

SOME CONSIDERATIONS CONCERNING FEMALE MOOSE CALLS DURING THE RUTTING PERIOD

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ABSTRACT: Between August 15 and October 31, 1984, in the Parc de la Jacques-Cartier, up to 53 female moose (*Alces alces*) calls were heard daily. These calls peaked at the end of September and beginning of October. The majority of calls heard when moose were visible, were emitted by females who appeared to run away from males. We suggest that female vocalizations to attract males, are not as useful in high densities as at low densities. Also, we suggest that females were in a post-estrous period and no longer available for mating when heard.

Key words: behavior, call, moose, rutting period, vocalization

RÉSUMÉ: Sur une base journalière, un total de 53 originales (*Alces alces*) ont été entendues dans le Parc de la Jacques-Cartier, entre le 15 août et le 31 octobre 1984. Le pic des vocalisations entendues est survenu à la fin septembre et début octobre. Contrairement à ce qui est généralement rapporté dans la littérature, la majorité des vocalisations entendues, lorsque les orignaux étaient visibles, l'ont été alors que les femelles semblaient fuir les mâles. Nous suggérons que les vocalisations émises par les femelles pour attirer les mâles ne sont pas autant nécessaires en forte densité qu'en faible densité. Nous émettons l'hypothèse que la majorité des vocalisations ont pu être émises en période post-oestrus. La notion voulant que les vocalisations émises par les femelles servent à attirer les mâles, tel que rapporté en Amérique du Nord, devrait être révisée.

Mots-clés: appels, comportement, orignal, rut, vocalisation

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The moose rutting period has been described in numerous studies (Dodds 1958, Altmann 1959, Geist 1963, De Vos *et al.* 1967, Markgren 1969, Lent 1974, Peek *et al.* 1986, Van Ballenberghe and Miquelle 1996). Moose are not recognized as a vocal animal, but during the rutting season, vocalizations are emitted by both males and females. Altmann (1959) described a female call as a loud, plaintive call for the bull whereas the latter emits grunts or croaks while responding or during his search for a female (Altmann 1959, De Vos *et al.* 1967,

Lent 1974). Lent (1974) reported that female calls do attract bulls but that females then acted in a non-receptive fashion, whereas Van Ballenberghe and Miquelle (1996) reported that moans emitted by females were most often produced in response to the approach of a bull.

Except for Van Ballenberghe and Miquelle (1996) most of the studies concerning moose vocalizations are of qualitative nature. The objective of this paper is to present data concerning the context in which female vocalizations are emitted.

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STUDY AREA

The Parc de la Jacques-Cartier (670 km²) is located 50 km north of Québec city. An area of approximately 10 km² located in this park was used for the study of vocalization and associated behavior (Fig. 1). Elevation in the study area ranges from 450 - 1,000 m. The forest is typically boreal and dominated by balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*). Paper birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*) are the main secondary species. In 1973, the area was closed to logging, hunting, and trapping. In January 1980, the moose density was estimated at 5.3 moose/10 km² (Gauvin 1980).

METHODS

Field observations for the vocalization study were conducted by 2 people, around 4 lakes, between August 15 and October 31, 1984. From August 15 to September 5, data were collected every second day, and then collected every day for the rest of the period. Observations were made from towers and were continuous from sunrise to sunset. The day was divided into 4 periods: the first 3 hours after sunrise, 3 hours after sunrise to the zenith, from zenith to 3 hours before the sunset, and 3 hours preceding the sunset. More details are presented in Dussault and Huot (1986).

