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EXTRATERRITORIAL MOVEMENTS AND DISPERSAL OF WOLVES IN SOUTHCENTRAL ALASKA

Wolf (*Canis lupus*) packs consist of family groups of 2 to 20 or more individuals that occupy and vigorously defend a common territory (Mech, 1970; Van Ballenberghe et al., 1975; Peterson, 1977). The entire pack may briefly leave its territory during times of food shortage but such events are rare; contacts with other wolves during such forays are typically violent and occasionally fatal (Wolfe and Allen, 1973; Mech, 1977). In addition, individuals may temporarily leave their pack's territory and some may disperse, but the nature and extent of such movements and the events that precede them are poorly documented. This paper describes the movements of seven adult and yearling wolves that individually engaged in extraterritorial movements or dispersal and documents three instances of temporary or permanent association between individuals and members of alien packs.

Ten adult and yearling wolves from four packs with contiguous territories were radiocollared beginning in mid-April 1975 in the Nelchina Basin (62°N, 146°W) of southcentral Alaska. These and several other pack members followed for brief periods were radiotracked and observed from airplanes (Mech, 1974) for periods up to 16 months postcapture. Territory boundaries were defined by the minimum area method (Mohr, 1947) after plotting the locations of the instrumented wolves and their associates (Fig. 1). Obvious trespasses by packs were excluded from this analysis. Several months of observations totalling more than 80 locations per pack were necessary to identify territory boundaries because year-long territory size was relatively large (Table 1). Other wolf packs that inhabited territories adjacent to the study packs were identified by a combination of radiocollaring and random observations of wolves and wolf signs. The entire area was known to be saturated with territory holders, but pack size and wolf density varied greatly from pack to pack and among years.

Only three of 10 collared wolves were not known to venture from their pack's territory. Two of these included the alpha male and an adult female of a cohesive group of wolves that numbered up to 20 during the last winter of study. This pack, the Sinona wolves, seldom split during winter and had access to a much larger concentration of moose (*Alces alces*) than did the other packs. No trespasses into adjacent territories by this pack were observed. However, on 17 May 1976 a young adult male of this pack was radiolocated about 13 km southeast of the edge of the Sinona pack's territory (Fig. 1) in the territory of a nonradioed pack. When next located on 25 May he had rejoined the pack and was consistently associated with it until early 1977 when aerial hunters reduced the pack to two members.

A second radiomarked pack, the Hogan Hill wolves, included a young female that made one short foray about 6 km beyond the territory boundary. On 25 February 1976 she and two other pack members trespassed into the territory to the Sinona pack which was then about 17 km away in the center of its territory. The collared female returned to and remained part of the Hogan Hill pack until at least 19 November 1976 when her radiocollar failed.

The Hogan Hill pack also contained a young adult male that was with the pack on 27 consecutive locations between early November 1975 when he was collared until late February 1976 when the pack trespassed about 8 km west into the territory of a nonradioed pack. Here, they consumed the carcass of an adult moose near which the collared male was snared and released alive by a local trapper. He recovered completely and on 8 March and 12 March this wolf was seen travelling with a collared young adult female of the Keg Creek pack. They were within the Hogan Hill pack's territory but near the common boundary of the two packs (Fig. 1). Each collared wolf subsequently returned to its pack; the male was consistently part of the Hogan Hill pack between 16 March and 16 April. Between 17 April and 30 September this wolf was not located within the Hogan Hill territory except for two brief occasions in mid-May and early September when he returned and was observed at moose kills with two associates. On 1 October 1976 and 25 March 1977 he was located about 58 km northeast of the edge of the Hogan Hill territory, but in the interim he returned briefly to the territory on 22 December 1976 when he was seen with three associates. He was also observed with four associates on 29 December deep within the territory of the Keg Creek pack. During his absences from the Hogan Hill territory, aerial searches for this wolf were frequent; it is very unlikely that he was present nearby but undetected. The extraterritorial locations of this wolf in October 1976 and March 1977 were within the territory of a nonradioed pack; he was accompanied by one wolf of unknown affiliation in this territory at his last location in March 1977.

The Keg Creek collared female that associated with the Hogan Hill male in March 1976 ultimately

