datum	uur	aantal	plaats en richting	waarnemer
	15.30 „	90 ex.	Brunssum Z.	D. v. Asperen
	15.30 „	„ 90 ex.	Heerlen ZO.	Br. Arnoud
	15.30 „	150-200 ex.	Heerlen.	J. v. Keulen
	16.00 „	plm. 70 ex.	Heerlen.	H. Finken
28 oktober	?	21 ex.	Herkenbosch Z.	J. G. Tillemans
	10.25 „	25 ex.	Imstenraderbosch Z.	Z. C. Fijnaut
	10.30 „	25 ex.	Heerlen Zeer laag Z.	Mevr. Bult (Schaesbergervlde)
	10.30 „	22 ex.	Vaesrade.	W. de Veen
	16.30 „	plm. 50 ex.	Ospeler Peel Pleisterend.	H. M. van Deurssen
	17.15 „	17 ex.	Ospeler Peel vanuit oosten komend	Van Bussen
	20.30 „	?	Ospel.	H. van Deurssen
	21.00 „	Zeer veel	Ubachsberg op dakhoogte	Schaakxs
	21.30 „	?	Boven Ospeler Peel.	G. van Deerssen
29 oktober	1.30 „	?	Hoog overvliegend Ospel.	H. van Deurssen
	plm. 15.00 „	?	Meyel.	Van Bussen
2 november	15.20 „	plm. 20 ex.	Zelfkant ZZW.	Hidde Bult
8 november	23.30 „	?	Maastricht.	Dr. P. v. Nieuwenhoven

DISTRIBUTION AND ABUNDANCE OF BATS IN S. LIMBURG FROM 1958 TILL 1962

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CONTENTS

Introduction

In 1957 we published a paper on distribution and decline of bat populations in S. Limburg from 1942 till 1957. The present study is a sequel to it, dealing with the bat populations during the succeding 5 years.

Since 1957, circumstances in the S. Limburg caves have changed a great deal. Mushroom culture has been stopped in some of them and hibernating bats have no longer been disturbed by banding. The annual census has been continued, but the bats have been identified *in situ*, if possible. In addition, observations have been made on habitat selection inside the caves during hibernation; results will be published elsewhere (Bezem, Sluiter and van Heerdt, 1964).

In the present study the same species and the same caves are regarded, as have been studied previously (Sluiter and van Heerdt, 1957). As to sampling technique we refer to the same paper. The caves are recorded on the map of fig. 1.

It must be remembered that our results refer to „sampling" caves only, i.e. caves having been sampled regularly since 1942 (for cave nrs cf. Bels 1952). A still greater number of s.c. „non sampling" caves is spread along the valleys of the rivers Jeker, Maas and Geul and near the village Sibbe. In some of them considerable numbers of bats roost during winter, for instance in the Sibbergroeve (cf. Sluiter and van Heerdt, 1964), but these numbers cannot be taken into account when the distribution and the relative abundance of bats during recent years are compared with older data of this kind. Moreover it must be mentioned that the population of a cave may not remain constant in the course of one winter (cf Bels 1952, van Nieuwenhoven, 1956). To make the samples comparable, they are taken always during the first ten days of January.

1. The present situation

To judge the present situation, we will consider the annual sample sizes during the period 1958/'62.

