bears pre (2000) and post (2001) closure of the McLeod Lake Landfill.

| Bear ID no. | Offspring in Den | Year | Leading tree species | BEC zone | Den type | Stand age[a] | Aspect | Elevation | Canopy closure (%) | Slope (°) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Adult female with 2 dependent COYs (2000), 2 dependent yearlings (2001)* | | | | | | | | | | |
| F12 | 2 COY's | 2000 | Se | ESSFmv3 | Excavated | Old (248) | NW | 1174 | 40 | 29 |
| F12 | 2 yearlings | 2001 | Bl | ESSFmv3 | not visited | Mature (78) | NE | 1245 | 40 | 17 |
| *Adult female with 2 dependent 3-year-olds (2000)* | | | | | | | | | | |
| F09 | M08, F07 | 2000 | Bl | ESSFwk2 | Excavated | Old (232) | E | 1231 | 65 | 31 |
| *Orphaned dependent yearling siblings (2000)* | | | | | | | | | | |
| F01/F06 | none | 2000 | Se | SBSwk1 | Excavated | Mature (88) | NE | 910 | 40 | 17 |
| *Adult female no dependents (2000), 3 dependent COYs (2001)* | | | | | | | | | | |
| F02 | none | 2000 | Se | SBSmk1 | Excavated | Old (165) | NW | 807 | 55 | 24 |
| F02 | 3 COY's | 2001 | Se | SBSmk1 | not visited | Old (145) | E | 938 | 45 | 15 |
| *Young adult female no dependents (2000), 2 dependent COYs (2001)* | | | | | | | | | | |
| F10 | none | 2000 | Se | SBSwk1 | Excavated | Old (185) | NE | 906 | 50 | 27 |
| F10 | 3 COY's | 2001 | Pl | SBSwk1 | not visited | Old (112) | S | 933 | 60 | 22 |
| *Subadult females no dependents* | | | | | | | | | | |
| F04 | none | 2000 | Fd | SBSwk1 | Cave | Old (100) | NW | 895 | 60 | 14 |
| F11 | none | 2000 | Se | SBSmk1 | Excavated | Old (115) | NE | 813 | 60 | 31 |
| F07 | none | 2001 | Se | SBSwk1 | Excavated | Young (29) | SE | 878 | 45 | 16 |
| F06 | none | 2001 | Se | SBSwk1 | not visited | Old (148) | NW | 908 | 30 | 17 |
| *Subadult male* | | | | | | | | | | |
| M03 | | 2000 | Se | SBSwk1 | Excavated | Old (165) | NW | 880 | 70 | 17 |
| *Adult male* | | | | | | | | | | |
| M05 | | 2000 | Se | SBSwk1 | Excavated | Mature (92) | S | 992 | 35 | 23 |

[a]Young: 0-45, Mature 46-99 years, Old ≥100 years. Projected stand age as determined through GIS is provided in brackets.