Human calls were used to stimulate

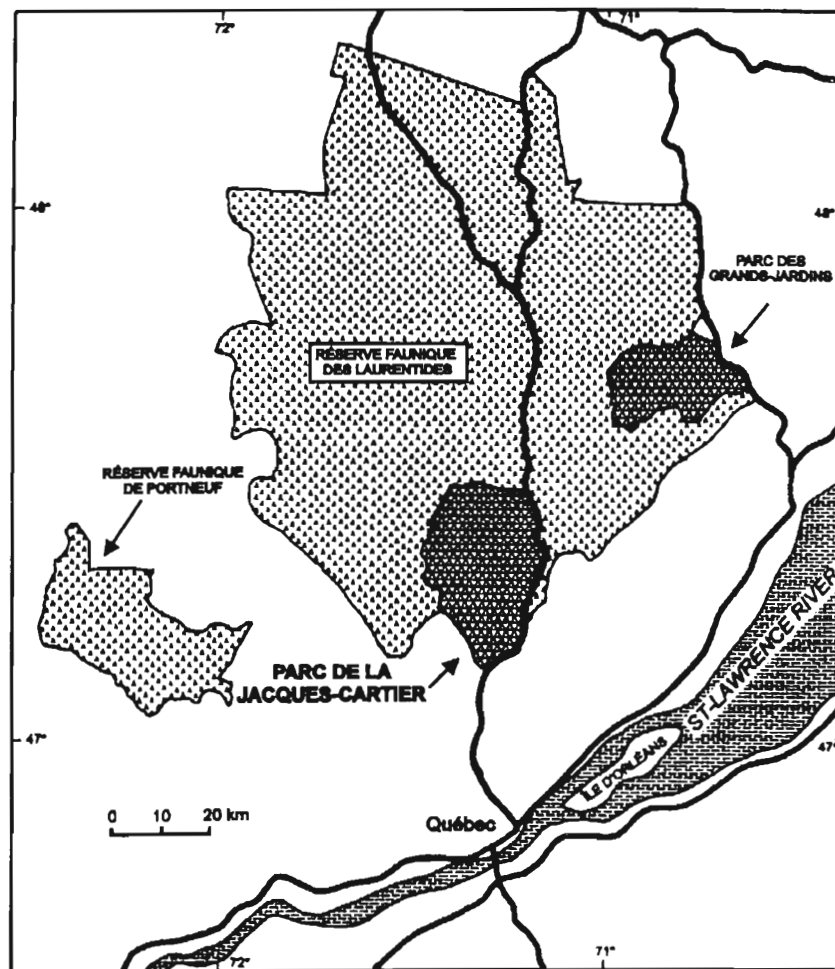


Fig. 1. Location of the study area.

responses from bulls every second period of observation ("stimulation period"), alternating with a period without any human stimulation called the "spontaneous period". During the periods with stimulation, we tried to obtain a response from bulls by emitting 2 female call imitations every 10 minutes. The first day, the first and third period were stimulation periods while on the following day the pattern was reversed. Four observation towers were located in trees overlooking 4 different lakes, and each observer spent a complete day at a given lake. Observers rotated among observation stations, completing the cycle every 4 days.

We defined the word "vocalization" as a call, or a series of calls, corresponding to the term "moaning or wailing" (Bubenik 1998) emitted by a specific female. Males were classified as spikes, forked, or palmate. The data were analyzed using chi-square tests and tests of availability-utilization data (Neu *et al.* 1974, Byers and Steinhorst 1984).

RESULTS

Behaviors were classified into 4 categories for the objectives of this study. "Unreceptive" behavior refers to females who ran away from bulls. The traditional pattern is a silent female, drinking or feeding, then running away, with vocalizations from bulls who tried to approach her. After that, the bull would stop his approach and the female would quiet down when approximately 10 m away from him, then return to her main activity. If the male insisted, the scenario was repeated. In 1 case a female was observed vocalizing while being closely followed by a male, when she jumped into a lake and swam across. The bull remained on the opposite shore, and further vocalizations were not heard. "Tolerance" behavior refers to a female who would not run away from the male, but would emit vocalizations when the bull (spike) had naso-

genital contact. "Low grunts" behavior refers to vocalizations emitted by females, but audible only at short distance (approximately 5 m). Sometimes the behavior was classified as "unknown" when we could not ascertain what was occurring because the action was seen for less than a minute.

