

Howling at two Minnesota wolf pack summer homesites

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Howling sessions were monitored at two Minnesota wolf pack homesites for 2255 h between 29 April and 3 August 1973. All sessions recorded occurred from dusk through early morning, with an evening peak for one pack. Within a night, multiple sessions were grouped temporally, most occurring within an hour of one another. Howling rates for both packs increased throughout the homesite season, with the larger pack howling twice as frequently. The role of howling in both intrapack and interpack contexts was considered. Much of the howling seemed to be involved in the coordination of pack activities. Further, the low frequency and clumped temporal distribution of sessions suggest that howling plays a secondary role in interpack contexts to other modes such as scent marking during the homesite season, but may increase in relative importance once homesites are abandoned and pack travel becomes nomadic.

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Les sessions de hurlements ont été enregistrées pendant 2255 h en deux territoires de bandes de loups, entre le 29 avril et le 3 août 1973. Toutes les sessions avaient lieu du crépuscule au petit matin et comportaient, chez l'une des bandes, un sommet d'intensité durant la soirée. Lorsqu'il y avait des sessions multiples au cours d'une même nuit, elles étaient regroupées dans le temps, l'intervalle entre deux sessions étant ordinairement de moins d'une heure. Les taux de hurlements des deux bandes ont augmenté durant toute la saison d'occupation des territoires, la bande la plus importante hurlant deux fois plus souvent. On a examiné le rôle des hurlements dans le contexte "intra bande" et dans le contexte "inter bandes." Une bonne partie des hurlements semble servir à la coordination des activités des bandes. De plus, la fréquence peu élevée et la répartition contagieuse des sessions dans le temps semblent indiquer que les hurlements jouent un rôle secondaire dans les relations interbandes comparativement à d'autres modes, comme le marquage par odeurs, durant la saison d'occupation des territoires; l'importance relative des hurlements peut toutefois augmenter lorsque les territoires sont abandonnés et que les bandes deviennent nomades.

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Introduction

[Wolf (*Canis lupus*) howling can play an important role in territory maintenance through advertisement (Harrington and Mech 1978b). This conclusion was based on an experimental study, analyzing the responses of free-ranging, radio-collared timber wolves to simulated wolf howling (Pimlott 1960). However, the relative value of howling vis-à-vis scent marking (Peters and Mech 1975), the other major territory maintenance system in forest habitats (Harrington 1975), cannot be determined until a pack's rate of howling is known. This rate will indicate how often howling can

mediate interpack interactions.] With a finer knowledge of howling's role in spacing, its possible use as a 'natural' management tool can be evaluated, especially in areas where protected or desired wolf populations abut and occasionally come into conflict with human settlements.

Currently, data on howling rates are scanty, and come primarily from captive studies (Klinghammer 1978; Zimen 1971, 1976), where man-made sounds are often a source of stimulus. Some howling data from wild wolves have been reported (Voigt 1973; Peterson 1974; Carbyn 1975), but because they were collected unsystematically, they do not adequately describe howling rates. Therefore the present study sought to determine the rate of howling, and its relation to seasonal, diurnal, and pack factors. Because it was not possible to monitor

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howling in packs throughout their nomadic fall-winter period, when travel throughout the territory is extensive and rarely site restricted (Ognev 1962; Mech 1970), we monitored the packs while they were restricted by young to specific homesites (dens and rendezvous sites) (Murie 1944; Joslin 1967).

Methods

Summer homesites (HS) of the Jackpine (JP) and Harris Lake (HL) packs in northern Minnesota were monitored between 29 April and 3 August 1973. Both packs have been subjects of a long-range, population dynamics - behavioral ecology study (Mech 1973, 1977a, 1977b) and Harrington and Mech (1978b) provided background on the study area and pack histories). During the current phase of the study, the JP pack consisted of three adults, two or three yearlings, and six pups, occupying a 270-km² territory adjacent to the smaller HL pack, which consisted of two adults, one or two yearlings, and two pups, occupying a 160-km² territory. Both packs' territories were surrounded by several others.

Howling was monitored automatically by modified U.S. Navy sonobuoys placed within 200-400 m of the HS. An omnidirectional microphone (Realistic 'Highball 2') replaced the original sonobuoy hydrophones, and in calm air could detect human howling from up to 3.2 km. Audio output was relayed to a field station 9 km from one HS and 18 km from the other, monitored by a Lafayette 'Micro-P' 148- to 174-MHz receiver, and recorded continuously on a Sony TC-353 stereo deck. Over 6 h of recording time was possible using 0.5-mil tape (7-inch reel (1 inch = 25.4 mm)) recorded at 4.8 cm/s. The recordings were scanned for howling at 38.1 cm/s on a Nagra IV-D tape recorder. Once howling was heard, pack and time could be determined by channel and tape count on the Sony.

Two types of howling were noted: single and group. During a bout of howling, a single wolf usually howled about once every 10 s (Harrington and Mech 1978a). Thus a single session was considered terminated if more than 1 min of silence followed a single howl. Group sessions were generally started by one or two single howls, with other animals joining immediately. Throughout the remainder of a session, several animals usually howled concurrently. Short pauses sometimes occurred, but these were generally less than 10 s long. We considered that 1 min of silence signaled the end of a group session.