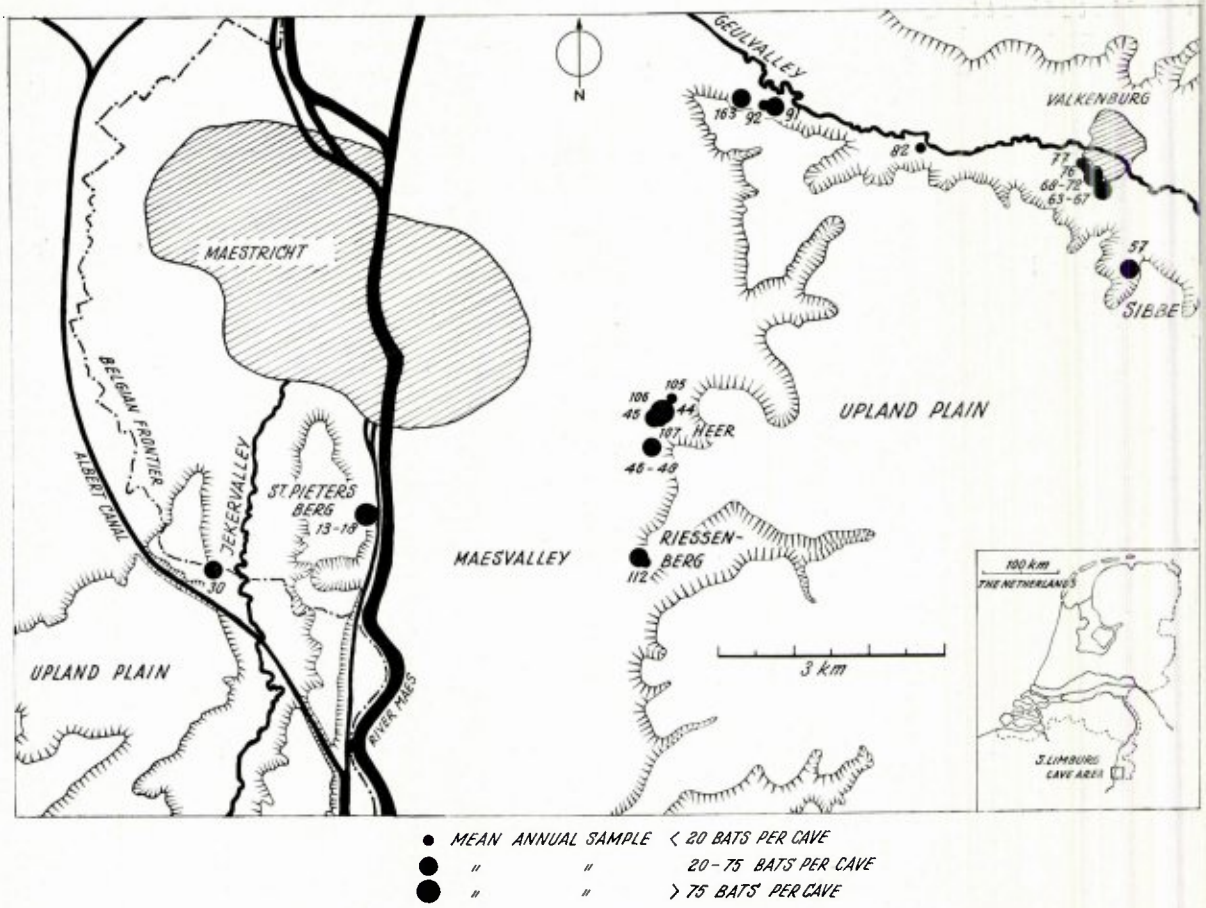

Fig. 1. The cave area of S. Limburg, subdivided into 7 geographical sections (cf. table 2). The entrances of sampling caves are indicated by black dots, the size of which is roughly proportional to the abundance of bats in the cave involved.

a. Abundance

An impression of the relative abundance of 7 bat species hibernating in the cave area as a whole can be gained from the survey of annual sample sizes in all sampling caves combined, as recorded on table 1.

Since 1957, *Myotis mystacinus* has been the most abundant species hibernating in S. Limburg, followed by *Myotis daubentoni*, which is playing the role of "runner up". The other species, *M. mystacinus* included, do not show an obvious tendency to increase nor to decrease in number during these 5 recent years.

TABLE I. Numbers of bats counted in the sampling caves 1958/1962.

Species	Year '58	'59	'60	'61	'62	Totals
M. mystacinus	167	119	158	145	131	720
M. daubentoni	53	77	94	93	135	452
M. dasycneme	60	65	68	76	73	342
M. nattereri	66	59	88	66	61	340
Rhin. hipposideros	34	50	39	32	37	192
M. emarginatus	34	25	32	40	50	181
M. myotis	35	30	11	24	33	133
Totals	449	425	490	476	520	2360

b. Distribution.

