

## **ANALYSIS OF LITTER SIZES AT BIRTH AND AT 7 DAYS OF NURSING IN MINK (*NEOVISON VISON*) OF BLACK VELVET, HEDLUNG WHITE, AND SILVERBLUE COLOR TYPES**

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**Abstract.** The aim of this study was to evaluate the effect of litter size at birth on offspring raising and an attempt to establish the litter size that would be optimal for the nursing process. We analysed litters of 390 one-year-old females of three color types: Black Velvet (or short NAP), Hedlund White, and Silverblue. Each study group comprised 130 mink. Within each group, we analysed the litter size and birth and the number of pups that survived until the age of seven days. Also percentage proportion of various classes of litter sizes is given and survival rate (in percentage) of pups in each litter has been calculated. The analysis reveals that if litter sizes comprise 10–11 pups, most of them will not be properly nursed, and as few as 2 to 6 pups have a chance to survive in many of such large litters; only in Black Velvet femals, the decline in litter size was to 9 pups, on average. An interesting fact also is that females that give birth to a single pup often do not raise it at all. The presented analysis leads to a conclusion that litters of 2 to 9 pups are best in terms of nursing success, with apparent differences resulting from the color type.

**Key words:** litter size, *Neovison vison*, nursing, reproduction

### **INTRODUCTION**

Best possible reproduction performance is the most important if not fundamental issue for the breeder, since it underlies the economic viability of the farm.

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Reproduction parameters that are of greatest importance in mink reproduction include litter size at birth and at weaning.

Reproductive parameters in mink vary greatly depending on the individual genotype. According to many authors [Møller 2000, Socha et al. 2003, Kołodziejczyk, Socha 2006, Sulik et al. 2007, Ślaska et al. 2009, Felska-Błaszczuk et al. 2010], gestational length, litter sizes, and weaning success differ depending on the color type of the female. The female's year in the breeding herd is an equally significant factor of reproductive abilities, as some authors raise [Møller 2000, Socha, Markiewicz 2001, Kołodziejczyk, Socha 2006, Socha, Kołodziejczyk 2006, Hansen, Berg 2010]; however, opinions on this effect differ between the authors. As reported by Dziadosz et al. [2010], females at age of up to two years are characterised by the best reproductive parameters. Socha et al. [2002, 2003], Socha and Kołodziejczyk [2006], and Ślaska et al. [2009], on the other hand, maintain that females at age two years are those most productive ones.

The average litter size attained on a mink farm remains within the range 2.2 to 5.9 pups [Amstislavsky, Ternovskaya 2000, Socha, Markiewicz 2002, Persson 2007, Pastirnac, Gruia 1980]. Observations carried out on leading Polish mink farms indicate that the average litter size in the nest ranges between 6.5 and 7 pups, although much larger litters, 14–18 pups, are not rare [Sulik, Felska 2000, Sulik et al. 2007, Felska-Błaszczuk et al. 2010 a, Seremak et al. 2011]. Felska-Błaszczuk et al. [2010 b] report that a good female should raise 4–5 offspring per year. Pre-weaning mortality of the pups is a significant issue; it is highly variable and may range from 13% to, in extreme, 27% [Lagerkvist et al. 1994].

As a rule, very large litters show very low survival rate until weaning, since the pups are much smaller and the dam has a limited capabilities of nursing. In 2007, a record high litter size, 23 pups, was noted on a mink farm in north-west Poland; none of the pups, however, survived until weaning [Felska-Błaszczuk et al. 2010b]. Too large litters often cause post-lactational exhaustion, which frequently leads to death of the dam [Rouvinen-Watt 2003]. Similar opinion was expressed by Schneider et al. [1992], who stated that nursing disease resulting from large litters may lead to more than 50% mortality of females.