Results

Two HL pack HS's were monitored for 1453 h between 29 April and 3 August, and 45 howling sessions were recorded. Only 203 h was monitored during the first month, but after 29 May, 79% (1249 h) of the time was monitored. Between 2000 and 0900 hours (CDT), when all sessions were recorded, 89% (752 h) of the time was monitored.

Two JP pack HS's were monitored for 802 h between 9 June and 20 July, with 32 howling sessions recorded. Between 2100 and 1100 hours, when all howling was recorded, 91% (522 h) of the time was monitored.

Diurnal Occurrence of Howling

All sessions recorded occurred from dusk through early morning (Fig. 1). A major peak in

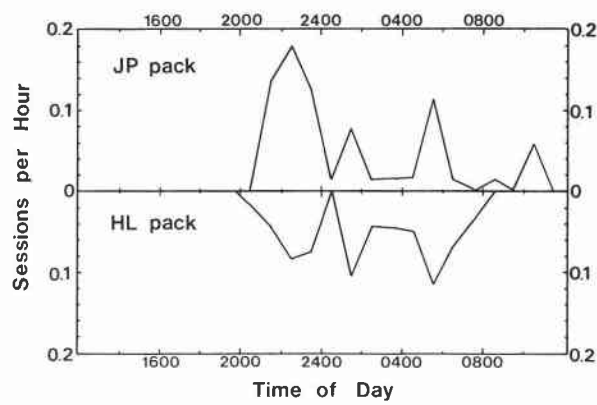


FIG. 1. Rate of howling as a function of time of day for two Minnesota wolf packs. (Rate expressed as number of sessions per total hours monitored.)

howling frequency occurred in the evening for the JP pack; this peak, as well as two smaller ones, were also evident in the HL pack. However, this correspondence in peak howling times does not reflect vocal interaction between the two HS's; the HS's were 10 km apart, at the probable maximum range of howling in forest habitats (Harrington and Mech 1978b), and howling sessions at the two HS's never occurred at the same time and only rarely occurred on the same night.

During 12 nights, there was only one session per night. On the other 15 nights that howling was noted, we recorded from 2 to 14 sessions per night (median = 4). Sessions each night tended to be grouped (Fig. 2). A high proportion of sessions followed within 15 min of previous ones, and over 80% of these subsequent sessions occurred within 1 h after other howling sessions. Thus howling was recorded during only 16 of 75 nights (21%) for the HL pack and 11 of 41 nights (27%) for the JP pack.

Seasonal Occurrence of Howling

Howling increased throughout the HS season

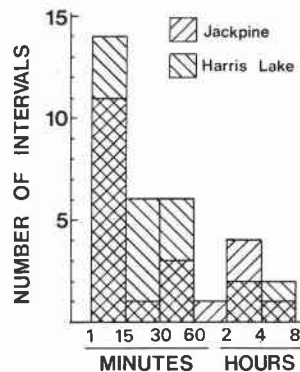


FIG. 2. Length of time interval between adjacent howling sessions occurring during the same night.

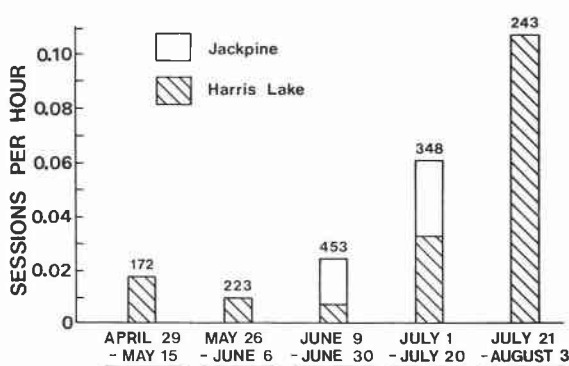


FIG. 3. Seasonal changes in howling rate. The number of hours monitored for each pack appears above each period. The Jackpine pack was only monitored between 9 June and 20 July.

TABLE 1. Howling rate as a function of number of adults per pack

Pack	No. of adults ^a (year)	Howling rate	
		Sessions per night	No. of nights
Algonquin Park, Ontario, Canada ^b			
Source Lake	5 (1967)		
	4 (1968)	0.152	112
	3 (1969)		
Opeongo Lake	5 (1967)		
	5 (1969)	0.538	26
Fool's Lake	6 (1968)		
	6 (1969)	1.229	57
Superior National Forest, Minnesota (present study)			
Harris Lake	3 or 4 (1973)	0.366	41
Jackpine	5 or 6 (1973)	0.780	41

^aIncludes yearlings.
^bVoigt (1973).

for both packs (Fig. 3). During the first 2 months, the HL pack howled about once per 100 h monitored. During July the rate increased, and by early August, when the HS was abandoned, the pack howled about once every 10 h monitored. Although the JP pack was monitored for only 6 weeks, its howling frequency doubled during that period to about one session per 20 h by mid-July.