In most caves the number of individuals of one species counted during one visit is too small to make possible reliable conclusions concerning the distribution of this species over the caves of the area. Even addition of 5 annual samples does not solve this problem in every case. Therefore, we are obliged to group the sampling caves also into larger units, called "geographical sections of the cave area". They are recorded on table 2. From fig. 1 this grouping of caves can be seen to be rather natural as the sections are at least one kilometer apart, while the distance between the caves of one section is much smaller as a rule. It must be emphasized, however, that the corridor surface included in a section is not for each section alike, meaning that the numbers on table 2 do not relate to densities.

They can serve, therefore, only to show differences in abundance between the species in a section i.e. specific differences in distribution over the cave area.

Species / Section	*M. myst.*		*M. daub.*		*M. das.*		*M. natt.*		*Rhin. hipp.*		*M. emarg.*		*M. myotis*		Species combined 1958/1962
	nr	fr.	nr	fr.	nr	fr.	nr	fr.	nr	fr.	nr	fr.	nr	fr.	
Heer, cave nrs 44-48, 105-107	154	0.214	135	0.299	96	0.281	76	0.224	25	0.130	25	0.138	45	0.338	556
St. Pietersberg nrs 13-18	150	0.208	153	0.338	47	0.137	124	0.365	13	0.069	30	0.166	18	0.135	535
Geulvalley nrs. 82, 91, 92, 163	172	0.239	75	0.166	71	0.208	72	0.212	29	0.151	33	0.182	28	0.211	480
Valkenburg nrs 63-67, 68-72, 76, 77	131	0.182	46	0.102	66	0.193	33	0.097	50	0.260	61	0.337	10	0.075	397
Riessenberg nr 112	69	0.096	29	0.064	51	0.149	17	0.050	45	0.234	25	0.138	31	0.233	267
Jekervalley nr 30	34	0.047	11	0.024	8	0.023	12	0.034	2	0.010	3	0.017	1	0.008	71
Sibbe nr 57	10	0.014	3	0.007	3	0.009	6	0.018	28	0.146	4	0.022	0	0.000	54
Sampling caves combined	720	1.000	452	1.000	342	1.000	340	1.000	192	1.000	181	1.000	133	1.000	2360

TABLE 2. Annual samples 1958/1962 combined and recorded for each species and each geographical section; nr = number, fr. = fraction.

According to the fractions on table 2, specific differences in distribution are evident and need no further description.

2. Changes in abundance during the period 1946/1962 in all sampling caves combined

Annual sample sizes may fluctuate considerably (cf. table 1). This artefact, due to our superfical way of sampling, makes it difficult to recognize the general trend in the abundance of our bat species during the long period we are going to consider in this paragraph. In order to get numbers which characterize this trend as sharply as possible, the samples of all caves are added again and the years pooled into larger units. To this end, the following subperiods have been created: 1946/'49, 1950/'53, 1954/'57 and 1958/'62. Results are recorded in fig. 2.

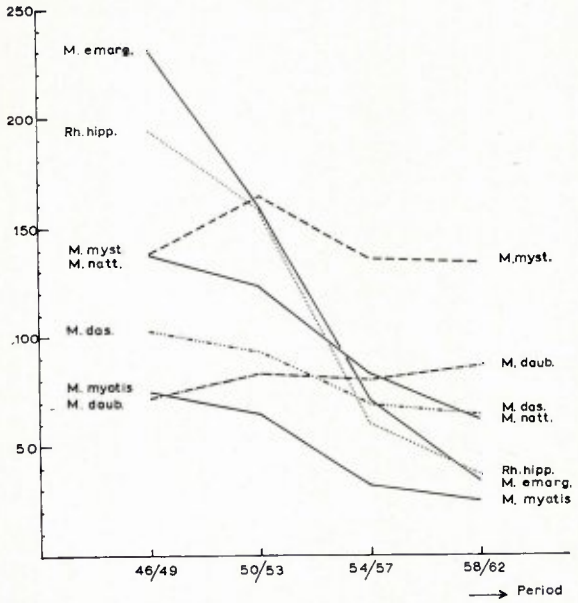

Fig. 2. Mean annual sample sizes in all sampling caves combnedi and plotted against time. The period 1946/62 is divided in four subperiods: 1946/49, 1950/53, 1954/57 and 1958/62.