To prevent excessive mortality of pups and improve weaning rates, pups from very large litters are transferred to smaller ones. According to Seremak et al. [2011], the number of weaned from litter also depends on the quality of care of the people working on the farm. These authors observed a dependence between the levels of selected reproductive parameters of mink, such as fertility, female fecundity, weaning rate, and the teams of servicing workers.

The aim of this study was to evaluate the effect of litter size at birth on the nursing efficiency and an attempt to establish the optimal litter size in terms of weaning success.

## **MATERIAL AND METHODS**

The study was carried out in 2010 on a mink farm situated in north-western Poland. The animals were housed, managed and fed in a standard way, according to commonly recognized standards. We analysed data on litters from 390 one-year-old females of three color types: Black Velvet (or short NAP), Hedlund White, and Silverblue. Each study group comprised 130 females of the breeding stock. Within each group, we analysed the litter size and birth and the number of pups that survived until the age of seven days. Also percentage proportion of various classes of litter sizes is given and survival rate (in percentage) of pups in each litter has been calculated. We also estimated the correlation between the quantity of pups born and raised until day 7 after birth; for this we used Spearman rang correlation.

## **RESULTS AND DISCUSSION**

Table 1 presents litter sizes for each color type. Within the Black Velvet type, nests containing eight pups represent the most frequent ones (20.77%), followed by nests with seven pups (20.00%). In Silverblue mink, most frequent were nests with nine pups (23.85%), followed by 10 (20.0%), and eight (19.21%). In Hedlund White mink, the share of sizes of individual litters was different; a high, 10% proportion of litters were represented by just one pup born, whereas the most common litter contained four pups (17.69%). The females of this color type were characterised by the lowest average litter size, 5.35 pups, which resulted from the high proportion of „single” litters, as compared with the other color types. The highest mean litter sizes were attained by Silverblue mink, 7.61 pups, as this type had the highest proportion of litters comprising 8, 9, or 10 pups, as compared to the other studied color types.

Pastirnac and Gruia [1980] describe the following distribution of litter sizes: 1, 2, 3, 4, 5, 6, 7–9 pups are born in, respectively, 21.5, 19.2, 17.4, 12.2, 13.4, 9.9, and 6.4% of litters. These quantities differ from those obtained in this study, since Black Velvet and Silverblue mink gave birth to much more litters with a higher number of pups (7 to 9), and the percentage of small litters, 1 to 3 pups, was lower in our study.

After seven days from birth, the percentage share of each litter sizes (Table 2) differed considerably from the data noted at birth (Table 1). Mortality recorded at age seven days was from 10.3% in Black Velvet to 38.7% in Hedlund White type. Litters were found in which no pups survived at all; these represented 3.08% in Silverblue, 1.54% in Black Velvet, and 0.77% in Hedlund White of all studied females. Nearly 80% of pups in Hedlund White were found in nests conta-

Table 1. Percentage of different litter sizes at birth within the studied color types of mink

Tabela 1. Procentowy udział miotów o różnej liczebności przy urodzeniu w obrębie badanych odmian barwnych norek

Litter size Wielkość miotu	Colour type – Odmiana barwna			Total, % Ogółem, %
	Black Velvet, % Black velvet, %	White Hedlund, % Biała Hedlunda, %	Silverblue, % Silverblue, %	
1	3.08	10.00	6.92	6.67
2	4.62	8.46	3.85	5.64
3	5.38	6.92	2.31	4.87
4	5.38	17.69	0.77	7.95
5	3.85	10.77	2.31	5.64
6	18.46	11.54	7.69	12.56
7	20.00	10.77	8.46	13.08
8	20.77	6.92	19.23	15.64
9	13.85	8.46	23.85	15.39
10	3.08	6.15	20.00	9.74
11	1.54	2.31	4.61	2.82
Mean litter size, pups Średnia wielkość miotu, osobniki	6.58	5.35	7.61	6.51

Table 2. Percentage of different litter sizes at 7 days from birth within the studied color types of mink

