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## Movements and Home Range of the Porcupine in Northeastern Oregon

### Abstract

Capture-recapture techniques and radio-telemetry were used in an investigation of porcupine (*Erethizon dorsatum*) movements and home range in a ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) forest in northeastern Oregon. Significantly ( $p < 0.05$ ) shorter movements in December to February as compared with April to July were related to seasonal changes in weather and vegetation. An average yearly home range size of 70.1 ha was found for two female porcupines radio-tracked from February through August. The maximum distance between recaptures was 525 m to 1156 m, which compares closely to the length of home range areas for porcupines radio-tracked during the study.

### Introduction

Porcupines frequently cause extensive silvicultural damage resulting in severe losses in young timber stands. Consequently most studies of porcupines have dealt with appraising damage to trees and controlling porcupine numbers. Little research has been reported on movements and behavioral patterns. The porcupine occupies a wide geographical range and occurs in many different vegetation types. Probably movements and behavior vary with habitat. This report discusses movements and home range in a ponderosa pine and Douglas-fir forest in northeastern Oregon.

### Study Area

Research was conducted on a 1500 ha area in the Heppner Ranger District of the Umatilla National Forest, located 60 km south of Heppner, Oregon. Detailed descriptions of the region can be found in Franklin and Dyrness (1973) and Hall (1973). The study site vegetation varied from sparsely scattered junipers (*Juniperus occidentalis*) with a bunchgrass (*Poa sandbergii*) ground cover to ponderosa pine and Douglas-fir stands with a groundcover of sedge (*Carex* sp.), strawberry (*Fragaria virginiana*), heartleaf arnica (*Arnica cordifolia*), pea (*Lathyrus* sp.), and snowberry (*Symphoricarpos albus*).

### Methods and Materials

Field work was conducted from June 1973 through August 1974. Porcupines were captured in a 20-gal plastic garbage can, weighed, and immobilized with phencyclidine hydrochloride (Sernylan: Parke, Davis and Company) and triflupromazine hydrochloride (Vetame: E. R. Squibb and Sons) at a dosage level of one mg per kg of body weight (Seal and Erickson, 1969). After immobilization each animal was measured and its sex was determined. Age was calculated using the dental-age correlation established by Kochersberger (1950) and Dodge (1967), which is based on eruption, replacement, and wear patterns of the cheek teeth. Numbered, color-coded, plastic discs were attached to the ears using aluminum self-piercing domestic livestock eartags (Hasco style #1-

851, National Band and Tag Company, Newport, Kentucky).

Capture-recapture techniques and biotelemetry were used to study movements and home range. A vehicle was driven in the evening hours on a 7.6 km route throughout the summers of 1973 and 1974 for a total of 68 trips. Porcupines seen in the headlights were identified if previously captured, and processed if new animals. One hundred eighteen porcupines were captured one or more times during the study for a total of 231 captures.

An additional 32 porcupines were captured between December 1973 and August 1974 in a separate radio-tracking study area. Nineteen of these animals were observed two or more times for a total of 67 observations. Six porcupines were tagged with radio transmitters as described by Marshall *et al.* (1962) and were tracked intensively for a total of 495 animal-days. Tracking was from February through August 1974 and the number of tracking days per animal varied with capture date and telemetry capabilities. Fixes were plotted on tracing paper overlays from aerial photographs, and home range areas were measured using a portable area meter (model L1-3000, Lambda Instrument Corporation). Geometric centers of activity were determined using the method of Hayne (1949). Activity radii (Dice and Clark, 1953) were calculated from these geometric centers of activity. In this study all areas of porcupine activity were included within the home range boundaries. Feeding behavior was observed visually and was compared to feeding behavior reported in the literature.

