FLUCTUATIONS IN DAILY ACTIVITY OF MUSKRATS IN EASTERN SOUTH DAKOTA

Joel F. Lyons, Craig D. Kost, and Jonathan A. Jenks
Department of Wildlife and Fisheries Sciences,
South Dakota State University
Box 2140B, Brookings, SD 57007

ABSTRACT

Daily muskrat (*Ondatra zibethicus*) activity was assessed in the fall of 1995 adjacent to the Big Sioux River, in south central Brookings County, South Dakota. Activity was determined using direct observation and trapping. Muskrats were observed from 7 to 28 October and trapped from 6 to 10 and 16 to 21 November. During ice-free periods muskrats were active during nocturnal and crepuscular hours, and were rarely observed during diurnal hours. Peak activity occurred between 0401 and 0500 hours. Trapping data collected during the onset of ice-over showed a significant increase in diurnal activity. Our results support other findings that indicate that muskrats display a bimodal activity pattern and that they modify their activity patterns from nocturnal during summer to diurnal during winter.

INTRODUCTION

Seasonal movements and migrations of muskrats (*Ondatra zibethicus*) have been well documented (Errington, 1939; Sather, 1958; Boutin and Birkenholz, 1987). Migrations generally occur in spring and fall or during times of overcrowding or drought (Errington, 1939). Muskrats are known to be territorial (i.e., family groups actively defend their habitations within their home range) and dispersing juveniles tend to remain close to their natal territories (Sather, 1958).

Muskrats are predominantly nocturnal, but may occasionally be observed during the day in spring and fall (Boutin and Birkenholz, 1987). MacArthur (1980) reported that muskrats in Manitoba, Canada displayed a bimodal trend in activity during summer, with periodic activity throughout the day, and peak levels of activity occurring between sunset and sunrise. During winter, muskrats also displayed periodic daytime activity, but a bimodal activity pattern was less evident. Peak winter activity was observed from late afternoon to early evening.

Bimodal daily and feeding activity patterns of muskrats were documented by Van Horn (1975) in Wisconsin. During ice-free periods, peaks in activity occurred one to two hours prior to sunrise. After ice-over he documented an increase in the proportion of daylight activity, with the peak in activity occurring shortly after sunset.

Sokolov et al. (1983) recorded change in muskrat cardiac rhythm in Russia, using a radiotransmitter, to determine daily activity levels. They determined that muskrats displayed a 3-phase activity pattern. During ice-free periods, the first activity period was one or two hours prior to sunset, continuing until sunrise. Diurnal activities were greatest from 0601-0800 to 1001-1100 hours and from 1201-1400 to 1601-1800 hours, second and third phases, respectively. After ice-over, muskrats retained a 3 phase activity pattern, but the major activity period occurred during daylight hours.

The objective of our study was to determine activity patterns of muskrats in eastern South Dakota during the fall using direct observation and trapping. We hypothesized that muskrat activity, for a 24 hour period, would be equally distributed over time for observation and trapping periods.

STUDY AREA

Our study site was located adjacent to the Big Sioux River in south central Brookings County, South Dakota (Fig. 1). The area has a continental climate with an annual average rainfall of 59.5 cm and an average annual temperature of 5.78 C (Hadeen, 1994). Muskrat habitat at the study site consisted of a small stream that flowed into a Class IV (Stewart and Kantrud, 1971), partially drained palustrine wetland, 0.75 km in length. Cattails (*Typha* sp.) and common reed (*Phragmites australis*) were the dominant vegetation at the study site. Tree species, such as cottonwood (*Populus deltoides*) and peachleaf willow (*Salix amygdaloides*), occur adjacent to wetlands in the region.