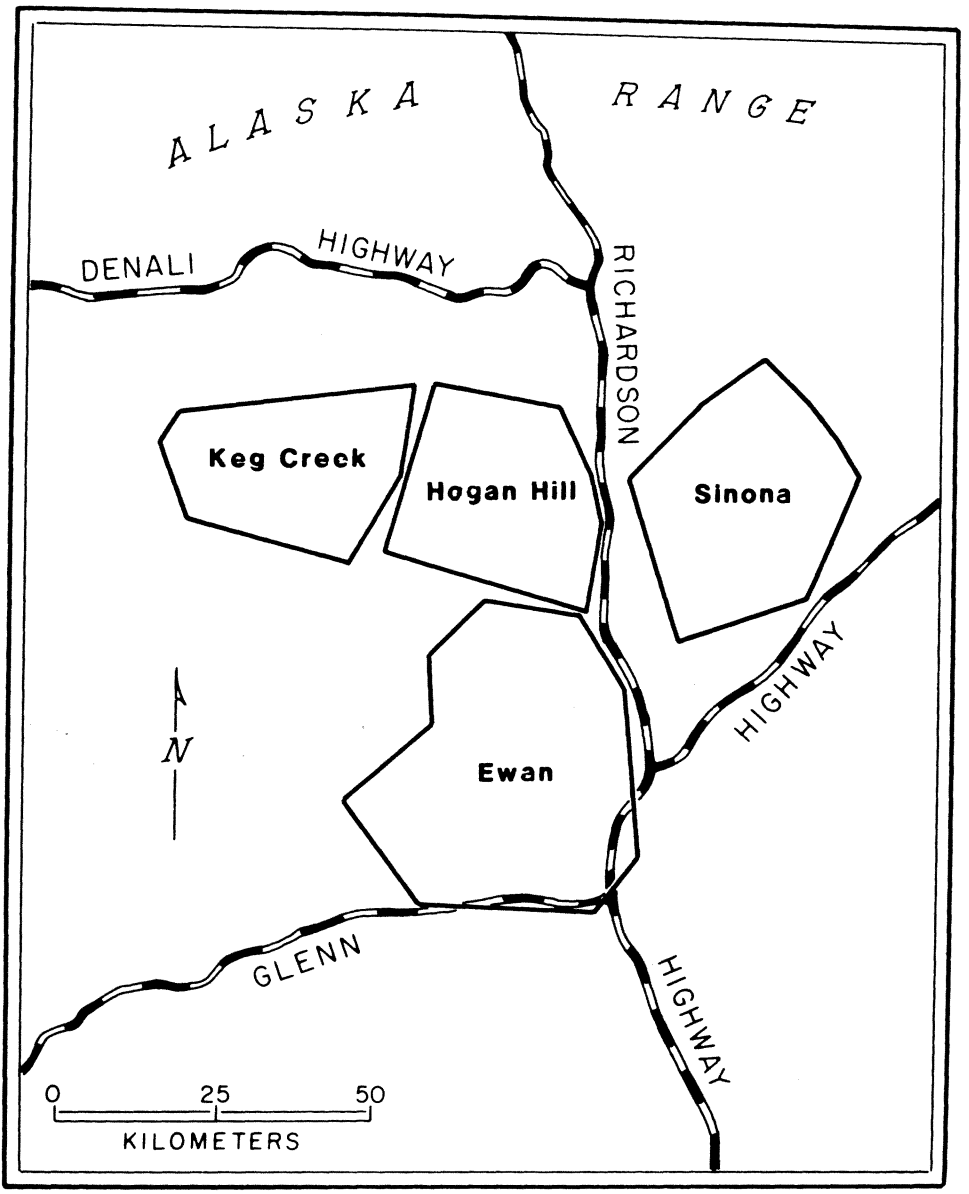

FIG. 1.—Spatial relationships of four wolf pack territories in the Nelchina Basin of southcentral Alaska.

dispersed and occupied a territory west of the Keg Creek territory. Prior to her brief association with the collared male she was observed with the Keg Creek pack on 36 of 47 occasions over a 10 month period. She was with the pack on 7 of 10 occasions between late March and late May, but was 56 km from the edge of the pack's territory on 22 April within the territory of a fourth radiomarked pack known as the Ewan wolves. Dispersal occurred in late May into an area left vacant by removal of a pack five months previously by the Alaska Department of Fish and Game during an experimental wolf control program. This collared female and a young male associate were shot in July 1976 in their newly established territory of 816 km^2 (Ballard et al., in litt.).

TABLE 1.—*Characteristics of four radiomarked wolf packs in the Nelchina Basin, south-central Alaska.*

Pack name	Locations used to construct territory boundaries		Territory size (km^2)	Mean early winter pack size
	Number	Extremedates		
Sinona	155	20 Apr 75–3 Feb 77	1,222	12.7
Hogan Hill	88	6 June 75–19 Nov 76	1,235	7.0
Keg Creek	89	19 Apr 75–16 Dec 76	979	9.3
Ewan	83	16 Apr 75–25 Feb 76	1,693	8.0

A young adult male of the Keg Creek pack also dispersed after being found with the pack on 40 of 42 occasions between May 1975 and early January 1976. Intensive searches failed to locate him between 12 January and 22 January, but he was again with the pack on 29 January and 2 February 1976 after which radio contact with him was lost. In April 1977 this wolf was recaptured as part of a pack of seven wolves that included a young collared female that had dispersed from the Ewan pack in February 1976 (Ballard et al., in litt.). The new pack's movements were centered about 55 km south of the edge of the Keg Creek territory.