These graphs show how *Rhinolophus hipposideros* and *Myotis emarginatus* have lost their position as the most numerous species in favour of *Myotis mystacinus*, whereas the other species maintained their positions more or less.

3. Changes in abundance during the period 1946/'62 in the geographical sections

In paragraph 1b we demonstrated the existence of considerable specific differences in distribution over the geographical sections of the cave area during recent years. In order to investigate this phenomenon during a longer period we have added again the annual samples of the sampling caves belonging to one geographical section and grouped again the years 1946/'62 in subperiods, as we have described in paragraph 2.

In the sections Sibbe and Jekervalley the numbers of specimens of our 6 *Myotis* species are too small to be considered; only those of *Rh. hipposideros* in Sibbe are worth mentioning. Results are recorded in the figs. 3—9.

Conclusions

a. Originally, *M. mystacinus, M. daubentoni* and *M. nattereri* were much more numerous in the section St. Pietersberg (= the cave Slavante) than in the other sections; the numbers of *Rh. hipposideros* have been always very small in the St. Pietersberg.

b. Generally, the numbers of bats found in the St. Pietersberg show a tendency to decrease, whereas those in the sections Heer and Riessenberg tend to remain constant or even to increase in the same time (*M. emarginatus* and *Rh. hipposideros* excepted).

c. The numbers in the section Geulvalley tend to decrease more or less (*M. mystacinus* and *M. daubentoni* excepted).

d. In the section Valkenburg, numbers of bats remain constant, except those of *M. emarginatus* and *Rh. hipporideros*, which decrease heavily.

4. Changes in abundance during the period 1946/'62 within geographical sections

Mostly, the annual samples of each species in one cave are too small to be regarded separately and to be compared. Even when the samples in one cave are pooled during 4 or 5 subsequent years, the numbers obtained are not fit to be used for this purpose in many caves and in many species. Exceptions can be made for the richest caves and the species most abundant in them, for instance the Schenkgroeve (nr 163) in the Geulvalley and the Gemeentegrot (nrs 68—72) in Valkenburg.

In order to demonstrate changes which may occur inside a geographical section, we have chosen both caves mentioned above. We calculated for them fractions of the total numbers found in their section during the period 1946/'62, which is divided into the same four subperiods as is done in the preceding paragraphs.

Geulvalley

In the Schenkgroeve, *Myotis mystacinus, M. daubentoni, M. nattereri* and *M. dasycneme* are sufficiently abundant to be investigated as is mentioned above. The fractions of these species are recorded in fig. 10.