Tabela 2. Procentowy udział miotów o różnej liczbie młodych odchowanych w siódmym dniu po urodzeniu w obrębie badanych odmian barwnych norek

Litter size Wielkość miotu	Colour type – Odmiana barwna			Total, % Ogółem, %
	Black Velvet, % Black velvet, %	White Hedlund, % Biała Hedlunda, %	Silverblue, % Silverblue, %	
0	1.54	0.77	3.08	1.80
1	4.62	16.15	3.85	8.21
2	8.46	19.23	6.15	11.28
3	6.92	20.77	3.85	10.51
4	6.15	23.08	6.15	11.79
5	6.15	7.69	4.61	6.15
6	16.92	7.69	9.23	11.28
7	16.92	2.31	18.46	12.56
8	19.23	2.31	22.31	14.62
9	12.31	–	16.92	14.61
10	0.77	–	5.38	3.07
11	–	–	–	–
Mean litter size, pups Średnia wielkość miotu, osob.	5.90	3.28	6.45	5.21
Mean mortality of pups, % Średnia śmiertelność młodych, %	10.3	38.7	15.24	20.0

ining 1 to 4 pups, whereas there were no nests with a number higher than 8 pups. The remaining color types demonstrated the highest percentage of nests with 6–9 pups. Pastirnac and Gruia [1980] observed that the mortality of young mink after 10 days from birth ranged from 9.1 to 15,2%.

In order to track the fate of, and to thoroughly analyse sizes of litters for each color type, these are presented in the graphs (Fig. 1, 2, and 3). The analysis for Black Velvet demonstrates that the nests in which one young was born per litter, after seven days were still alive in 75%, while 25% of females that gave birth to a single pup did not raise their offspring. Females that had a litter of two pups, on the other hand, raised 100% of them. All the females that had 11 pups born in the litter, after seven days raised 9 pups (Fig. 1).

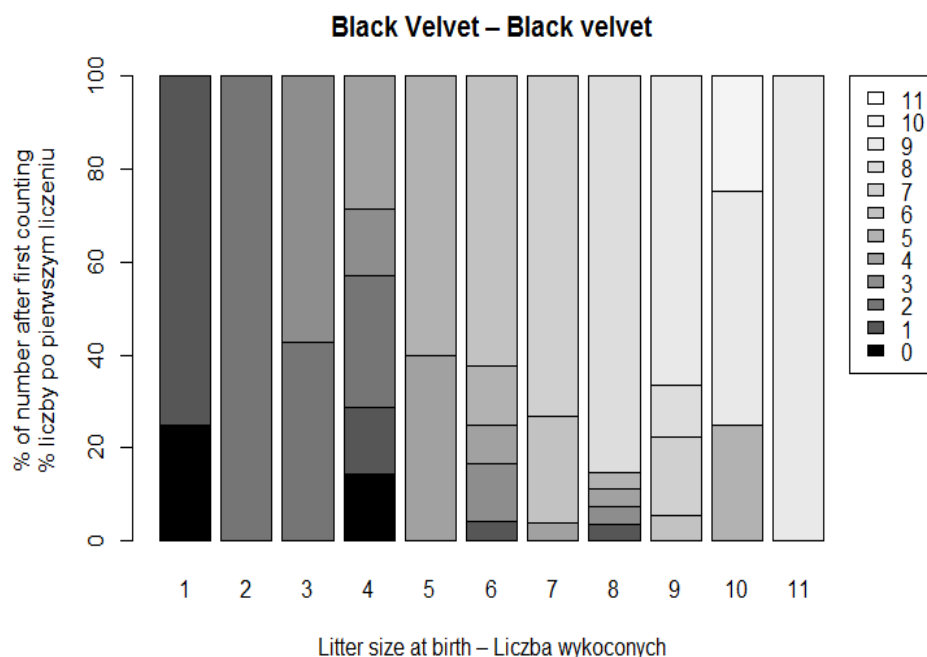


Fig. 1. Raising rate, %, of Black Velvet pups at day 7 after birth in relation to the litter size at birth

Rys. 1. Odchów (%) szceniąt norek odmiany Black velvet w siódmym dniu życia w zależności od liczby młodych w miocie przy urodzeniu

Spearman's rank correlation revealed that there is significant dependence between the number of born and raised pups for each studied color type. For Black Velvet, Hedlund White, and Silverblue, these correlations were, respectively, 0.86, 0.65, and 0.69.