Prior to her dispersal, the Ewan female was regularly part of the Ewan pack from mid-April to early October 1975. Between mid-October and early November she moved through the Keg Creek territory and that of at least two other nonradioed packs, travelling northwest as far as 58 km from the edge of the Ewan territory. She returned to her territory but did not accompany the Ewan pack when it trespassed 18 km into the Hogan Hill territory in early December. The collared female was with 1 to 2 Ewan pack associates on 23 of 25 occasions from December 1975 to late February 1976 when she permanently left the Ewan territory. In early May 1976 she was located west of the Ewan territory and was accompanied by four associates including two black-phase wolves that no Ewan wolves had been observed with during the preceeding year. The territory edges of the Ewan pack and the collared female's new pack were separated by about 14 km with a third, small, nonradioed pack present in the intervening area. The Ewan female remained with the new pack through at least October 1976 and the Keg Creek male remained with it through two breeding seasons until the pack was eliminated by aerial hunters in February 1978 (Ballard et al., in litt.).

The Ewan pack included an old adult male that travelled extensively throughout the territories of other packs following his capture in early November 1975. On 25 November he was 64 km west of the Ewan territory boundary but returned to the pack by 11 December and was observed with them for one week. On 6 January 1976 the remains of this wolf were found 18 km south of the Ewan territory boundary in the territory of a nonradioed pack that killed and consumed him.

These observations suggest that temporary extraterritorial movements of wolves are common in this area of Alaska. Wolf pack were no less territorial than those studied in other areas of North America, but individual pack members appeared more prone to leave their territories than wolves elsewhere. This may be due in part to larger territories in Alaska resulting in reduced boundary activity of residents and fewer repelling stimuli for intruders (Peters and Mech, 1975).

Extraterritorial forays showed no strong seasonal pattern but few were documented during summer when all collared wolves but one were associated with their packs' den sites. However, the frequency of such associations varied greatly among wolves. The tendency of certain wolves to remain apart from most other pack members within the territory or to spend prolonged periods out of the territory during all seasons increased the difficulty of accurately determining pack size and composition. For example, the Hogan Hill pack consistently contained seven adults and yearlings from summer through early winter 1975, but on one occasion in early August nine nonpup wolves were observed at the pack's rendezvous site.

Four wolves that ultimately dispersed permanently during this study showed a common pattern of one or more preliminary extraterritorial trips followed by a return to the territory and integration back into the pack. Acceptance of these wolves by the pack occurred despite absences as long as 15 weeks. Because few areas were devoid of territory holders, dispersing wolves generally travelled through and ultimately settled in areas used by alien packs. This pattern differed from most of the dispersals documented by Fritts and Mech (1981) wherein young wolves generally left their territories permanently in autumn, settled in areas not occupied by resident packs, and often became breeders. The Minnesota population, however, was not saturated and formation of new packs was an important component of its dynamics.

The tendency of wolves to return to their territory following a pre-dispersal foray may result from their failure to quickly find receptive aliens or suitable vacant areas. Wolf-free areas appeared only when humans eliminated packs, and most intact packs were probably hostile to nonmembers. Dispersing wolves would therefore have a low probability of quickly encountering suitable conditions and would be forced to either continue searching or return to their original territory before departing permanently. Under these constraints, wolves would be expected to frequently move long distances during dispersal in order to encounter areas they could permanently occupy.

While pair formation by dispersing wolves seems well documented (Rothman and Mech, 1979; Fritts and Mech, 1981) the acceptance of one or more non-related wolves by an established pack or temporary assocations of alien pack members that subsequently return to their respective packs are well documented only by the present study. Rothman and Mech (1979) discussed one case where the alpha female of a pack containing no other adult females died and was replaced by a female loner. However, the history of the loner was unknown; conceivably she could have been a loosely associated pack member or could have returned to the pack after a lengthy absence. Fritts and Mech (1981) recognized this possibility for three similar cases they witnessed. It is probably significant that the instances described here involving brief associations of alien wolves and integration of individuals into an established pack all occurred during or near the breeding season.

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TWO LITTERS RAISED IN ONE YEAR BY A WOLF PACK

Wolf (*Canis lupus*) packs typically produce only one litter per year even if several sexually mature females are present. Among 20 packs studied from 1 to 8 years in northeastern Minnesota, none produced more than a single litter per year (Packard and Mech, 1980). Only one or two of about 12 females bred each year at Isle Royale, Michigan (Wolfe and Allen, 1973). Packard and Mech (1980) concluded that extra litters probably fail to survive; indeed, Peterson (pers. comm.) observed in Alaska that a litter of seven born to a subordinate female 30 km from the pack's main den apparently all perished by mid-August.

Nevertheless, records exist of attempted breeding or pregnancy in more than one female in a wild pack (Jordan et al., 1967; Rausch, 1967; Peterson, 1977) and one published account describes the survival of two