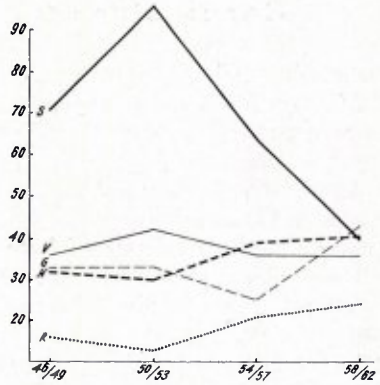

Fig. 3 Myotis mystacinus

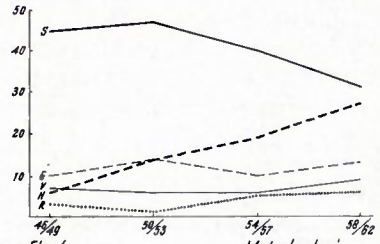

Fig. 4 M. daubentoni

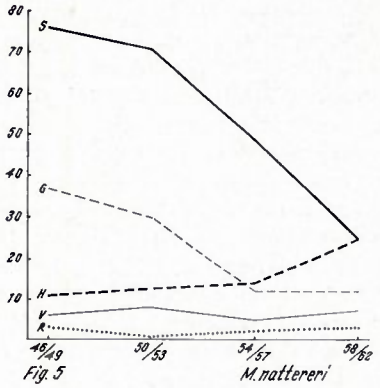

Fig. 5 M. nattereri

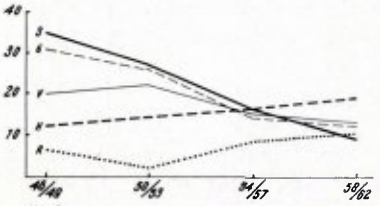

Fig. 6 M. dasycneme

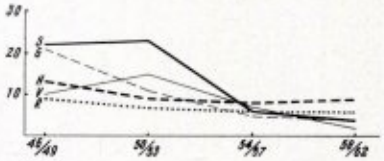

Fig. 7 M. myotis

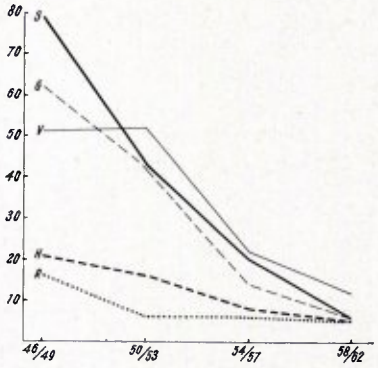

Fig. 8 M. emarginatus

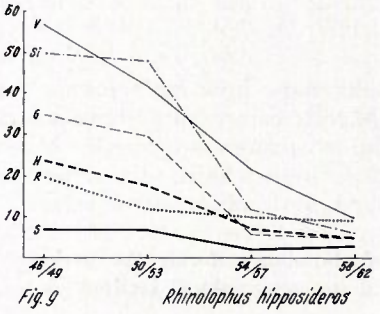

Fig. 9 Rhinolophus hipposideros

Fig. 3—9. Mean annual sample sizes during the periods 1946 / 49, 1950 / 53, 1954 / 57 and 1958 / 62 of 6 *Myotis* species and of one *Rhinolophus* species in 5 resp. 6 geographical sections of the cave area plotted aganst time.

S = St. Pietersberg; V = Valkenburg; G = Geulvalley; H = Heer; R = Riessenberg; Si = Sibbe (cf. fig. 1).

Conclusions

a. Since 1946, *M. mystacinus* has a preference for the Schenkgroeve, if compared with the other caves in the section Geulvalley, Leeraarsgrot (nr 91) and Ravengrot (nr 92). This preference appears to be constant as the years go on.

b. In *M. daubentoni, M. nattereri* and *M. dasycneme* the Schenk fractions are low originally, but increase continuously. Recently, the fractions of two of them have reached about the same value as has been common for *M. mystacinus* all the time (70—80%).

Valkenburg

In the Gemeentegrot, *M. mystacinus, M. emarginatus, M. dasycneme* and *Rh. hipposideros* are sufficiently abundant to investigate their fractions in this cave against the background of the section Valkenburg as a whole. Results are shown in fig. 11.

Conclusions

a. *M. mystacinus* seems to prefer the other caves in Valkenburg (Fluwelen grot (nrs 63—67) and Plenkert grotten (nrs 76—77)) above the Gemeentegrot. Fractions decrease gradually from 28% to less than 10%.

b. The fractions of *M. emarginatus, M. dasycneme* and *Rh. hipposideros* are high originally (> 50%), but show a tendency to decrease. This tendency seems to come to an end in more recent periods.

5. Changes in abundance during the period 1958/'62 within the cave Slavante

The geographical section called St. Pietersberg is represented by one large cave called Slavante (nrs 13—18). In order to investigate the distribution of bat species in this vast labyrinth, we have subdivided this cave into five cave sections, as can be seen on fig. 12.

Many corridors of the sections II and V have been cut open by quarrying on behalf of a large cement factory which has been built in the quarry shortly after the war. The sections I and III are situated more inwardly; on their opposite side, they are connected on many places with labyrinths which do not belong to the sections regarded here. Section IV is much more isolated: it can be reached from section I by two corridors, and it is connected with section V by two corridors also.