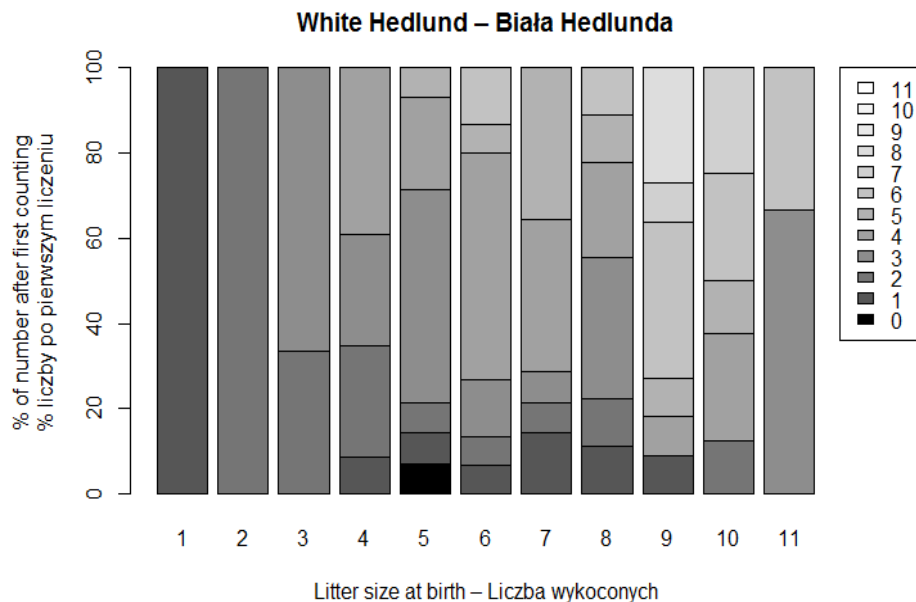


Fig. 2. Raising rate, %, of Hedlund White pups at day 7 after birth in relation to the litter size at birth

Rys. 2. Odchów (%) szceniąt nerek białej Hedlunda w siódmym dniu życia w zależności od liczby młodych w miocie przy urodzeniu

