

DANISH REVIEW OF GAME BIOLOGY Vol. 6. no. 2

Edited by Anders Holm Joensen

Studies on the Weasel (*Mustela nivalis*)  
and the Stoat (*Mustela erminea*) in Denmark

by  
METTE FOG

(Med et dansk resumé: Studier af brud (*Mustela nivalis*) og lækat  
(*Mustela erminea*) i Danmark.)

Резюме на русском языке:  
Исследования *Mustela nivalis* и  
*Mustela erminea* в Дании.

COMMUNICATION NO. 74 FROM VILDTBIOLOGISK STATION

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## Introduction

In spite of the fact that the weasel (*Mustela nivalis*) and the stoat (*Mustela erminea*) are widely distributed in Denmark very little is known on occurrence, sex and age composition in wild populations nor of breeding biology of the two species.

In 1959 the Game Biology Station, Kalø, started an investigation on the two species, the purpose of which was to elucidate some of these problems. In 1963 all data were analysed and used as thesis for my masters degree at the University of Århus.

The analysis comprises 198 animals

collected specifically for this investigation as well as skinned specimens in the collection of the Zoological Museum in Copenhagen.

This paper describes the method of capture, the geographical occurrence, and methods of aging *Mustelidae* and it also gives some data on the moult of the stoat.

The animals collected for this investigation were trapped by game advisors and game keepers, and I am most indebted to them all for their valuable help. I want to thank the Zoological Museum in Copenhagen for supplying specimens for the investigation.

## Material

From September 1959 to April 1962 altogether 84 stoats (*Mustela erminea*) and 114 weasels (*Mustela nivalis*) were collected (Table 1). Included in the analyses is one female stoat trapped in October 1956. The animals were trapped in different places around the country, including 25 trapped on the estate of Kalø.

At Kalø the following method was used: Common tip up traps without bait were placed abt. 100 metres apart, mostly

along hedges, forest edges, in ditches, along stonewalls or in game trails. The traps were examined daily and occasionally moved to new localities. Besides stoats and weasels many mice, voles and rats were caught. Experienced game keepers maintain that a good location for trapping stoats is along streams particularly under bridges. Most of the animals caught outside Kalø were taken in tip up traps too.

	1956	1959	1960	1961	1962	Total <i>i alt</i>
<i>Mustela nivalis</i>		7	19	83	5	114
<i>Mustela erminea</i>	1	11	14	55	4	85
Total, <i>i alt</i>	1	18	33	138	9	199

Table 1. The number of animals collected for the present investigation.

Tabel 1. Antal indsamlede dyr i forbindelse med denne undersøgelse.

*Monthly capture record*

Figs. 1 and 2 show the number of animals captured per month for the two species when all four years records are pooled. For 16 individuals the date of capture is missing.

Most of the animals were trapped between May and September, while the wintermonths only account for very few. Because of this uneven distribution of the material there would be rather poor basis for satisfactory investigations on f. ex. moult and food habits.

The main reasons for the majority of animals being trapped in the summer is, that trapping was intensified in May-June 1961 and also that the population is the largest in the summertime when it comprises a large proportion of unexperienced young animals.

Especially in early summer the game keepers are trapping stoats very intensively in order to avoid damage on hand-reared game birds.

*Sex ratio*

113 weasels (*Mustela nivalis*) were sexed: 65 % (73) were males and 35 % (40) females. The excess number of males is

not exceptional for the Danish data. Also POHL (1910) states that 73 % out of 230 weasels were males. REICHSTEIN (1956) found 71 % males out of 419 and HILL (1939) had 73 % males out of 446 animals.

DEANESLY (1944) later worked out HILL's material, and her explanation is that females do not move much during pregnancy and lactation and are therefore less liable to be trapped. Since weasels probably often breed more than once annually, females will be difficult to catch during a rather long period of the year. The distorted sex ratio in the sample may of course indicate a true sex composition in the population, but this I consider rather unlikely.

85 stoats (*Mustela erminea*) were sexed: 43 were females and 42 males. Other trapped samples of *Mustela erminea* have, however, shown a dominance of males: DEANESLY (1935) had 61 % males out of 640 individuals, ELDER (1945) found that when the population was low 80 % of the trapped animals were males, but when it was increasing only 60 % were males. FLINTOFF (1935) found 63 % males out of 6,221 examined.

