USE OF TELEMETRY TO STUDY BEHAVIOR OF DOMESTICATED MOOSE

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ABSTRACT: A telemetry system was designed to assist in the study of moose behavior at the Kostroma moose farm in Russia. Two telemetry systems were used to locate instrumented animals and to capture physiological data from some. The activity rhythm of moose could be generalized from records of heart and respiration rates without the need for visual observation. Microcomputer software was designed to process heart–rate data previously recorded on a strip chart.

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Moose behavior was studied at the Kostroma experimental moose farm in Russia. Hand–reared moose on the farm were studied with minimal interference because the animals were habituated to the presence of people. Experimental animals were able to range over large areas that resembled natural moose habitat outside the farm setting. Telemetry was used to study movements and home range, as well as certain physiological parameters. This paper generalizes our experience with using telemetry to study moose behavior at the Kostroma moose farm over a 10–year period.

METHODS AND EQUIPMENT

Two telemetry systems were designed; "Los–2", a simple radio–tracking transmitter that provided positional data only, and "Los–3", a system that transmitted physiological data in addition to position information (Table 1). Both systems operated between 166.7 and 167.5 MHz, with output less than 30 mW. Transmitter range was 2 – 15 km, depending on terrain. The 330g version of Los–2 had a life expectancy of 670 days (30 days for the 60g version). The Los–3 transmitter could transmit for 40 days (transmitter weight = 330g). The 60g

Table 1. Technical specifications of "Los–2" and "Los–3" moose telemetry systems.

	"Los–2"	"Los–3"
Band (MHz)	166.7–167.5	166.7–167.5
Maximum output power (mW)	30	30
Signal range depending on the terrain (km)	2–15	2–15
ECG frequency band (Hz)		0.2–300
Range of ECG transmission (km)		1.5–10
Expected life (days)		
330g transmitter	670	40
60g transmitter	30	1
Precision of radio direction finding (degrees)	1–2	1–2

Los–3 transmitter could transmit for only 1 day. In addition, the Los–3 unit transmitted physiological data over a range of 1.5 – 10 km at a frequency of 0.2 – 300 Hertz.

Both hand–held and stationary receivers used during this study provided accuracy to within 1–2 degrees. Data on heart rate and respiration rate were initially recorded on a strip chart. A photo–reader was designed to scan the physiological data into a computer. Special software, that we designed, interpreted the scanned data, corrected some anomalies, and plotted output on a diagram with proportional time scale. Some errors on the strip chart caused by radio interference were corrected by hand prior to scanning into the computer. A parallel radio communication system enabled observers to transmit their behavioral observations back to the central tracking station.

RESULTS AND DISCUSSION

We were able to compute instantaneous heart rate values, heart rate variation indices, and mean heart rate values during some successive heartbeat intervals. The electrocardiographic transmitter was sensitive enough to detect and transmit fetal heart beat data from free–ranging pregnant cow moose configured with external electrodes. Figure 1 is a graph that shows the plotted heart beats of a female moose and its unborn calf.

Telemetry enabled long–term observations of mother–calf interactions from the time of birth of the calf until separation of mother and calf a year later when a new calf was born. All types of interactions could be related to corresponding cardiographic and respiratory data transmitted to the central tracking station and computerized. Hand–reared females and their offspring that were free–ranging over the farm ignored an observer at a distance of several

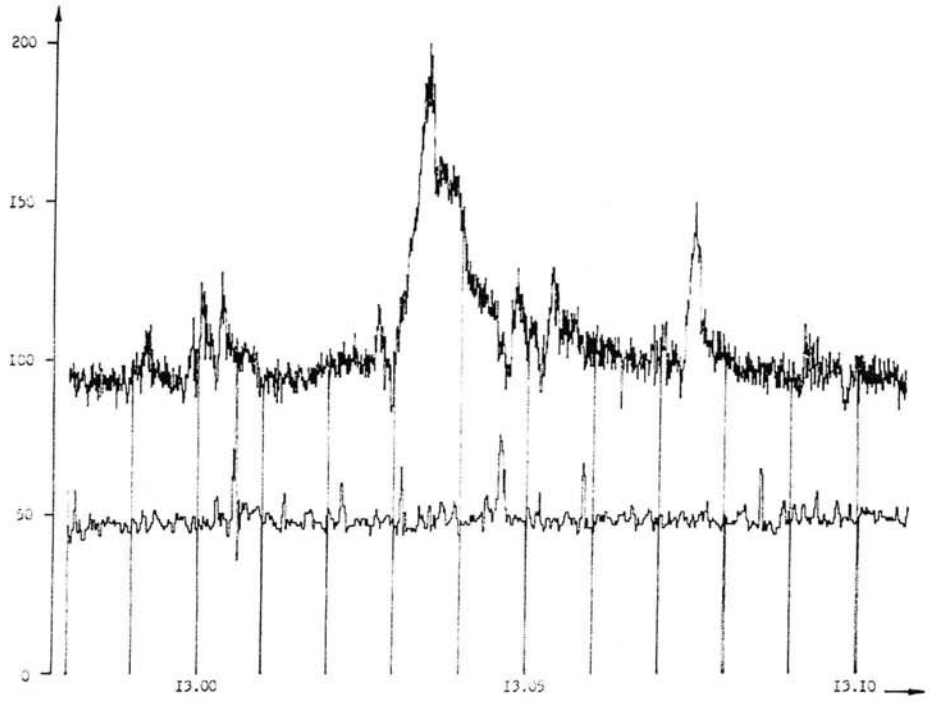

Fig. 1. Examples of fetal (bottom) and maternal (top) heart rates of moose recorded with the "Los–3" telemetry system.

