

## **ANALYSIS OF COPULATIONS IN AMERICAN MINK FEMALES MATED EVERY DAY DURING THE BREEDING SEASON**

Beata Seremak, Aleksandra Siekierska, Lidia Felska-Błaszczuk,  
Małgorzata Dziadosz-Styś, Bogdan Lasota, Marta Dworecka-Borczyk

West Pomeranian University of Technology, Szczecin, Poland

**Abstract.** The experiment was aimed to observe the behavior of ranch American mink females during the breeding season. The study was conducted on a group of 11 females of the color type Pearl, which were admitted to a male each day during the 13-day mating period. Each successful mating was noted, which allowed the capture the length of naturally variable intervals between mating encounters, and the number of copulations throughout the breeding season. In addition, the following reproductive parameters were determined: the length of pregnancy, total litter size at birth, live births per litter, and litter size at weaning. Based on the survey it was found that if mated daily, most females were prone to have a natural 3-5-day break during the breeding season. We found that the sexual activity of the female mink was very high, and that most of the females mated eight or nine times over the entire period.

**Key words:** American mink, mating, reproduction

### **INTRODUCTION**

The mink have a monoestrous sexual cycle and the estrus in females has a varying intensity, which is due to the cyclical ova maturation and ovulation [Bowness 1968, Jarosz 1984, Socha, Markiewicz 2002]. The mating procedures on Polish mink farms take place in March, females are mated several times during the breeding season, which is associated with repeated cycles of ova maturation phases [Murphy 1983, Wehrenberg et al. 1992], which means that a female can give

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Corresponding author – Adres do korespondencji: dr hab. Beata Seremak. West Pomeranian University of Technology, Szczecin, Department of Biotechnology of Animal Reproduction and Environmental Hygiene, Doktora Judyta 6, 71-466 Szczecin, Poland, e-mail: beata.seremak@zut.edu.pl

birth to young from two different ovulations [Ślaska and Rozempolska-Rucińska 2011]. The blastocyst in the uterus undergoes the effect of diapause [Murphy 1983, Wehrenberg et al. 1992, Renfree and Shaw 2000, Isakova et al. 2001, Thom et al. 2004, Persson 2007]. During this period mitotic divisions of the embryo are inhibited and there is a delay in the process of embryonic implantation [Song et al. 1998, Lopes et al. 2004]. The diapause in mink, according to Rose et al. [1986] and Song et al. [1998], ranges from 5 to 55 days. According to Murphy and James [1974], the average length of diapause is 18–25 days.

Bearing in mind that the ova maturation phases repeat several times during the estrus, mink farmers apply several mating operations during the mating season [Narucka 1973, Jeżewska, Maciejowski 1989, Jeżewska, Maciejowski 1993], thereby increasing the number of fertilized egg cells [Felska, Sulik 2000]. The mating system that is implemented on the farm is the key factor of the resulting reproductive parameters. Maciejowski [1975], conducting research on the effects of different systems of mating on fertility and fecundity, found six system variants, depending on the times the mating and gaps between copulations. Most frequently, matings are carried out for two consecutive days and again, 7 to 10 days after the first mating [Felska-Błaszczuk, Sulik 2008]. Mink breeders found that, to obtain the best results, one-year-old mink should be mated four times, whereas two-year-old and older females should copulate twice [Felska-Błaszczuk 2012].

Studies have shown that there is a statistically significant correlation between the date of the first mating, number of mating repetitions, length of gestation, birth date vs. the number of young born and raised [Narucka 1977, Lisiecki, Sławoń 1980, Seremak et al. 2009]. The average litter size on Polish mink farms, according to Felska and Sulik [2000], is 5–6 pups, while Socha and Markiewicz [2002] argue that it is even lower, ranging from 2.2 to 5.9. Such large variations in litters indicate a high potential for improvement within this trait. Divergence of opinion and lack of proven optimal mating systems for farms prompted the authors to carry out these observations, which aimed at natural behavior of female mink mated every day of the breeding period.

The aim of this study was to determine the number of copulations in ranch mink and duration of naturally regulated gaps between mating encounters among females which were mated every day of the breeding period. In addition, the following reproductive parameters were analyzed: total litter size at birth, live births per litter, and litter size at weaning.