### Results and Discussion

Average distances for the move from one day's resting location to the next day's location are given in Table 1. Distances reported are for the linear distances between the locations and are not necessarily distance traveled by porcupines. Porcupines usually did not move in straight lines as observed by tracks in the snow, but in meandering routes which were often two or three times as long as the linear distance between successive resting locations. An analysis of variance (among months;  $df = 9$ ,  $MS = 4936435.5$ ; within months;  $df = 136$ ,  $MS = 639147.4$ ) is significant at the  $p = 0.05$  level. Computation of the least significant difference shows that movements during December to February are different ( $p < 0.05$ ) from movements during April to July. Seasonal changes in weather and food availability appear to control the extent of porcupine movements. From August through February porcupines fed on the needles and the inner bark of trees. Rain and snow storms decreased movements as animals sought shelter either in trees or dens. Such was the case for January and February when individuals were ob-

TABLE 1. Average distances between daily resting locations for porcupines in northeastern Oregon.

Month	Number of observations	Distance in meters
November	1	181
December	8	100
January	15	34
February	10	80
March	4	234
April	12	328
May	25	442
June	38	360
July	3	370
August	30	246

served to remain in the same tree for as long as 16 days. Similar behavior was observed by Hoffer (1967) in a northern California pine-juniper forest and by Brander (1973) in a Michigan hardwood-hemlock forest. Porcupine movements gradually increased in the spring as the diet switched from bark and needles to succulent ground vegetation. Ground vegetation composed the bulk of the diet with the porcupines moving every night searching for favored foods until hot weather in July caused the vegetation to dry out. When this event occurred, porcupines gradually resumed feeding on tree needles and bark and their movements decreased.

Home range variables for six porcupines are given in Table 2. Areas vary greatly according to the method used to calculate home range size. The minimum area method (Mohr, 1947) connecting the outermost location points is the least conservative method, and it incorporates areas in which individual animals never were seen. The habitat type minimum area method is based on my analysis of the plant community boundaries and on the locations for an individual animal in relationship to those boundaries. Instead of connecting the outermost location points with straight lines, I followed the boundaries of the plant communities in which the movements occurred. I believe this method is a more accurate determination of the size and shape of the home range area because my data from the intensive radio-tracking study indicate that individual porcupines remain closely associated with particular plant communities. This method is similar to the atypical-habitat elimination method of Ables (1969).

TABLE 2. Home range variables for six porcupines in northeastern Oregon.

	1	2	3	4	5	6
Age	Juv.	Adult	Adult	Adult	Adult	Adult
Sex	Male	Female	Female	Female	Female	Female
Date instrumented	10 Jan 74	2 Feb 74	22 Feb 74	5 Apr 74	5 May 74	8 Jun 74
Date radio package removed	31 Jan 74	6 Mar 74	7 Jul 74	27 Aug 74	27 Aug 74	27 Aug 74
Number of days instrumented	22	33	136	145	115	81
Area in hectares						
Minimum area (Mohr, 1947)	3.9	8.1	28.8	80.8	82.1	22.6
Modified minimum (Harvey and Barbour, 1965)	a	a	a	39.1	66.8	a
Circle from mean activity radii (Dice and Clark, 1953)	3.1	13.8	19.5	23.0	65.6	17.1
Habitat type minimum area	a	a	a	62.5	77.8	15.4
Distance in meters						
Maximum length	274	399	747	1241	1463	792
Maximum width	174	337	671	937	722	512

a—unable to calculate

Porcupine No. 1 used an area of 3.9 ha during three weeks in January and porcupine No. 2 used 8.1 ha in February. In January and February movements were short and the animals often remained stationary for several days. No. 3 was radio-tracked from late February through early May. During this period weather conditions improved and porcupine movements increased. No. 4 and No. 5 were instrumented in the spring season and they demonstrated the trend toward a further increase in home range area into the summer season. Their cumulative home range sizes were likely at or near maximum size. Although radio-tracking was halted at the end of August, ranges would not have in-

creased appreciably before cold weather decreased overall movements. No. 6 was tracked from June through August. Her movements tended to be shorter than those of either No. 4 or No. 5 for the same period. All three females had young; however, the fate of the offspring of No. 4 and No. 5 was unknown. The young of No. 6 could be found close to its dam throughout the summer. The young tended to move in loose association with its dam and often the two were separated by only a short distance. Similar behavior was reported by Marshall *et al.* (1962).