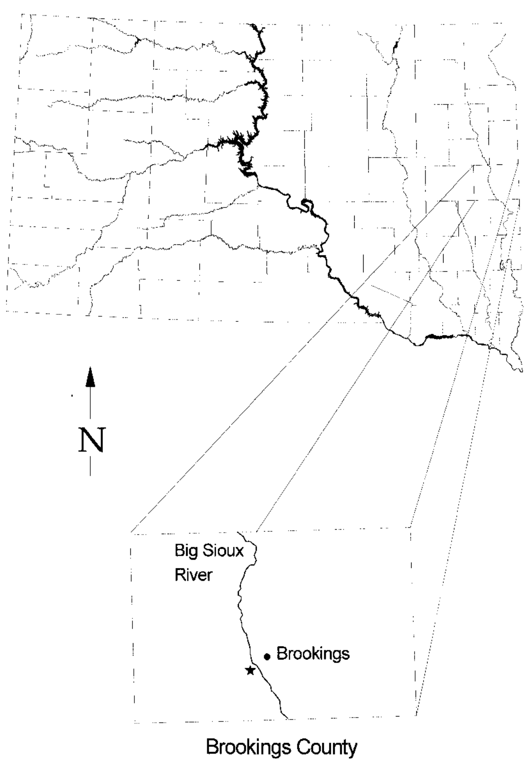

Figure 1. Location of study site adjacent to the Big Sioux River in south central Brookings County, South Dakota.

METHODS

Activity levels of muskrats were determined by direct observation, from 7 to 28 October 1995. Viewing occurred at four established observation points around the wetland. Two observation points were from trees and two were from points on an adjacent road. The wetland was monitored for a total of 24 hours. Viewing times ranged from one to three hours per day and continued for three weeks until every hour in the 24 hour period had been monitored. Viewing sites were alternated every half hour to avoid location bias. Activity levels were determined by the number of muskrat sightings recorded during the different observation periods.

Trapping of muskrats was initiated on 6 November, two days after the opening of the 1995 trapping season. Bodygrip, colony, and leghold traps were set from 6 to 10 and 16 to 21 November at the study site and at other wetland locations along the travel route from Brookings to the study site. Traps were set in locations that required muskrats to leave their dens or houses and exhibit activity to be captured. Traps were checked three times a day; 0800 (midnight to sunrise activity), 1600 (daylight activity), and 2400 (sunset to midnight activity) hours. Traps were checked at these times because sunrise and sunset occurred between 0701-0800 and 1901-2000 hours, respectively. This allowed midnight to sunrise and daylight activity period traps to be checked during daylight hours.

Relative frequency of muskrat observations and harvest rates were compared within and across time periods using Pearson chi-square tests (Wilkinson, 1990).

RESULTS

Two hundred seven muskrat sightings were recorded during the study: 123, 0001-0800; 6, 0801-1600; and 78, 1601-2400 hours. Hourly sightings ranged from a maximum of 32 muskrats between 0401-0500 hours to a minimum of 0 muskrats for periods 0801-1200 and 1501-1700 hours. Little (i,e., ≤8 muskrats) to no activity was observed during daylight hours (Fig. 2).

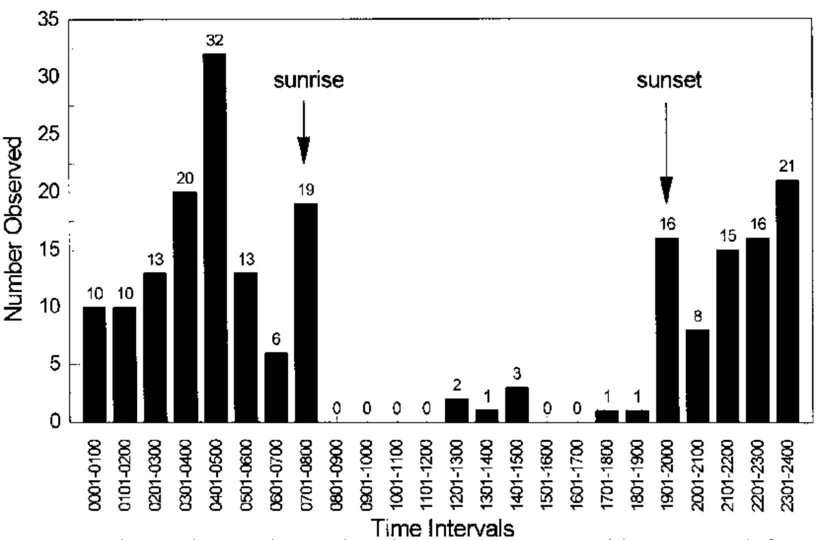

Figure 2. Hourly muskrat sightings by observation over a 24 hour period, from 7 to 28 October 1995 at a wetland in south central Brookings County, South Dakota.