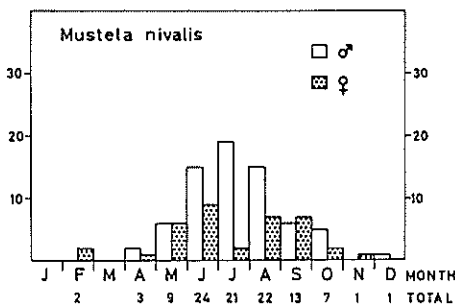


Fig. 1. *Mustela nivalis*: The distribution of 106 animals on months of capture. 4 years taken together.

Fig. 1. Fordeling på årets måneder af 106 indsamlede *Mustela nivalis*.

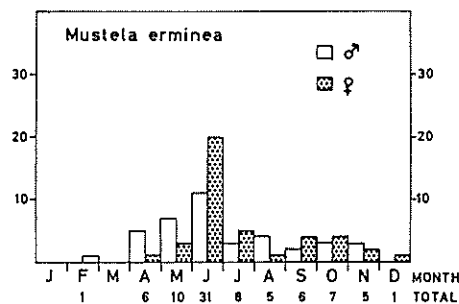


Fig. 2. *Mustela erminea*: The distribution of 80 animals on months of capture. 4 years taken together.

Fig. 2. Fordeling på årets måneder af 80 indsamlede *Mustela erminea*.

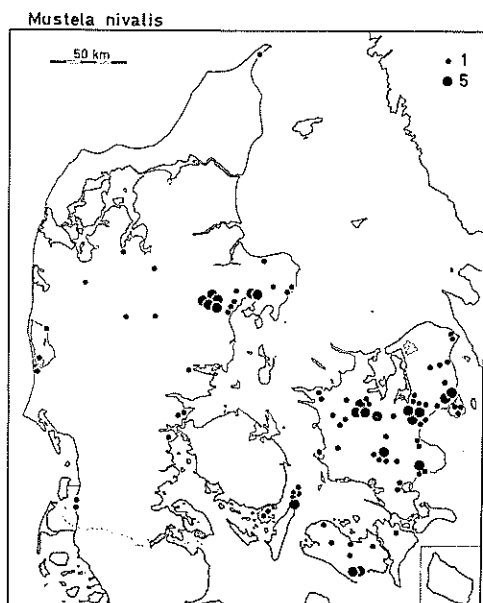


Fig. 3. *Mustela nivalis*: Localities where 178 animals were trapped.

Fig. 3. Fangststederne for 178 *Mustela nivalis*.

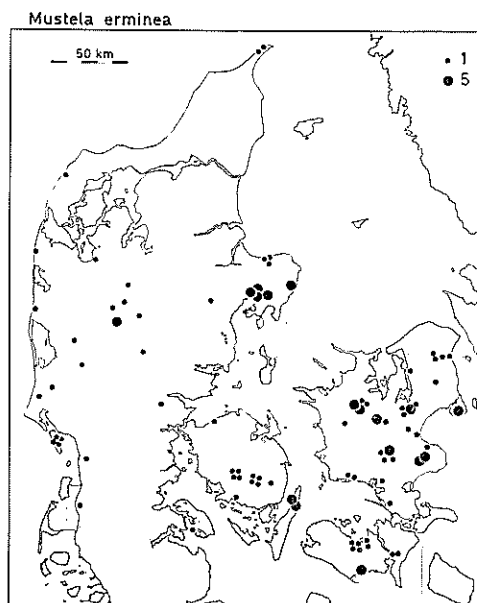


Fig. 4. *Mustela erminea*: Localities where 154 animals were trapped.

Fig. 4. Fangststederne for 154 *Mustela erminea*.

#### *The occurrence of the two species in Denmark*

The general impression (e. g. MANNICHE 1933) has hitherto been that in Denmark the weasel is less numerous than the stoat. This has been based on visual observations which undoubtedly favour the larger and more conspicuous of the two species.

In the present material the weasel is by far the most numerous. It is dominant in most areas in each year's collection. The sample is only representative if the two species are equally easy to trap, which is not known. But we may conclude, that the weasel is more common than was earlier assumed. The maps Figs. 3 and 4 show where in Denmark weasels and stoats have been trapped. The material includes both data from the present investigation and from collections of stoats and weasels in the Zoological Museum,

Copenhagen, and the Museum of Natural History in Århus.