When both packs were monitored simultaneously, the JP pack howled twice as often as the HL pack (Fig. 3). Because many sessions tended to be grouped within an hour (above), such groupings were labeled 'bouts.' Howling bouts were twice as common for the JP pack (17 vs. 9).

Discussion

Voigt (1973), Peterson (1974), and Carbyn (1975) reported howling to be more common at night in the HS season, and our results confirm their findings. Peterson (1974) also reported a major evening peak in howling rate and suggested that it was associated

with adult departures from the HS. Two of the three group howls reported by Murie (1944) occurred shortly before adults departed to hunt. We also found an evening peak in howling rate (Fig. 1). On the other hand, Carbyn (1975) reported a major peak in howling between 0400 and 0600 hours, when 60% of all group sessions occurred. Interestingly, both Minnesota packs studied had secondary howling peaks between 0400 and 0700 hours, suggesting that, as Carbyn noted, "this time period was important in the activity pattern of the pack" (Carbyn 1975, p. 56).

Of the howling heard near an Isle Royale HS, 45% included wolves howling away from the site (Peterson 1974). The howling of the distant wolves often stimulated replies from animals at the HS. In some cases, the distant animals returned shortly to the HS. Thus the peaks in howling throughout the night are evidently associated with adult departures and arrivals. In addition, howling at HS's may also reflect vocal interactions with pack adults traveling near the sites.

No previous studies have reported a seasonal increase in howling frequency, although Joslin (1967) did observe an increase in elicited (human stimulated) howling during the same season. He and Voigt (1973) both believed that this increase reflected increased pup responsiveness. During the present study and a related one (Harrington 1975; Harrington and Mech 1978b), we noted that in July pups began howling with increasing frequency; thus they may be responsible for much of the seasonal increase, although an adult influence (Joslin 1967) cannot be entirely discounted at present.

Differences in howling rates among packs were also reported by Voigt (1973). Howling rate may be positively correlated with the number of adults per pack (Table 1). Since adults generally travel singly or in small groups during the HS season (Joslin 1967; Mech, unpublished results), the probability of adult departures, arrivals, and interactions with HS animals would increase with pack size. Thus higher howling rates of larger packs may simply reflect the greater number of wolf 'units' traveling at a given moment.

Howling evidently serves several functions within and among wolf packs (Joslin 1967; Mech 1970; Harrington and Mech 1978a). As discussed above, it plays a role in intrapack communication, especially in expediting and coordinating events such as departures, reunions, or movements (Peterson 1974; Harrington and Mech 1978a). The progressive increase in howling during summer may reflect an increasing need for long-range, intrapack communication as pups become more

mobile, and packs begin the gradual abandonment of their predictable HS locations. The long distances traveled nightly after HS abandonment will place a further premium on effective pack coordinating mechanisms. Therefore, one would expect that the howling rate will remain high, or even increase, during the fall-winter nomadic period.

At the same time, howling can also mediate interpack communication, primarily involving the avoidance of one pack by another (Harrington and Mech 1978a, 1978b). In this regard, pack howling before adults depart from a HS could play two roles. First, it could advertise the resident's location so that strange wolves traveling nearby might avoid the HS and its defense. Second, replies to pack howling could advise the residents about an area to be avoided, or, if the intruders are close to the HS (Joslin 1967), of an area to be approached defensively. Then throughout the night, howling by single wolves away from the HS could further reduce their chances of accidentally encountering a stranger.

To be maximally effective amongst packs, vocalizations should have long ranges, and howls do (Joslin 1967; Harrington and Mech 1978b). But in addition, they should be uttered frequently and spontaneously (Marler 1968). However, during this study we noted that each pack howled on only about 25% of the nights. Even when they howled it was either only once or in fairly tight, temporal bouts. Thus the infrequent and sporadic nature of the howling we recorded suggests that it was not being used as effectively as possible for interpack communication, at least during the HS season.

Pack travel changes radically from radiating movements away from summer HS's to long-distance, nomadic travel (primarily within the established territory) once HS's are abandoned (Ognev 1962; Mech 1970). During the HS period, the pack's location is fairly predictable, the amount of trespassing is low (Mech, unpublished results), and the degree of scent marking on major routes to the HS is high (Peters and Mech 1975). Therefore strangers rarely intrude, and when they do, they probably encounter scent marks well in advance of the HS. Thus howling would not likely be of much importance as an additional warning against intrusion.

However, during the entire nomadic period nightly locations are largely unpredictable. In addition, if prey have become scarce, trespassing may increase at this time (Mech 1977b). Thus scent marking during this season has limitations, especially when packs simultaneously approach an area of territory overlap (Peters and Mech 1975) or are

trespassing, because scent marks provide little immediate or future information about pack locations. Therefore, a means of immediate advertisement, such as howling, could be highly important. In this context, the rate of howling increased 10-fold during the study, and since our observations terminated a month before most HS's were abandoned, further increases might be expected.

Thus, from both intrapack and interpack considerations, we expect the howling rate to remain high, and probably increase, during fall and winter. Only further study will determine this conclusively.

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