We observed a reduction in muskrat activity at 2400 hours. Ten muskrat sightings were recorded for each of the two one-hour periods following midnight (0001-0100 and 0101-0200 hours). At 0201 hours, activity gradually increased to the daily high of 32 muskrat sightings, which occurred between 0401-0500 hours. After 0501 hours, activity gradually declined until sunrise, 0701-0800 hours, when observations increased to 19 muskrat sightings. The only observed muskrat activity during daylight hours occurred between 1201-1500 and 1701-1900 hours. Maximum number of muskrat sightings recorded in any period during the day was three. At sunset, 1901-2000 hours, activity increased to 16 muskrat sightings. The hour following sunset, activity decreased to eight sightings, followed by a gradual increase to 21 sightings between 2301-2400 hours (Fig. 2).

One hundred four trap nights (8, bodygrip; 16, colony; 80, leghold) were recorded during the study, with a total of 29 muskrats trapped: 13, 0001-0800; 7, 0801-1600; and 9, 1601-2400 hours. A significant difference (X^2=22.076, df=2, P<0.0001) was observed between observation and trapping frequencies when time periods were combined. No difference was observed between observation and trapping rates for time periods 0001-0800 and 1601-2400 hours when data were compared using 90% Bonferroni confidence intervals (24.30-65.11%, 0001-0800 hours; 8.83-44.51%, 0801-1600; 13.57-51.77%, 1601-2400 hours). However, observation activity for time period 0801-1600 hours, which occurred prior to ice-over, differed from trapping activity which occurred during a transition to ice-over (Fig. 3). A significant difference (X^2 =100.96, df=2, P<0.0001) also was observed between time periods for observation data (51.67-66.60%, 0001-0800 hours; 0.90-6.44%, 0801-1600 hours; 30.41-45.14%, 1601-2400 hours). No difference (X^2=1.93, df=2, P=0.381) was observed between time periods for trapping data (Fig. 3).

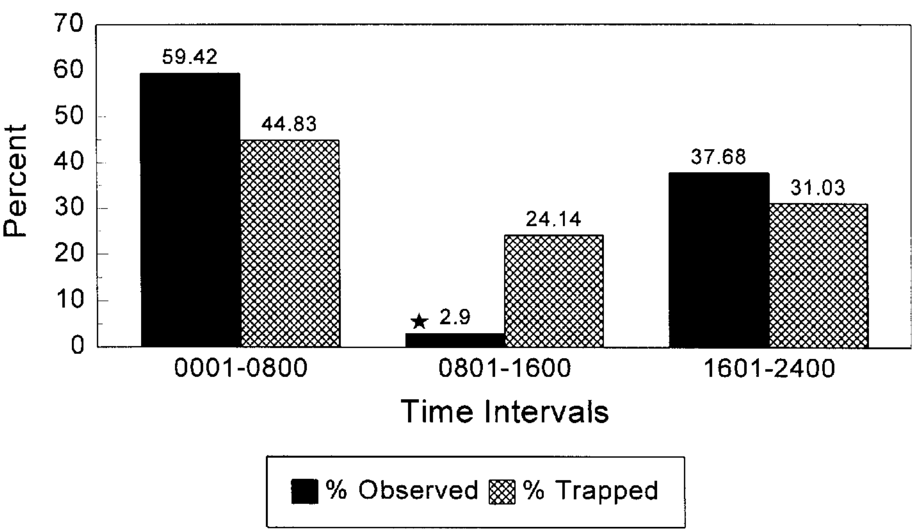

Figure 3. Percent of muskrat observations, 7 to 28 October, and muskrats trapped, 6 to 10 and 16 to 21 November 1995, during a 24 hour period at a wetland and along a trapping route in south central Brookings County, South Dakota. (* % Observed significantly differed from % trapped during 0801-1600 hour period.)