Most animals were collected in Zealand, Lolland and E. Jutland. This is due to the fact that in these parts of the country there are many estates and therefore many game keepers. When the material for this investigation was collected the Game Biology Station especially asked the game keepers to cooperate, and altogether 85 % of the animals came from game keepers. Also sportsmen were asked through their magazines to send individuals of the two species to Kalø. All were offered payment for the specimens, but sportsmen in general have very little chance to kill these animals, and all the collected individuals were in fact trapped.

The annual kill of stoats in Denmark is 4000-6000 individuals (STRANDGAARD 1964). Fig. 5 which is based on the bag

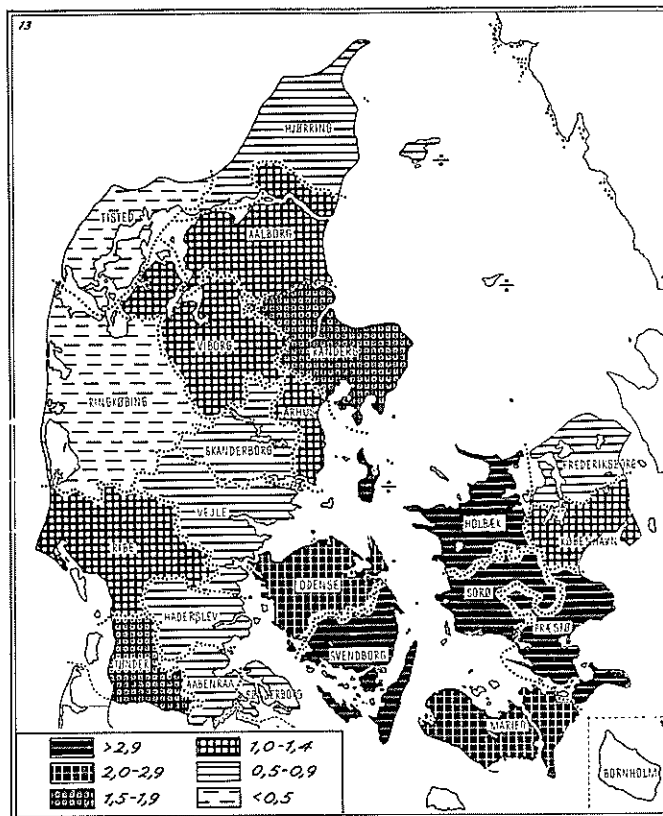


Fig. 5. The bag record of *Mustela erminea* in Denmark 1957/58. Bag per 1000 hectares (10 km<sup>2</sup>). (From STRANDGAARD 1964).  
 Fig. 5. Jagtudbyttet af *Mustela erminea* i Danmark 1957/58. Udbytte pr. 1000 ha (10 km<sup>2</sup>). (Fra STRANDGAARD 1964).

record from 1957/58 shows that the species occurs in all parts of Denmark except some of the islands, e. g. Bornholm, Læsø, Anholt, and Samsø. The densities of killed stoats do probably not indicate the

relative population density, but are rather more a result of the presence of estates and game keepers in the eastern parts of the country.

### Age determination

#### Baculum

The baculum (os penis) of all males was boiled in water for 15–30 minutes and cleaned. Later they were bleached for 24 hours in 6 % H<sub>2</sub>O<sub>2</sub> and finally dried.

For both species two types of baculum were found: 1) a thin bone, roughly equal in diameter down most of the length, and 2) a thicker bone with an excrescence at

the proximale end. From descriptions of os penis in *Mustelidae* by ELDER (1951), LECHLEITNER (1954) and POPOV (1943) there is reason to believe that type 1) belongs to juvenile and type 2) to adult animals. There were, however, bones which were neither typically juvenile nor adult, but intermediate.

The weight and appearance of os penis have formed the main basis of the age determination of males described in the following.

*Mustela nivalis*

The sample of baculum from weasels is 59 (Fig. 6). The juvenile type baculum was weighing less than 25 mg, while the adult type was heavier than 30 mg. The distinction between the weights of adult type and juvenile type baculum is quite clear. Most of the old males are from June and July and the majority of the young males from July, August and September. The earliest male with a young type baculum was trapped on May 20th.

Three bones from summer and autumn were the intermediate type, neither typically juvenile nor typically adult.

*Mustela erminea*

A total of 33 bacula from stoats could be determined. Weight and shape are shown in Fig. 7. Though the sample is small it is very peculiar that no old males are trapped later than July 1st.