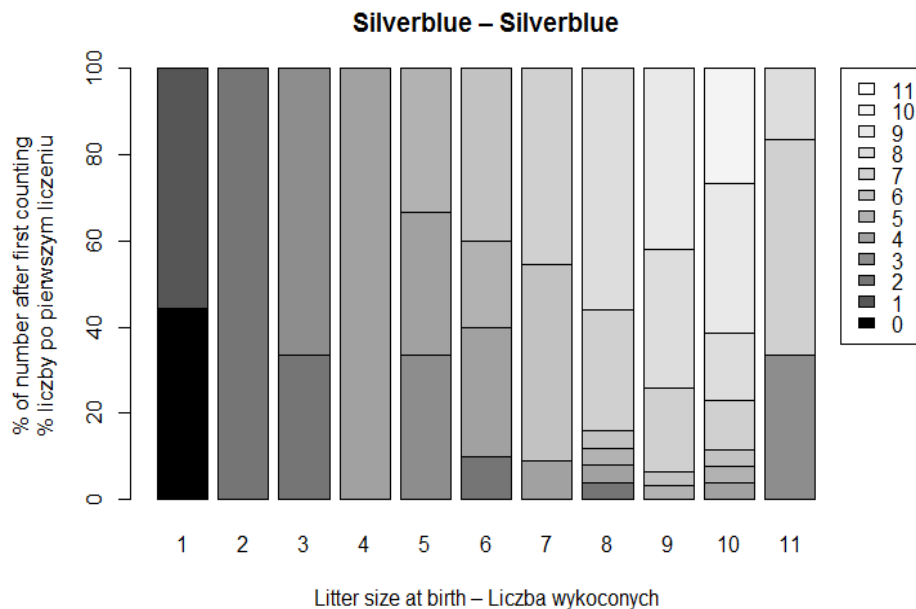


Fig. 3. Raising rate, %, of Silverblue pups at day 7 after birth in relation to the litter size at birth

Rys. 3. Odchów (%) szceniąt nerek odmiany Silverblue w siódmym dniu życia w zależności od liczby młodych w miocie przy urodzeniu

The analysis of Hedlund White shows that females that gave birth to 1 or 2 young in a litter, until day 7 raised 100% of them. Within this type of color, it is interesting that none of the larger litters, ie of nine, ten, or eleven individuals, did not survive in 100% of the initial number (Fig. 2). These nests were observed to have significant rate of deaths and so, for example, in litters where 11 pups were born, only 3 to 6 young were found after 7 days.

On the other hand, for the Silverblue type the nests with one pup born in the litter, it turned out on the seventh day after birth that about 45% of these nests did not raise the young (Fig. 3). In nests with 2 and 4 born pups, the females raised 100% of their offspring. O the nests with 11 pups at birth, 33.4% contained 3 pups on the seventh day after birth.

According to Lagerkvist et al. [1994] one of the reasons for poor survival of young during rearing is cannibalism of dams, which often destroy the entire litter. This can be caused by many factors, including hereditary tendencies, dietary faults, or impaired water management in the body of animals.

## CONCLUSION

The presented analysis shows that a large number of mink pups per litter at birth has a negative effect on their further rearing. It has been shown that on the seventh day of life there is a high percentage of loss, particularly in large litters (10–11 pups), as well as for single individuals at birth. Best rearing outcome [%] was observed in the case of litters, where the number in pups at birth ranged from 2 to 9.

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### **ANALIZA ZALEŻNOŚCI POMIĘDZY ODCHOWEM NORCZĄT (*NEOVISON VISON*) A LICZEBNOŚCIĄ URODZONYCH MŁODYCH W GNIEŹDZIE**

**Streszczenie.** Celem pracy była ocena wpływu liczebności miotu przy urodzeniu na odchów młodych oraz próba ustalenia optymalnej dla odchowu młodych wielkości miotu. Analizie poddano mioty od 390 jednorocznych samic nerek 3 odmian barwnych: czarnej, tzw. short NAP (Black velvet), białej Hedlunda (white) i Silverblue. Każdą grupę badawczą stanowiło po 130 nerek. W obrębie każdej z grup badawczych przeanalizowano liczebność miotów przy urodzeniu oraz liczbę młodych odchowanych w siódmym dniu po urodzeniu. Podano procentowy udział miotów o różnej liczebności i obliczono przeżywalność młodych nerek (również w procentach) w poszczególnych miotach. Z przedstawionej analizy wynika, iż zbyt liczne mioty z jedenastoma, dziesięcioma młodymi nie są odchowywane, i w dużym procencie pozostają w nich od 2- 6 młodych, jedynie w obrębie odmiany Black velvet w miotach takich w dużym procencie zostało po 9 młodych. Ciekawym jest również fakt, iż samice, które urodziły po jednym młodym, często ich nie odchowują. Przeprowadzona analiza pozwala na stwierdzenie, iż najkorzystniejsze dla odchowu są mioty o liczebności od 2. do 9. młodych z obserwowanym różnicami w zależności od odmiany barwnej.

**Słowa kluczowe:** *Neovison vison*, odchów, rozród, wielkość miotu.

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