As this subdivision has not been made before 1957, the distribution of bats in the sections of Slavante can be studied during the pe-

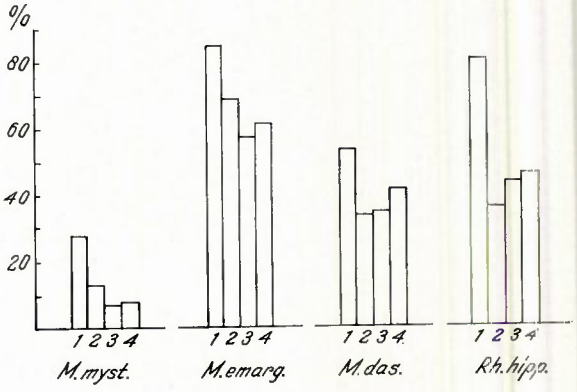

Fig. 10. Fractions in the Schenkgroeve (nr 163) of total numbers of bats counted in the section Geulvalley (nrs 163, 91 and 92). These fractions are compared in the periods: 1 = 1946/49, 2 = 1950/53, 3 = 1954/57 and 4 = 1958/62.

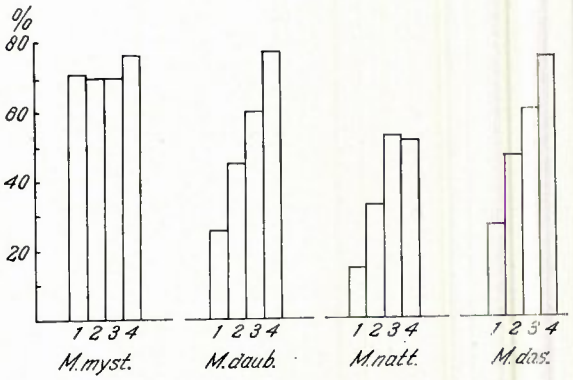

Fig. 11. Fractions in the Gemeentegrot (nrs 68-72) of total numbers of bats counted in the section Valkenburg (nrs. 68-72, 63-67, 76, 77). These fractions are compared in the periods: 1 = 1946/49, 2 = 1950/53, 3 = 1954/57 and 4 = 1958/62.