All baculum with a weight less than 30 mg were the juvenile type, while baculum weighing more than 40 mg conformed to the adult type. Three baculum were intermediate, and since these animals were trapped in April and May they were probably one-year old males.

*Other age criteria*

The bodies of 24 males (12 ad + 12 juv) of both species whose age was safely determined on basis of the weight and morphology of the baculum, were carefully examined for other possible age criteria.

In both species the sagittal crest, crista sagittalis, was found to be small in the young animals and strongly developed in the adults.

Furthermore it was clear that in the adults the humerus had a small excrescence at the proximal end just below or on the lower part of the epiphysis. This excrescence was absent in the young ones.

An examination of 165 humerus and 175 crista sagittalis of the two species

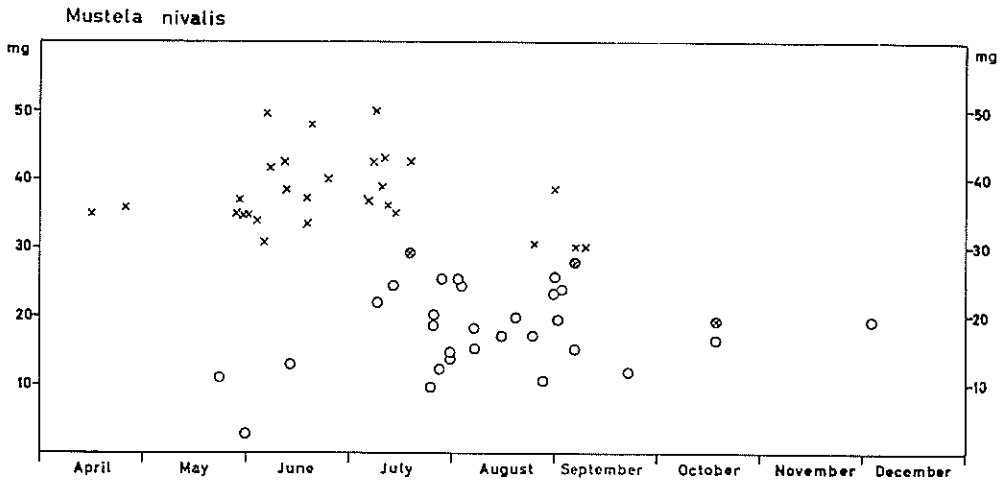


Fig. 6. *Mustela nivalis*: The monthly distribution of 59 baculum on the two types. x adult type, o juvenile type, ⊗ intermediate type.

Fig. 6. Vægt og udseende af penisben fra 59 *Mustela nivalis* fordelt på årets måneder.



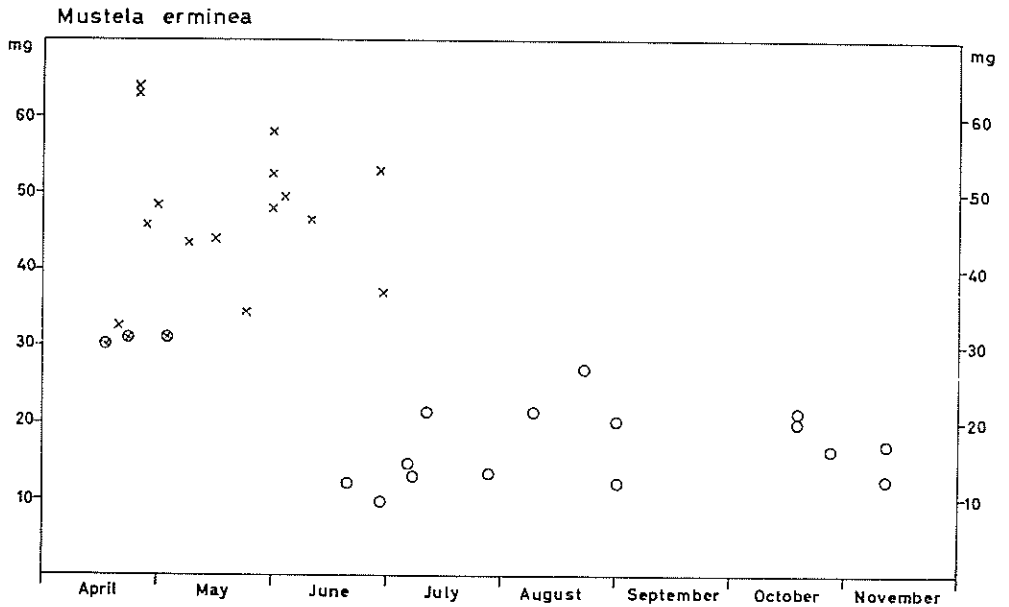


Fig. 7. *Mustela erminea*: The monthly distribution of 33 baculum on the two types. x adult type, o juvenile type, ⊗ intermediate type.

