

Homing by Radio-collared Black Bears, *Ursus americanus*, in Minnesota

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Five Black Bears (*Ursus americanus*) that had been radio-tracked most or all of their lives were transported up to 61 km outside their familiar areas. The three oldest bears quickly moved home or homeward despite their unfamiliar surroundings and despite winds blowing from other than the homeward direction. The prompt returns of these bears support conclusions from previous studies using bears whose familiar areas were unknown: Black Bears can orient homeward without using familiar landmarks.

Key Words: Black Bear, *Ursus americanus*, orientation, navigation, familiar area, movements, nuisance bears, translocation, orphaned cubs, rate of travel, Minnesota.

Black Bears, *Ursus americanus*, commonly return home after being translocated long distances (Erickson et al. 1964; Harger 1970; Alt 1977). However, no bear has previously been monitored before translocation to determine the extent of its familiar area, so that questions have remained as to whether bears that return home demonstrate true navigational ability or simply memory of seldom-used areas (Beeman and Pelton 1976; Baker 1978). This paper presents results of translocation experiments using five Black Bears that were intensively radio-tracked before translocation. Three of them (numbers 436, 462, and 503) were radio-tracked since they were cubs. The other two (littermates 308 and 310) were captured initially as cubs and were recaptured as two- or three-year-olds (see below) in their mother's territory and radio-tracked for a year before translocation. All five were fairly sedentary throughout the radio-tracking period prior to translocation, thereby permitting unusually complete documentation of familiar areas: 562 of 564 attempts to locate them by radio were successful. Radiolocations were obtained primarily by aircraft tracking and were representative of all seasons in each year.

When captured for translocation, each bear was drugged with phencyclidine and promazine and remained unconscious for some or all of the transportation period. Wind directions were recorded at the time of release and determined for subsequent days from U. S. Weather Bureau records. The study was conducted in northeastern Minnesota where terrain is gently rolling, forest habitat is nearly continuous, and there are few large highways, large waterways, or other physiographic features to prevent homing or to channel bears homeward. Towns are widely scattered, and there were no industries or large

airports near the bears' home areas to provide cues for homing.

Case Histories

1. Female 436 was radio-tracked during 7.5 years of life, first as a cub by her mother's signals and after 14 months of age by her own radio-collar. She was located 256 times in 257 attempts. Two hundred thirty-eight (93%) of those locations were in an area 9.6 km in diameter, which included her own and her mother's territories. Twelve locations (5%) were obtained outside that area when she accompanied her mother 32 km east as a cub, and six locations (2%) were obtained up to 6 km outside the first area when she was older.

On 16 July 1978, she was drugged and transported unconscious 68 km to a point 60 km northwest of any previous radio-location (Figure 1). From the release point, the homeward direction was a sector 15 degrees wide, covering only 4% (15°/360°) of the directions she could have traveled. She returned to the capture site in nine days, averaging at least 7.5 km/day. Winds were from the home direction the first two days, from behind her the next five days, and from her right the last two days.

2. Female 310 was originally captured as a cub with her mother and was recaptured and radio-collared as a three-year-old at the edge of her mother's territory on 31 May 1972. From then until she was transported in August of the next year, she was located on all 103 telemetry attempts. This period included some extraterritorial wandering as a three-year-old and in her travels as a four-year-old with her first litter. In addition, her mother was radio-tracked in 1970 and 1972 (43 of 43 telemetry attempts successful) to

determine areas where the mother might have led Female 310 as a cub. Mothers commonly use the same feeding areas year after year (Rogers 1977). All locations for 310 and her mother were within an area 11 km across.

Female 310 was captured on 14 August 1973 at a campground that she and her cubs frequented. She was drugged and transported 65 km (Figure 1), without her cubs, to a point 61 km northeast of any previous radio-location. From the release point, the homeward sector (10 degrees wide) covered only 3% (10°/360°) of the directions she could have traveled.