Porcupine recaptures along a 7.6 km route aided in the determination of home range size. The maximum distances between captures for 51 porcupines recaptured along the route (total of 112 recaptures) are summarized in Table 3. The range in average maximum distance between summer captures of 525-1156 m (Table 3) compares closely to the range of 512-1463 m (Table 2) for the maximum width and length of home ranges determined by radio-tracking during spring and summer.

TABLE 3. Average maximum distance (m) between summer captures for 51 porcupines along a 7.6 km route in northeastern Oregon.

Number of captures/animal	Number of animals in sample	Average maximum distance between captures	Extremes of average maximum distance between captures
2	26	525	0-2119
3	11	858	337-2131
4	4	662	369-1188
5	4	1131	546-1717
6	2	802	642-1173
7	3	1140	385-2632
9	1	1156	

These movement data appear very similar to those recorded by Dodge and Barnes (1975), but larger than those reported in most other studies. Dodge and Barnes (1975), in a western Washington Douglas-fir forest, found an average daily movement of 273 m and an average range of 81.2 ha (minimum area method) for females radio-tracked 10 to 13 months. This finding is similar to the yearly average movement of 238 m and to the 80.8 and 82.1 ha ranges for porcupines No. 4 and No. 5, respectively, which I tracked in northeastern Oregon. Brander (1973) reported an average summer daily movement of 150 m; Marshall *et al.* (1962) reported average movements during late May through early July of 111 m and 129 m, from dusk to dawn, and 81 m and 80 m, from dawn to dusk, for two adult females. These movements for porcupines in Michigan hardwood-hemlock forests were much less than those I found in Oregon. The average distance of 446 m between captures for summer months reported by Randall (1971) in mixed shrub-pine vegetation in Nevada was smaller than that within my study area (Table 3). In a pine-juniper forest in northern California, Hoffer (pers. comm.) found an average summer movement of 144 m. He believed reduced movement occurred because animals were feeding in alfalfa fields. His figures for winter months (65 m) are similar to those I found.

Porcupine movements apparently are influenced strongly by habitat and vary from one area to another. Porcupines in eastern and midwestern hardwood-hemlock forest appear to occupy separate summer and winter ranges and tend to concentrate at denning

areas or areas of prime habitat (Dodge, 1967). Winter movements are reduced; animals only leave the shelter of dens to feed in nearby trees. Shapiro (1949) reported an average distance of 131 m between captures in New York, and Dodge (1949) reported 91 m in Massachusetts. Krefling *et al.* (1962) in Wisconsin found an average of 829 m between summer captures and winter recaptures. Dodge (1967) found six animals traveled an average of 1500 m from winter captures to summer recaptures. Such seasonal shifts in home range did not occur in my study area. Similar findings were reported by Dodge and Barnes (1975), Hoffer (1967), and Randall (1971) in other western forests.

Porcupines appear to maintain home range areas in successive years. Ten animals tagged the summer of 1973 and recaptured the summer of 1974 in this study had maximum distances between captures averaging only 722 m (Table 4). Similar results have been found in other studies. Krefling *et al.* (1962) recaptured two animals, tagged two years previously at winter feeding areas, an average distance of 100 m from their original capture sites. Randall (1971) had an average recapture distance of 536 m for 12 porcupines captured one summer and recaptured the next. Brander (1973) found an average distance of 699 m between capture sites for four porcupines recaptured after 1-10 years.

TABLE 4. Ten porcupines captured the summer of 1973 and recaptured the summer of 1974 along a 7.6 km route in northeastern Oregon.

Animal number	Original capture date	Days since 1st capture	Number of captures/animal	Maximum distance between captures (m)
7	7 Aug 73	382	4	369
8	15 Aug 73	334	2	449
9	16 Aug 73	369	4	722
10	16 Aug 73	343	2	353
11	19 Aug 73	315	2	0
12	19 Aug 73	346	2	369
13	21 Aug 73	313	2	225
14	25 Aug 73	310	2	449
15	28 Aug 73	374	7	2632
16	3 Sep 73	355	3	1653

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