Fig. 7. Vægt og udseende af penisben fra 33 *Mustela erminea* fordelt på årets måneder.

showed a good correlation between well-developed crista sagittalis and excrescence on humerus and vice versa. Some animals had an excrescence on humerus, but no developed crista sagittalis. These individuals were mainly trapped in September, October, November and December, which might indicate, that the excrescence on humerus is developed before the crista sagittalis. All these animals are considered young ones. At which age the two criteria become »adult« is not yet known,

but there may well be differences in the two species and/or sexes.

*Weight*

All the collected animals were weighed immediately after their arrival at Kalø. Some individuals had lost the tail. The weights of these animals are not included in Table 2 and Figs. 8 and 9.

The males are evidently heavier than the females. The overlap between males

Species	Sex	No. of animals	Min. weight grams	Average weight grams	Max. weight grams
Art	Køn	Antal dyr	Min. vægt gram	Gennemsnitsvægt gram	Max. vægt gram
<i>Mustela nivalis</i>	♀	22	39,0	50,7	73,3
<i>Mustela nivalis</i>	♂	46	53,8	85,5	131,5
<i>Mustela erminea</i>	♀	31	92,0	143,2	190,2
<i>Mustela erminea</i>	♂	33	114,9	208,0	322,0

Table 2. Weights of 68 *Mustela nivalis* and 64 *Mustela erminea*.

Tabel 2. Vægte af 68 brude og 64 lækatter.

and females is greater for the stoat than for the weasel.

The relation between weight and age was examined for both species. Table 3 seems to show that the old males in the material of both *Mustela erminea* and *Mustela nivalis* are considerably heavier than the young ones, as the difference in average weight is abt. 26 g and abt. 36 g for the two species respectively. On the contrary there is no marked difference between young and old females in either of the two species. This may be caused in the more uncertain age-determination for the females, but it also corresponds with the fact that young female stoats very quickly within few months reach their sexual maturity and are fully developed very early (DEANESLY 1935). According to HILL (1939) males of the stoat are almost one year old before they are sexually matured, and weasel-males must be at least 4 months old.

*Skull length*

The length from the rhinion on the nasal bone to the occipital condyle was measured (Table 4). It may be assumed, that the young *Mustelidae* might have a shorter skull than the adults, but it appears from the measurements that the skull has

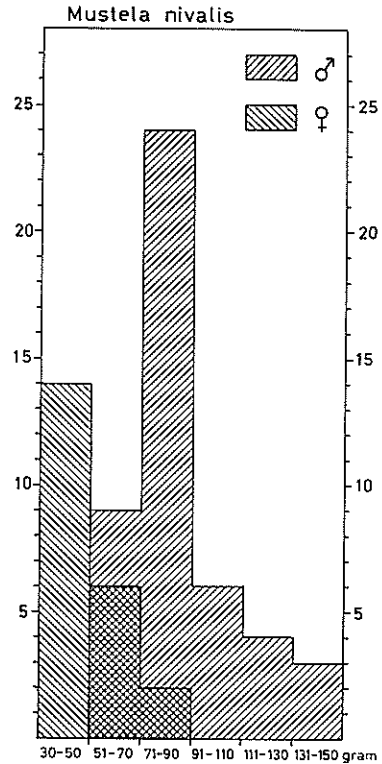


Fig. 8. *Mustela nivalis*: Weights of males and females. 23 % of the animals are overlapping.

Fig. 8. Vægte af *Mustela nivalis*, han og hun. De to køn overlapper hinanden i 23 % af tilfældene.