Over 700 hours of observation were made either during the stimulation or the spontaneous periods, for a total of 1,404 hours (Table 1). Fifty-three female vocalizations were heard, 50% in each period (Table 2) and no significant differences ($\chi^2 = 0.019$, $P > 0.90$) were detected between periods. In 58% ($n = 31$) of the cases the female was observed calling. Of these, 12 (39%) were during a spontaneous period and 19 (61%) were during a stimulation period. Of the remaining vocalizations ($n = 22$) which were heard without having any

Table 1. Number of hours of observation done in the Parc de la Jacques Cartier, Québec, from August 15 to October 31, 1984.

Date	Period		Total
	Spontaneous	Stimulation	
August 15-21	28.1	28.1	56.2
August 22-28	20.5	20.5	41.0
August 29 - September 4	20.0	20.1	40.1
September 5-11	71.3	71.3	142.6
September 12-18	81.7	81.6	163.3
September 19-25	85.2	85.2	170.4
September 26 - October 5	82.4	82.5	164.9
October 3-9	79.7	79.7	159.4
October 10-16	76.5	77.6	154.1
October 17-23	74.4	74.3	148.7
October 24-31	81.9	81.8	163.7
Total	701.7	702.7	1404.4

Table 2. Number of female vocalizations heard in the Parc de la Jacques-Cartier, Québec, from August 15 to October 31, 1984.

Period	Females		Total
	Heard and seen	Heard only	
Spontaneous	12	14	26
Stimulation	19	8	27
Total	31	22	53

visual contact, 14 (64%) were emitted during a spontaneous period and 8 (36%) during a stimulation period. We did not find any significant difference ($P > 0.10$) between the periods either for females heard and seen ($\chi^2 = 1.581$), or for those heard only ($\chi^2 = 1.636$).

The first 2 female vocalizations were heard on August 19. One followed a bull approach during a spontaneous period and the second followed a call from 1 of the observers. The other vocalizations were heard between September 6 and October 31. The highest number of female vocalizations ($n = 14$) were recorded on September 26 and October 2. When data

were pooled, we noted a significant increase ($\chi^2 = 8.98$, $P < 0.025$) in vocalizations between September 26 and October 9 when 22 vocalizations (41%) were heard (Fig. 2).

Of the 31 vocalizations heard when the female could be seen, 24 (77%) occurred when the cow was followed by a bull (Table 3). Of these females, 18 (75%) acted in a non-receptive manner. Two (8%) were tolerant toward the male, and on 4 (17%) occasions the behavior was classed as "unknown". Of the remaining 7 cases, 3 were low grunts heard during a spontaneous period on September 13, at 2 different lakes, and the last 4 vocalizations heard, occurred when the female was seen alone, following a call from observers between August 15 and September 19 (Table 3). In most of these cases, females moved toward observers except on 1 occasion, when the female was accompanied by 2 calves. Males associated with females while calling were classed as spikes on 3 occasions, forked on 6, and palmate on 9 occasions.

DISCUSSION

Altmann (1959) described the female call as a loud, plaintive call for the bull.