DISCUSSION

Muskrat observation (ice-free) data indicated that muskrats were active at night and inactive during the day. Our findings are supported by Van Horn (1975) and MacArthur (1980), who reported a bimodal activity pattern during ice-free periods with a majority of the activity occurring at night. MacArthur (1980) recorded peak levels in activity between sunset and sunrise. Van Horn (1975) noted that during ice-free periods a dominant peak in activity occurred one to two hours prior to sunrise. We recorded a similar occurrence three hours prior to sunrise, with a daily high of 32 muskrat sightings recorded. Sokolov et al. (1983) reported that muskrats (both captive and wild) had a 3-phase activity pattern. A distinct 3-phase activity pattern was not evident from our observation or harvest data. However, we did record a reduction in muskrat sightings during the two hour period following midnight (0001-0200 hours), which was similar to the findings of Sokolov et al. (1983).

At the beginning of the 1995 harvest season, average daily temperatures declined from 8.34 to -15.01 C. Although moderately sized lentic bodies of water remained frozen throughout the harvest period, smaller lentic and lotic areas became ice-free during the day. Muskrats in our study were harvested during the ice-free to ice-over transition period and were likely modifying their activity pattern, increasing activity during the diurnal period (based on trapping).

Our findings of increased diurnal activity during ice-over are supported by MacArthur (1980) who reported that peak muskrat activity during winter occurred in late afternoon and early evening. He also reported a season difference, summer versus winter, in nocturnalism of muskrats, using automated data recorded every five minutes over a 24 hour period. MacArthur (1980) also reported a reduction in the mean hourly activity index of muskrats, ([total observations per hour in which an animal is active away from a lodge or burrow / total of all observation per hour] X 100), two days after ice-over compared with two days prior to ice-over. In addition, he reported a difference in the N:D ratio of muskrats [mean hourly activity index for all hours between the hour of sunset and the hour of sunrise (N) / mean hourly activity index for all other hours (D)] between summer and winter automated data. Van Horn (1975) noted an increase in the proportion of daylight activity after ice-over when compared to previous ice-free weeks. Sokolov et al. (1983) reported that during ice-over, muskrats shifted their activity pattern from one where the major activity period occurred during nocturnal hours to one where the major activity pattern occurred during diurnal hours. However, their evaluation of the shift from nocturnal to diurnal activity was qualitative and not supported by our investigation.

MacArthur (1980) proposed that reduction in winter light intensity may be the primary factor responsible for increased diurnal activity. Kooyman (1975) reported that Weddell seals (*Leptonychotes weddelli*) relied heavily on vision for under-ice navigation and that the frequency of dives made by seals was greater during daylight hours. Muskrat houses are occupied by many individuals during winter (Errington, 1963; MacArthur and Aleksiuk, 1979). Increased diurnal activity patterns of muskrats during winter would ensure that houses will always be occupied, maintaining the microclimate within at a favorable temperature. This increased activity also ensures that the plunge hole would remain ice-free, allowing access into houses and feeding push-ups (MacArthur, 1978 and 1980). Ice cover also may offer protection from predators (Van Horn, 1975; MacArthur, 1980).

Increased diurnal activity of muskrats during winter may aid in the maintenance of body temperatures. This may be accomplished by increasing the frequency of foraging bouts during diurnal hours. MacArthur, (1980) reported that winter feeding of muskrats is intermittent, with individuals leaving their houses for periods greater than one hour. Energy gained from these feeding bouts would likely last long enough to be of thermoregulatory benefit to muskrats, generating metabolic heat and raising metabolic rates for up to five hours post feeding (MacArthur and Campbell, 1994).

Our observation technique was useful in documenting activity of muskrats during ice-free periods, but would not be useful for observing muskrats during periods of ice cover. However, the trapping technique, although somewhat difficult to use during periods of ice cover, was useful in documenting muskrat activity. During other seasons, a combination of observation, trapping, and radiotelemetry techniques would yield greater insight on seasonal fluctuations in daily muskrat activity.

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