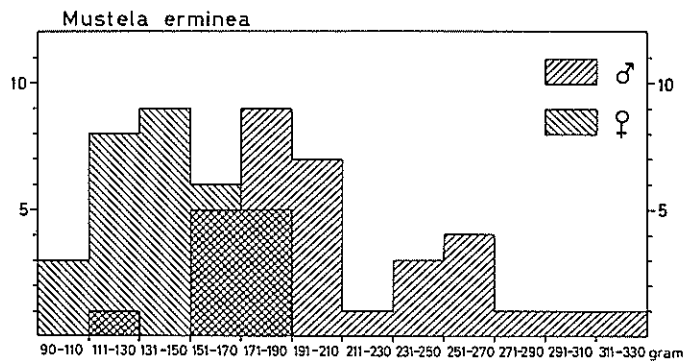


Fig. 9. *Mustela erminea*: Weights of males and females. 34 % of the animals are overlapping.

Fig. 9. Vægte af *Mustela erminea*, han og hun. Der er overlapping hos 34 %.

Species	Sex	Age	Number of animals. In () the number of animals whose weight is missing		Minimum weight grams	Average weight grams	Difference in average weight between adults and juveniles	Maximum weight grams
Art	Køn	Alder	Antal dyr. I () det antal, der mangler		Min. vægt gram	Gennem- snitlig vægt, gram	Forskel i gen- snitsvægt for ad. og juv. gram	Max. vægt gram
<i>Mustela nivalis</i>	♀	juv.	13	(16)	39,0	47,3		58,5
<i>Mustela nivalis</i>	♀	ad.	7		42,7	51,2	3,9	73,3
<i>Mustela nivalis</i>	♂	juv.	18	(17)	53,8	70,6		86,7
<i>Mustela nivalis</i>	♂	ad.	25	(7)	72,2	96,3	25,7	131,5
<i>Mustela erminea</i>	♀	juv.	22	(6)	92,0	139,7		190,2
<i>Mustela erminea</i>	♀	ad.	8	(2)	129,0	151,7	12,0	188,8
<i>Mustela erminea</i>	♂	juv.	14	(5)	114,9	190,8		279,0
<i>Mustela erminea</i>	♂	ad.	14	(5)	152,0	225,0	35,8	322,0

Table 3. Relation between weight and age for 63 *Mustela nivalis* and 58 *Mustela erminea*.

Tabel 3. Relationen mellem vægt og alder hos 63 *Mustela nivalis* og 58 *Mustela erminea*.

Species	Sex	Number of animals	Min. length	Average length	Max. length
Art	Køn	Antal dyr	Min. længde	Gennemsnits- længde	Max. længde
<i>Mustela nivalis</i>	♀	29	31,5 mm	32,9 mm	35,0 mm
<i>Mustela nivalis</i>	♂	60	33,0 mm	36,9 mm	40,7 mm
<i>Mustela erminea</i>	♀	32	38,9 mm	43,9 mm	48,6 mm
<i>Mustela erminea</i>	♂	34	43,5 mm	46,9 mm	50,7 mm

Table 4. Skull length in 89 *Mustela nivalis* and 66 *Mustela erminea*.

Tabel 4. Kranielængden hos 89 *Mustela nivalis* og 66 *Mustela erminea*.

Species	Sex	Juv.	Ad.	Age unknown	Total	% Juv.
Art	Køn	Juv.	Ad.	Alder ukendt	I alt	% Juv.
<i>Mustela nivalis</i>	♀	29	7	4	40	80,5
<i>Mustela nivalis</i>	♂	35	32	7	74	52,2
<i>Mustela erminea</i>	♀	28	10	5	43	73,6
<i>Mustela erminea</i>	♂	19	19	4	42	50,0
				20	199	

Table 5. Age of 103 *Mustela nivalis* and 76 *Mustela erminea* on basis of at least one age criterion.

Tabel 5. Alder hos 103 *Mustela nivalis* og 76 *Mustela erminea* bestemt efter mindst ét alderskriterium.

reached its full length when the young start moving around by themselves in June and July and are liable to be trapped.

*Age ratio*

Altogether it was possible to age – on the basis of at least one age criterion – 179 of the animals (Table 5). It must be

emphasized, however, that the age determination of females is rather uncertain. (It has not been tried to age the animals by their teeth structure). The percentage of juveniles is much higher in females than in males. Again the material is too small and as said before the age determination is uncertain.

**Moult in *Mustela erminea***

The stoat moults twice a year in the spring and in the fall, and in Denmark the coat is white in the wintertime.

In the Danish material (including 57 specimens from Zoological Museum, Copenhagen) no evidence of moult is found before November 10th (Fig. 10). A male from western Jutland, killed on this date, had many white hairs on the back, ears and tail. The earliest date for a stoat in full summer coat is on April 1st.