Upon release at 1745 h, still partially drugged, she moved farther from home. An hour later she turned around and started directly toward her home range. There was a crosswind from her right. At 1330 h on 17 August, 3.8 days later, she was still on a direct course toward home and 43 km closer to it, having averaged 11.4 km/day. Winds during this period had changed from the crosswind to a tailwind. Contact then was lost. She was assumed to have been poached at the point of signal loss because she was not found during an extensive aerial telemetry search and was not recovered during subsequent years of live-trapping in her home area or during statewide hunting seasons.

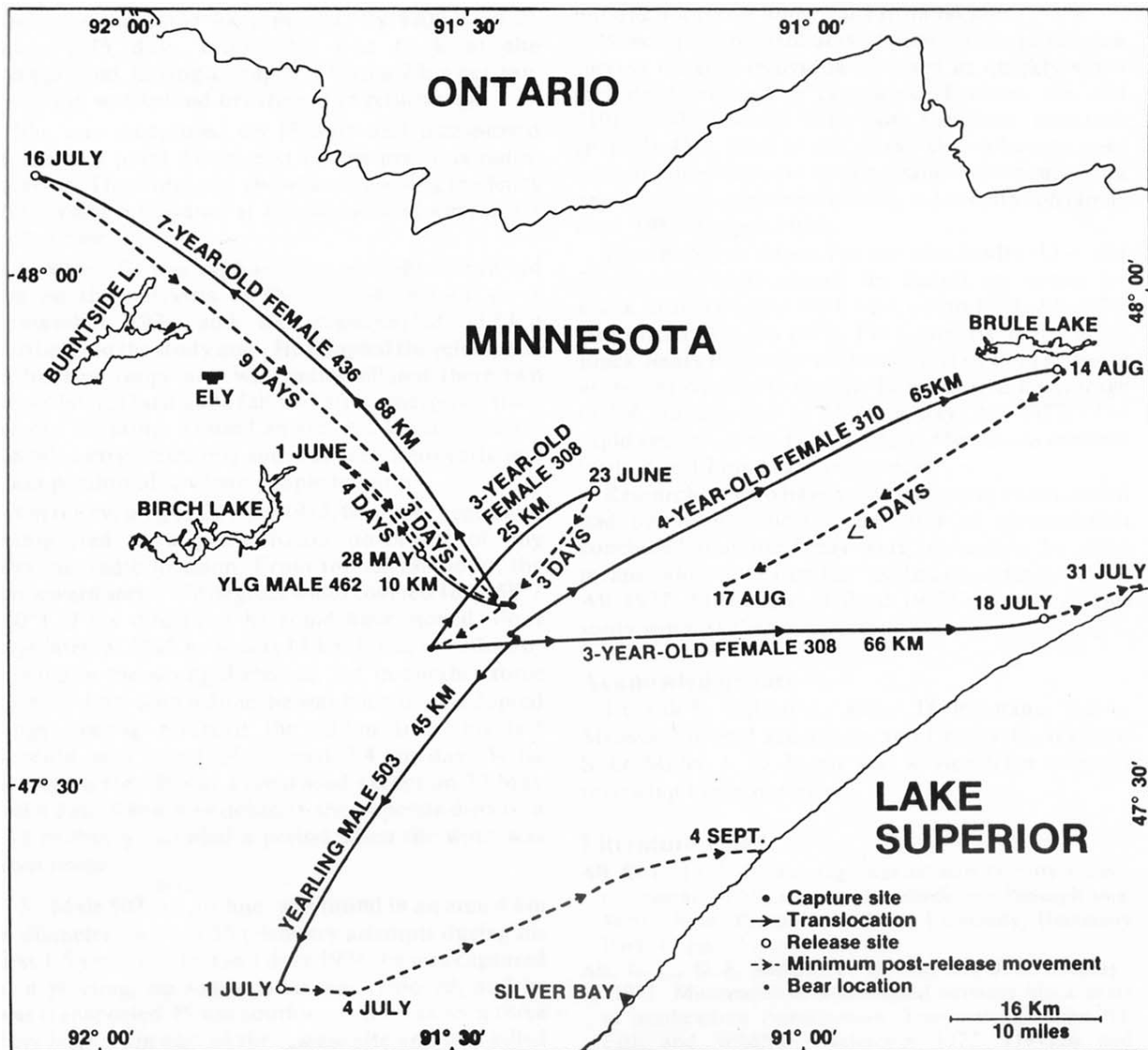


FIGURE 1. Movements of translocated Black Bears in northeastern Minnesota, 1972-1978.