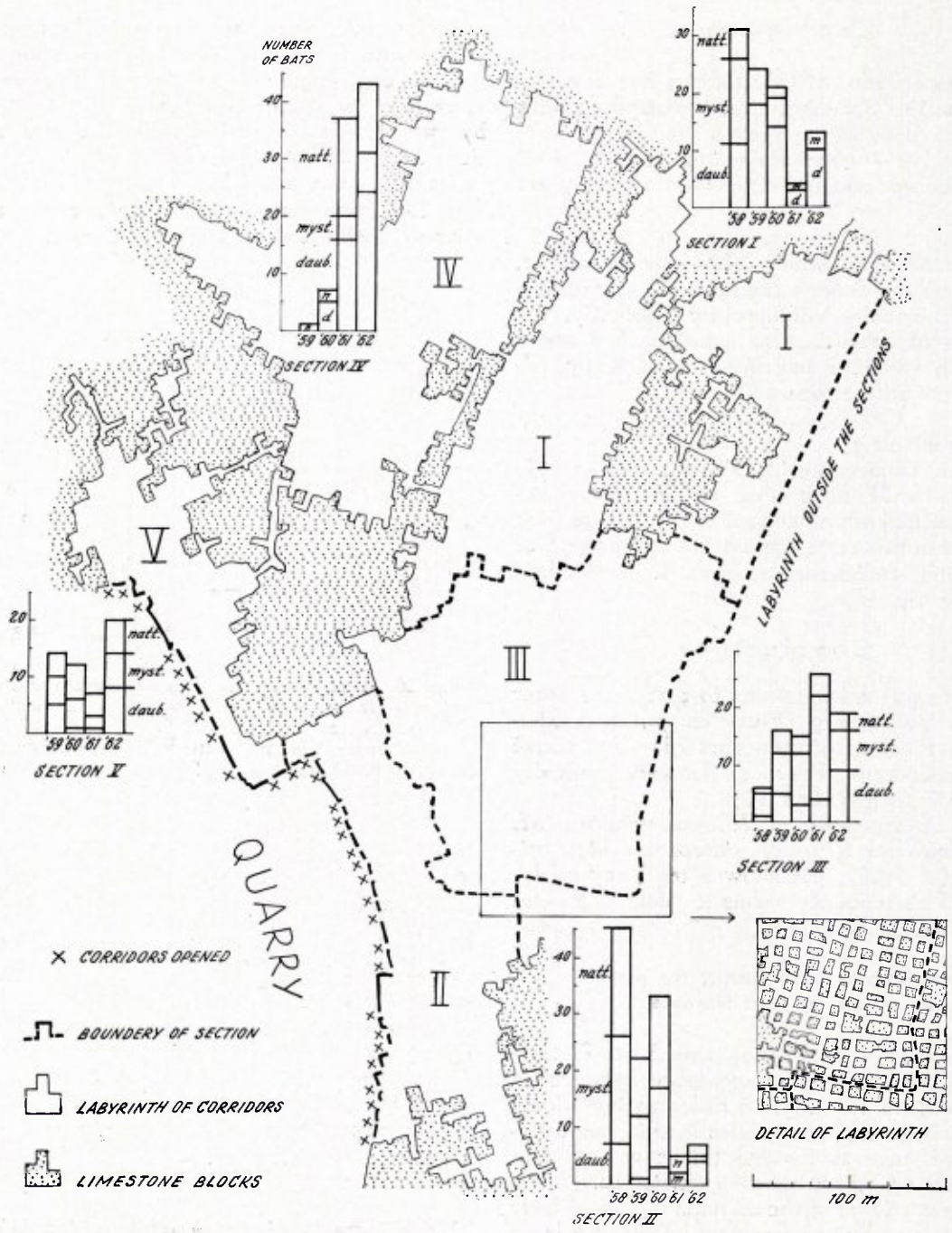

Fig. 12. Map of the cave Slavante (St. Pietersberg) showing the boundaries of the sections I—V; corridors are not drawn in. In the diogram; numbers of three *Myotis* species counted annually during the years 1958 / 62 are recorded for each section separately. The topographical data for this map are kindly provided by Ir. D. C. van Schaïk (Maastricht).

riod 1958/'62 only. Annual samples are recorded in diagrams on fig 12. Although the most abundant species are chosen *(M. daubentoni, M. mystacinus,* and *M. nattereri),* their numbers are too small to be compared annually in each section separately. Therefore, the samples in the sections I, II and V and those in the sections III and IV have to be combined. The latter are recorded as fractions of total annual scores in Slavante in fig. 13.

This figure shows that the fractions of section III and IV are very low originally, but increase rather suddenly to more than 50% during the years 1961 and 1962.

These results suggest that the bats are leaving the sections I and II, in order to settle in the sections III and IV recently.

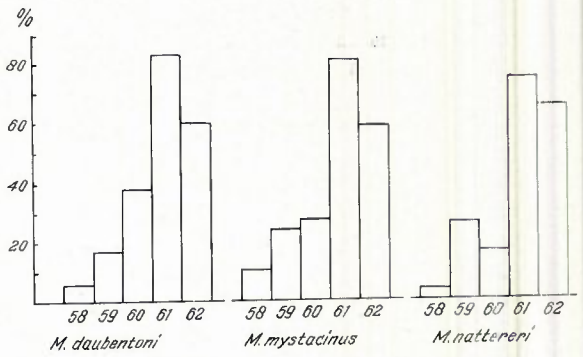

Fig. 13. Fractions in the cave sections III + IV of total annual samples 1958 / 62 taken in the cave Slavante (cf. fig. 12).

Discussion and summary

1. Abundance

The annual samples of bats hibernating in the cave area in S. Limburg (fig. 1) have not been decreasing in size during the period 1958/'62; in one case they even show a tendency to increase *(M. daubentoni).* This means that the decline of population size which was noted in many species previously has stopped since 1957. The abundance of the species during this recent period, as recorded on table 1, is mainly a consequence of the previous heavy decline of population size in three species which is rather low now: *Rh. hipposideros, M. emarginatus* and *M. myotis* (fig. 2). *M. mystacinus* is most abundant since 1957.