On basis of the entire sample, it appears that the fall moulting period is quite distinct, from the middle of November to the middle of December. The latest date for summer coat is November 22nd. For an animal in transitioncoat in fall the latest date is December 16th.

The moulting period in the spring is more prolonged. It probably changes greatly from year to year as the temperature in spring time in Denmark is very variable.

The first animal showing spring moult is from February 12th, but completely white animals are trapped as late as March 11th. The latest animal in transition coat is from April 3rd.

Some information of the length of the spring moulting period can be given from observations of two animals held in captivity. One animal, a female, started on March 21st with some brown hairs around the eyes. She stopped the moult

on March 30th because of confinement and at that time she had not finished. She had a brown stripe along the back. The shoulders and head were brown apart from a white spot between the eyes, the legs had just started to change colour, but the tail was still almost white.

The other animal, a male, showed the first brown hairs on March 10th and on March 21st after 11 days he had finished the moult.

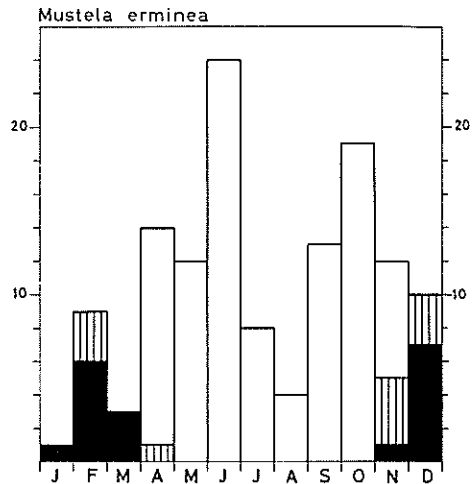


Fig. 10. Stage of moult during the year in 129 *Mustela erminea*. Black: winter coat, vertical hatching: transition coat, white: summer coat.

Fig. 10. Fældningsstadiet af 129 *Mustela erminea* fordelt på årets måneder. Sort: vinterdragt, lodret skraveret: overgangsdragt, hvid: sommerdragt.

## The least weasel (*Mustela minuta*)

The least weasel is described by POMEL in 1853 on basis of a specimen from Augvergne under the scientific name *Putorius microgale* (Nomen nudum) *Putorius minutus*.

To-day it is still discussed whether *Mustela minuta* is a valid species or only

a subspecies of *Mustela nivalis* (REICHSTEIN 1956).

The Kalø-sample of 114 weasels were all belonging to the *nivalis* species according to the criteria of size, weight, coat and skull length, described by ZIMMERMANN (1940).

### Summary

1. From various localities in Denmark 85 stoats (*Mustela erminea*) and 114 weasels (*Mustela nivalis*) have been collected in the years 1956 and 1959-62 (Table 1). In addition 57 skins of stoat from the Zoological Museum in Copenhagen, have been examined. The monthly capture record is seen on Figs. 1 and 2.

2. Of the collected weasels 65 % were males, of the stoats 50 % were males.

3. Trapping results indicate that the weasel is more common in Denmark than earlier assumed. Both species are distributed all over the country (Figs. 3 and 4).

4. Aging the two species was rather difficult. Only the males can be aged with certainty. The os penis develops

rapidly in size and weight when the animals become sexually mature (Figs. 6 and 7).

Other age criteria employed was the bodyweight (Figs. 8 and 9 and Table 2 and 3), the development of the crista sagittalis, a small thickening of the proximal end of the humerus and the skull length (Table 4).

Altogether it was possible to age 103 *Mustela nivalis* and 76 stoats (Table 5).

5. The stoat is the only Danish animal whose fur becomes white in winter. The autumn moult takes place from the middle of November to the middle of December. The spring moult seems to be less regular (Fig. 10).

6. The least weasel, *Mustela minuta*, was not found in the Danish material.

## Dansk resumé

### *Studier af brud (Mustela nivalis) og lækat (Mustela erminea) i Danmark.*

1. På forskellige danske lokaliteter er indsamlet 85 lækatte (*Mustela erminea*) og 114 brude (*Mustela nivalis*) i årene 1956 og 1959–1962. (Tabel 1). Til studiet af blandt andet lækattens dragtfarveskifte låntes desuden 57 skindlagte lækatte fra Zoologisk Museum i København. Fig. 1 og 2 viser fordelingen af de to arter på årets måneder.