3. Female 308, a littermate of Female 310, was also originally captured as a cub with her mother. She was recaptured and radio-collared as a two-year-old at the edge of her mother's territory on 30 June 1971. From then until she was translocated in June 1972, she was located by telemetry in each of 78 attempts. All those locations and all 43 locations for her mother (see account for Female 310) were in an area 10 km in diameter.

She became a nuisance at a campground and, on 23 June 1972, was captured, drugged, and transported unconscious 25 km to a point 21 km north of any previous radio-location. She had a year-old bullet wound that prevented her from straightening her right front leg. From the release point, the homeward sector (23 degrees wide) covered 6% ($23^\circ / 360^\circ$) of the directions she could have moved. By 1300 h on 26 June, 2.75 days later, she was back at the campground, having averaged at least 8.7 km per day. The wind was behind her the entire return trip.

She was recaptured on 18 July and transported 66 km to a point 61 km east of any previous radiolocation. That time, she showed no homing tendency and became a nuisance at a picnic area 11 km farther from home.

4. Male 462 was orphaned as an eight-month-old cub on the outskirts of Duluth, Minnesota, on 8 September 1972 and was transported 112 km northeast to the study area. He adopted the release site as his new range and was radio-collared there two weeks later. During the fall and after emergence from his den in spring, he used an area 4.2 km in diameter (28 telemetry locations) and was seen frequently in a 1 km portion of it where people fed him.

On the evening of 28 May 1973, he was drugged and transported to a point 10 km northwest of any previous radio-location. From the release point, the homeward sector (58 degrees wide) covered 16% ($58^\circ / 360^\circ$) of the directions he could have moved. Four days later, at 1615 h, he was 13 km farther northwest, moving in the wrong direction, but in another three days, by 1900 h on 4 June, he was back in his adopted range, having returned the 23 km from his last location at a speed of at least 7.4 km/day. Wind during his travels was a crosswind except on 30 May and 4 June when it switched to the opposite direction and probably included a period when the wind was from home.

5. Male 503, an orphan, was found in an area 4 km in diameter on 54 of 55 telemetry attempts during his first 1.5 years of life. On 1 July 1974, he was captured as a yearling, his radio-collar was removed, and he was transported 45 km southwest. He was seen three days later 9 km east of the release site and was killed

two months later 44 km farther east. He had moved 45 degrees off the homeward direction.

Discussion and Conclusions

The two adults (Females 310 and 436) showed good homing ability, moving quickly homeward from areas probably 60 km outside their familiar areas. The two yearlings (Males 462 and 403) moved long distances in nonhomeward directions, thereby showing poorer homing ability, as has been shown for young bears in other studies (Harger 1970; Alt et al. 1977; Harms 1980). However, when one of those yearlings, Male 462, eventually turned homeward, he traveled at a speed (7.4 km/day) approaching that of the adults. The crippled subadult (Female 308) was intermediate in that she homed quickly from 25 km but did not move homeward from 66 km.

Wind direction probably did not influence homing success because individuals homed as quickly when moving downwind or crosswind (Females 308 and 310) as when winds were from the home direction (Female 436). This is not to say that olfactory cues were not important for homing; wind-borne cues from any direction could conceivably aid orientation (Ioale et al. 1983; Rogers 1984).

The speeds of return for the two adults (11.4 and 7.5 km/day) were among the fastest on record for Black Bears (Harger 1970; McCollum 1974; Alt 1977; Gunson and Pipella 1977). For comparison, five adult Black Bears that were radio-tracked in Pennsylvania as they moved fairly directly home moved an average of 5.4 km/day (1.5 to 10.8 km/day; Alt 1977). The rapid returns of the two adults in Minnesota indicate fairly direct homeward movement.

Researchers who have studied homing by bears that had not been radio-tracked prior to translocation concluded that the bears were navigating by some means other than familiar landmarks (Harger 1970; Alt 1977; Miller and Ballard 1982). Results of this study support that conclusion.

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