## MATERIAL AND METHODS

The study was conducted in 2012 on a mink farm in Western Pomerania. The analysis included 11 females of the Pearl type of color, managed in the same con-

ditions in terms of housing and feeding. During the breeding season, daily mating system was used in those females. The breeding season lasted from 9 to 21 March, and each day during this time males were admitted to females, thus the animals were given the opportunity to mate for 13 days. The animals were observed and the occurrence of each mating encounter was noted. Based on our results, the number of copulations was calculated as well as the duration of gaps between matings. In addition, the following parameters were analyzed for breeding females: total litter size at birth, live births per litter, and litter size at weaning. The results were processed using a spreadsheet (Microsoft Office Excel<sup>®</sup> 2007).

## RESULTS AND DISCUSSION

Table 1 shows the characteristics of the naturally regulated numbers of mating encounters and length of gaps between the observed effective copulations, which presumably may be associated with the cyclically repeated phases of maturation of oocytes. The study shows that effective mating observed in individual females took place at different times during the period. After the first matings, followed by a natural, individually regulated break, mink entered the second period of increased reproductive activity. For most females, this period started on March 17. The study therefore shows that the first period involving 1 to 5 daily effective matings was followed by a natural interruption lasting 3 to 10 days (Table 1). The most frequently observed gap lasted from three to five days and was diagnosed in 9 females accounting for 82% of the total number of female mink.

During the 13-day study period, females exhibited high sexual activity and in the majority of cases 8–10 acts of copulation occurred during the period, which may be due to the stimulation of the male through a daily contact with the female (Table 1).

There are discrepancies in the assessment of the repetition cycle of ova maturation in female mink. According to Jeżewska and Maciejowski [1989], maturation of oocytes takes place several times during the breeding season at the intervals of 7–10 days, starting from the first days of March. According to other sources state, however, that after the first mating further oocyte development phases usually occur at the intervals of 6–8 days and, as a result the pursuing copulations, the ovulation and fertilization takes place [Murphy 1983, Wehrenberg et al. 1992].

The experiment revealed that in the observed group of mink the length naturally regulated break between the first and second period of successful mating was shorter than the interval that is commonly applied by farmers. According to Jarosz [1984], in farm practice, mating is repeated several times over the breeding season, with different mating systems recommended depending on the date the female was mated for the first time. Females mated for the first time in the period

between 10 and 20 March are mated on the following day as well as on the seventh and 8th day after the first mating, according to the scheme  $1 + 2 + \dots + 7 + 8$ . Results presented above show that the female sexual activity during the first mating usually maintained for a few days (up to 5), and the second period of effective mating for the majority of females occurred after a short 3-5-day interval. In two females we observed longer, 7- and 8-day break between copulations (Table 1).

Table 1. Characteristics of naturally regulated mating system in female Pearl mink

Tabela 1. Charakterystyka naturalnie regulowanego systemu kryć u samic norki amerykańskiej odmiany Perła

Female no. Numer samicy	Mating system System kryć	Date of 1st mating Data pierwszego krycia	Date of whelping Data wykotu	No. of matings Liczba kryć	Length of break between of matings, days Długość przerwy między kryciami, dni
1	1 + 2 + 3 + 4 + ...7 + 8 + 9 + 10	09.03	3.05	8	3
2	1 + 2 + 3 + 4 + ...8 + 9 + 12	09.03	29.04	7	4
3	1 + 2 + 3 + 4 + 5 + ...8 + 9 + 10 + 11 + 12	09.03	1.05	10	3
4	1 + ...9 + 11 + 12 + 13	09.03	29.04	5	8
5	1 + 2 + ...9 + 10 + 11 + 12	09.03	7.05	6	7
6	1 + 2 + 3 + 4 + 5 + ...9 + 10 + 11	09.03	2.05	8	4
7	1 + 2 + 3 + 4 + 5 + ...9 + 10 + 11 + 13	09.03	30.04	9	4
8	1 + 2 + 3 + 4 + ...6 + 9 + 10 + 12 + 13	09.03	29.04	9	3
9	1 + 2 + 4 + 5 + ...10 + 11 + 12 + 13	09.03	5.05	8	5
10	1 + 2 + 3 + 4 + 5 + ...10 + 12 + 13	09.03	30.04	8	5
11	1 + 2 + 3 + 4 + 5 + ...10 + 11 + 12 + 13	09.03	28.04	9	5

In addition, we traced selected reproductive parameters of females (Table 2).