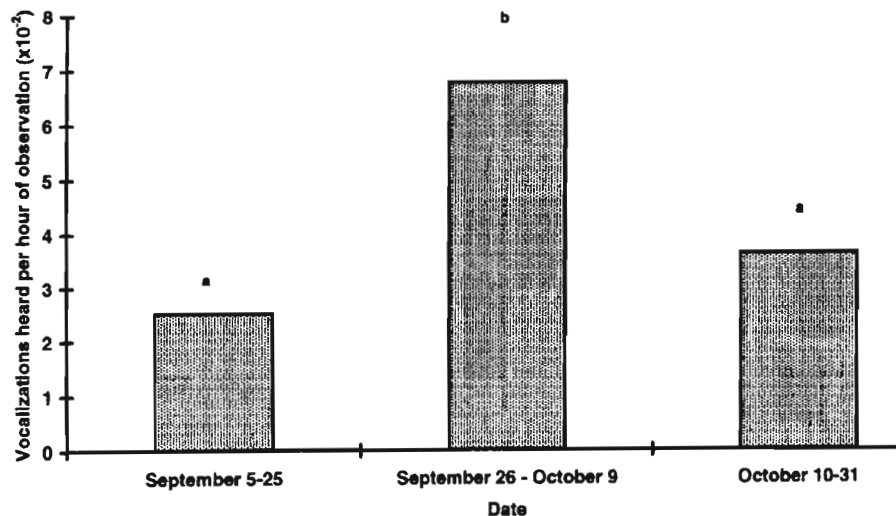


Fig. 2. Number of female vocalizations heard in the Parc de la Jacques-Cartier, Québec, from September 5 to October 31, 1984. Same letters above bars indicate no significant difference ($P > 0.05$).

Table 3. Number of females heard and seen in the Parc de la Jacques Cartier, Québec, from August 15 to October 31, 1984.

Behavior	Number
Followed by a male	
Unreceptive	18
Tolerance	2
Unknown	4
Others	
Low grunts	3
Following calls by observers	4
Total	31

However, no other author has reported the same. From the present study, despite the fact we observed moose for more than 1,400 hours during the rutting period, we could not conclude that females called to attract bulls. On the contrary, they seemed to run away from them. These observations are in agreement with Lent (1974) who mentions that females can vocalize while acting in a non-receptive way. However, Lent (1974) and Van Ballenberghe and Miquelle (1996) also suggest that bulls are apparently readily attracted by female calls.

Because moose are usually solitary (Bubenik 1971 *in* Bubenik 1998) and over most of its range lives in closed habitats, Fraser (1968) concluded that it is not surprising that moose use vocalizations for communication. As mentioned above, we did not hear any vocalizations aimed at attracting bulls. The low occurrence of this type of call in the present study and in others (Lent 1974, Van Ballenberghe and Miquelle 1996), could suggest that these calls are not as frequent as reported and the significance of female calls as an attractant for bulls, may have been exaggerated. However, it is possible that at high moose densities, moose have a sufficient number of occasions to

socialize without resorting to vocalizations. On the other hand, at low densities this communication tool might be more useful.

The timing of the vocalization in relation to estrous is also worth considering. If the female was in pre-estrous, she should have tolerated a male around her as the ovulation period lasts for only 15 - 36 hours (Schwartz and Hundertmark 1993). The same applies if they were in estrous. Therefore, we suggest that most female vocalizations occurred shortly after mating; i.e., during the post-estrous period. As moose are usually solitary animals, we can assume that the female, shortly after a successful mating, will return to solitary life. This indicates that copulation probably occurred the same day or a few days before we observed the unreceptive behavior which took place at the end of September and beginning of October. This last assumption is in agreement with the dates of mating estimated from vaginal smears obtained in the Laurentides wildlife reserve (which is adjacent to the Parc de la Jacques-Cartier; Sigouin *et al.* 1995). Similar results were obtained for the Matane Wildlife Reserve (Claveau and Courtois 1992) and in Manitoba (Crichton 1988, 1992). The only mating observed in this study was on October 2, and no vocalizations were heard before, during, or after the mating.

The hypothesis that the peak of female vocalizations corresponds to the post-estrous period is also in agreement with the peak of vulnerability of bull moose to hunting observed by Dussault and Huot (1986). Again, after the successful mating, the rejection of bulls by females may urge them to look for another mate. This could explain the high vulnerability of bulls to calls (Dussault and Huot 1986). The bulls attracted during this period were fully palmate and probably not just satellite bulls as suggested by Van Ballenberghe and Miquelle (1996).

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