meters. The lack of cardiographic response to the observer enabled us to relate mother–offspring and other interactions to parameters of both heart and respiration rates. An important aspect of the study had to do with alarm and defensive behavior (stress) of instrumented moose. This is especially important in a farm setting where stress must be minimized if production is to be optimized. Moose adapted quickly to very loud sounds from a loudspeaker calling moose cows to the farm. Conversely, a weak sound of a tree branch crushing was a very strong stimulus for hand–reared animals, even though they were not subject to the dangers confronted by wild moose. The telemetric records enabled us to determine the generalized state of an animal; whether it was lying, standing, walking, running, foraging, or ruminating (active or resting). Therefore, we could describe the activity rhythm in general, without visually seeing the animal, based entirely on heart and respiration rates. On this basis we determined that rhythms of activity and resting during the snow–free season average about 7–9 per day. Non–active periods during this time varied between 800 and 1,150 minutes per day (deviation less than 35%) for animals of any age from shortly after birth to old age. Figure 2 shows examples of charts of cow moose heart rates and heart and respiration

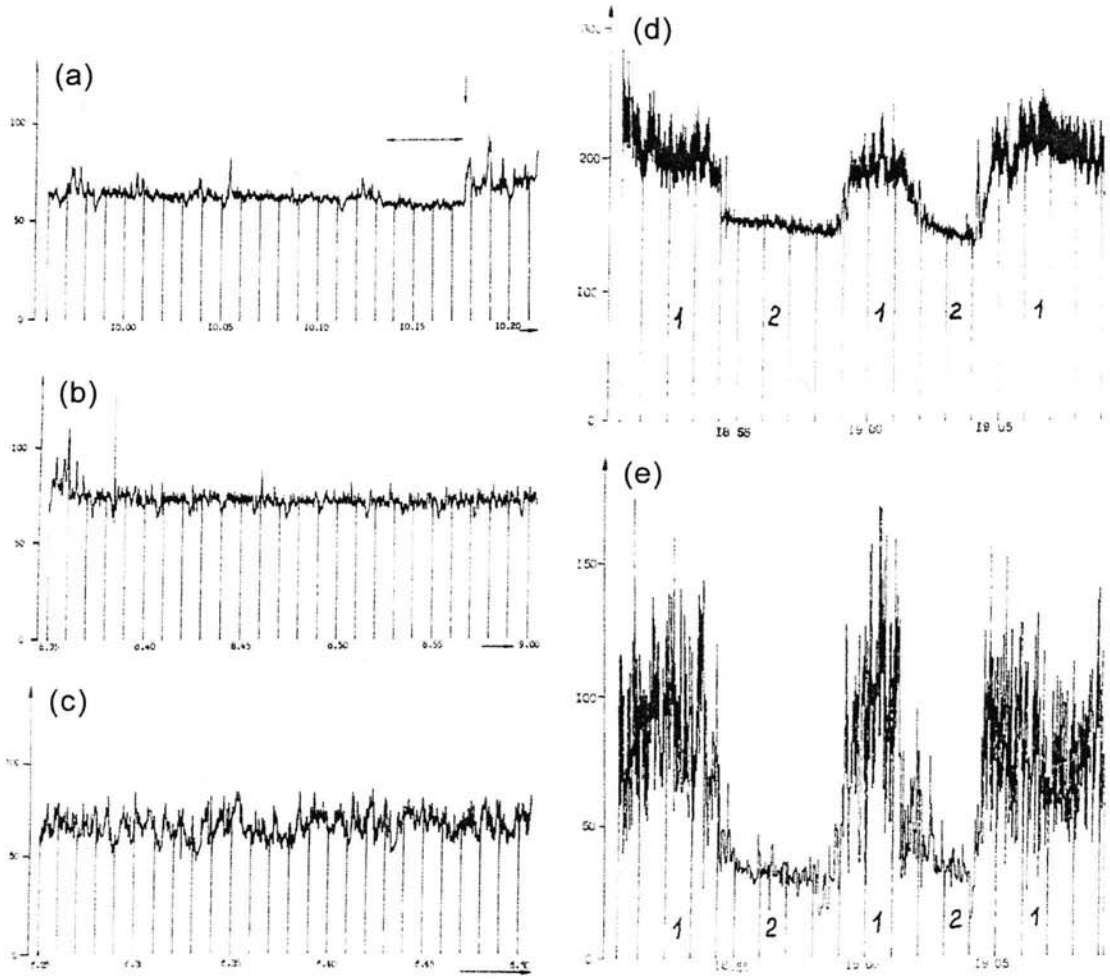

Fig. 2. Records of maternal moose heart rates (a – c), and simultaneous records of heart rate (d) and respiration rate (e) of a newborn calf moose during activity (1) and rest (2).

rates of a newborn calf. Portable telemetry equipment was always used when gathering physiographic data. Two stationary receivers were used occasionally to determine the initial location of animals for the physiological work. Moose movement and home range studies conducted at the Kostroma moose farm are reported in other publications. More than 1,000 hours of telemetric records and several thousand animal locations (fixes) were made during 10 years of work at Kostroma.