Studies have shown that the length of pregnancy is strongly associated with the date of mating [Seremak et al. 2009]. It was found that the average length of gestation resulting from mating between 4 and 8 March was 55.42 days, while between 9 and 21 March – 52.21 days [Felska, Sulik 2000], and the pregnancies between 45 and 55 days (including diapause) gave the largest litters [Jarosz 1984]. Mink gestational length in our study ranged from 51 to 59 days (Table 2). In the studied group of females, the largest litter of born, live born, and raised pups was attained by a female which had a gap between matings longer than six days. The female has successfully raised 9 pups. A high number of weaned offspring was also characteristic for two other females—one with a three- and the other with a five-days interval between matings. The female mink raised seven young each and had been mated between 5 and 9 times (Table 2). Good reproductive effects were

Table 2. Litter size at birth, live births per litter, and litter size at weaning in American mink of Pearl type in relation to naturally regulated break between matings

Tabela 2. Długość ciąży, liczba urodzonych i odchowanych młodych samic norki amerykańskiej odmiany Perła w zależności od naturalnie regulowanej przerwy między kryciami

Length of break, days Długość przerwy, dni	Female no. Numer samicy	Date of whelping Data wykotu	Gestational length, days Długość ciąży, dni	Litter size – Wielkość miotu		
				At birth Urodzone	Live born Żywo urodzone	At weaning Odchowane
3	1	3.05	55	2	2	0
	3	1.05	53	5	5	0
	8	29.04	51	7	7	7
4	2	29.04	51	3	3	3
	6	2.05	54	7	7	5
	7	30.04	52	6	6	0
	9	5.05	57	7	7	7
5	10	30.04	52	6	6	4
	11	28.04	50	8	7	4
≥ 6	4	29.04	51	9	9	9
	5	7.05	59	6	6	5

also attained by two other females with 3 and 5 day break between copulations; both mink raised seven young each. The worst reproductive parameters was noted in a female with a break of 3 days; only two live born pups were found in the nest, of which none survived during nursing. No effects were noted of the increased number of matings on the litter size (Table 2).

## CONCLUSIONS

1. The females that were able to mate every day demonstrated a tendency to have a natural, 3-5-day break during the breeding season.
2. A high sexual activity of mink females was observed over the entire breeding season, and it was found that most females mated 8 or 9 times.
3. Due to the small sample size of females testing should be continued.

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## ANALIZA PRZEBIEGU KRYĆ SAMIC NOREK AMERYKAŃSKICH DOPUSZCZANYCH DO SAMCA KAŻDEGO DNIA W SEZONIE ROZRODCZYM

**Streszczenie.** Celem doświadczenia była obserwacja zachowań samic norki amerykańskiej w okresie rozrodczym. Badanie przeprowadzono na grupie 11 samic odmiany Perła, które w ciągu 13 dni dosadzano codziennie do samców, umożliwiając zwierzętom krycia. Każde skuteczne krycie zostało odnotowane, co pozwoliło na wychwycenie długości naturalnie regulowanej przerwy pomiędzy kojarzeniami, liczby kryć w ciągu całego sezonu rozplodowego, dodatkowo określono parametry rozrodu: długość ciąży, ilość młodych urodzonych, żywo urodzonych i odchowanych. Na podstawie przeprowadzonych badań stwierdzono, iż norki mające możliwość codziennych kryć wykazały w większości skłonność do naturalnej 3–5 dniowej przerwy w trakcie sezonu rozrodczego. Stwierdzono wysoką aktywność płciową samic norek w trakcie całego okresu kopolacyjnego w trakcie którego zanotowano, iż większość samic dawała się pokryć 8 lub 9 razy.

**Słowa kluczowe:** norka amerykańska, krycia, rozród

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