2. Af de indsamlede brude var de 65 % hanner. Det diskuteres, om det skæve kønsforhold afspejler populationens sammensætning eller om det skyldes forskel i muligheden for at fange hanner og hunner. For lækattens vedkommende var kønsfordelingen 1:1.

3. Fangstresultaterne synes at vise, at bruden er mindst lige så talrigt forekommende i Danmark som lækatten (Fig. 3 og 4).

4. Tabel 2 viser, at hos såvel lækatten som bruden er hannerne tungere end hunnerne. Vægten af de to grupper overlapper dog i nogen grad hinanden (Fig. 8 og 9).

5. En sikker aldersbestemmelse lod sig hos begge arter kun foretage hos hannerne. Penisbenet, os penis, udvikler såvel form som vægt ved kønsmodningen.

Lækatte, hvis penisben, os penis, vejede mere end 40 mg var overvejende gamle dyr. Hos brudene var de hanner, hvis penisben vejede mere end 30 mg, adulte, mens de juveniles vejede mindre end 25 mg. Penisben hos unge dyr er spinkle og uden særlige fortykkelser, mens de hos de adulte er kraftige og med en kugleformet fortykkelse i den proximale ende. (Fig. 6 og 7).

Udviklingen af issekam, crista sagittalis, samt en fortykkelse i den proximale ende af overarmsbenet, humerus, kan bruges ved aldersbestemmelse af lækat og brud, men for begge kriterier gælder det, at man ikke nøjagtig ved, i hvilken alder de udvikles.

Tandslibning blev ikke forsøgt.

6. Der er ikke nogen udpræget forskel i vægt på de fangede unge og gamle hunner, mens materialet synes at vise, at unge hanner ikke har nået deres fulde vægt, når de om foråret og sommeren går i fælder. (Tabel 3).

7. Længden er målt på samtlige kranier, tabel 4. Der er en tydelig forskel på hanner og hunner af begge arter.

Der kunne ikke spores nogen forskel på unge og gamle dyrs kranielængde, hvilket tyder på, at kraniet har nået sin fulde længde, når individerne kun er nogle få måneder gamle.

8. Udfra mindst ét alderskriterium kunne alderen bestemmes hos 103 brude og 76 lækatte (Tabel 5). Begge arter er almindeligt forekommende i Danmark, bortset fra visse mindre øer som f. eks. Bornholm, Læsø, Anholt og Samsø (Fig. 5).

9. Lækatten er det eneste danske pattedyr, der har hvid vinterpels. Fældningen om efteråret finder sted fra midt i november til midten af december. Forårsfældningens tidspunkt er tilsyneladende ikke nær så konstant som efterårets (Fig. 10).

10. Der fandtes ikke dværgvæsel (*Mustela minuta*) i det danske materiale.

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### Резюме на русском языке.

#### Исследования *Mustela nivalis* и *Mustela erminea* в Дании.

1. В 1956 и 1959–62 годах из разных местностей Дании было собрано 85 экземпляров *Mustela erminea* и 114 *Mustela nivalis* (Табл. 1). Кроме того, было исследовано 57 шкурок *M. erminea* из копенгагенского зоологического музея. Ежемесячные результаты ловли показаны в фиг. 1 и 2.

2. Из собранных *M. nivalis* 65 проц. были самцы. Из *M. erminea*, самцы составляли 50 проц.

3. Результаты ловли указывают, что *M. nivalis* более распространен в Дании, чем это прежде предполагали. Оба вида распространены по всей стране (фиг. 3 и 4).

4. Определение возраста особей обоих видов было довольно трудно. Только возраст самцов возможно точно опре-

делить. Размеры и вес *os penis* быстро развиваются, когда животные достигают половой зрелости (фиг. 6 и 7).

Другими критериями возраста служили вес тела (фиг. 8 и 9, и табл. 2 и 3), развитие *crista sagittalis*, небольшое утолщение проксимального конца *humerus* и длина от *condylum occipitale* до *nasale* (табл. 4). В общем, имелась возможность определения возраста 103 *Mustela nivalis* и 76 *M. erminea* (табл. 5).

5. *M. erminea* является единственным животным Дании, мех которого зимой белеет. Осенняя линька происходит от середины ноября до середины декабря. Кажется, что весенняя линька менее постоянна (фиг. 10).

6. *Mustela minuta* в датском материале не встречалась.

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