As possible factors causing the fortunate recent constancy mentioned above, we believe the following may be mentioned:

a. Since 1957, no banding has taken place in S. Limburg.

b. Quarrying has been stopped near the Leeraarsgrot and the Ravengrot.

c. Mushroom culturers have left the Schenkgroeve and the Cannerberg and the main parts of the cave Slavante during the period 1958/'62.

d. In most of the remaining sampling caves hibernation of bats has not been disturbed by any kind of economical exploitation for a long time.

2. Distribution

According to table 2 the species investigated have a different preference for various geographical sections of the area. In addition, their preferences tend to change in most instances if compared with previous sampling results since 1946 (fig. 3—9).

The main phenomenon noted is that samples of many *Myotis* species show a tendency (some more, some less) to decrease in size in the cave Slavante (St. Pietersberg), and to remain constant or to increase in the same time in the caves of the sections near Heer and Riessenberg which are situated on the opposite side of the Maasvalley at a distance of circa 4 km. This suggests that many bats which have been driven out of Slavante (apparently by quarrying and mushroom culturing) have crossed the Maasvalley and have settled there in caves which have been undisturbed by human exploitation for a very long time.

Changes in preference for caves inside one geographical section during the period 1946/'62 could be shown in a few cases only. Although the species which were sufficiently abundant to be investigated do not behave all alike, it is noted that population sizes have increased in the Schenkgroeve relatively among the caves of the Geulvalley (fig. 10), and have decreased relatively in the Gemeentegrot among the caves of Valkenburg (fig. 11). In one special case, striking changes in the distribution inside a cave could be noted during the period 1958/'62. In Slavante, the main species (*M. mystacinus, M. daubentoni* and *M. nattereri*) tend to leave the

parts of the labyrinth which are menaced by quarrying or mushroom culturing and tend to settle in other parts which have been left by mushroom culturers recently (fig. 12 and 13).

Samenvatting

1. Het vleermuisbestand vroeger en thans.

In een vroegere publicatie moesten wij berichten, dat de populatie van een aantal vleermuissoorten, die in de Zuidlimburgse groeven plegen te overwinteren, op ontstellende wijze in aantal is teruggelopen gedurende de periode 1942/'57. Dit gold in het bijzonder: de Kleine hoefijzerneus (*Rhinolophus hipposideros*), de Ingekorven vleermuis (*Myotis emarginatus*) en de Vale vleermuis (*M. myotis*) (verg. fig. 2).

Bij een beschouwing van de jaarvangsten in de zg. monstergrotten (fig. 1) gedurende de periode 1958/'62 blijkt (tabel 1), dat de daling in het algemeen tot stilstand gekomen is, zij het voor de drie bovengenoemde soorten op een bedenkelijk laag peil.

Beter staat er een tweetal andere soorten voor, de Franjestaart (*M. nattereri*) en de Meervleermuis (*M. dasycneme*), die in het verleden minder sterk achteruitgegaan zijn en zich in 1958/'62 ook op een behoorlijk peil blijken te handhaven Nog beter is momenteel ongetwijfeld de stand van de Baardvleermuis (*M. mystacinus*) en van de Watervleermuis (*M. daubentoni*), welke laatste zelfs toeneemt in aantal gedurende de jaren 1958/'62.

Hoewel het onmogelijk is de oorzaken van deze verheugende wendingen exact aan te geven, zijn wij geneigd ze toe te schrijven o.a. aan de volgende feiten:

a. Er is sinds 1957 in Zuidlimburg geen vleermuis meer geringd.

b. De afbraak van de Leeraarsgrot in het Geuldal is gestaakt, wat tevens de rust in de nabij gelegen Ravengrot ten goede komt. De Schenkgroeve in het Geuldal is nu definitief beschermd als Staatsnatuurreservaat.

c. De champignonteelt is gestopt in grote delen van het stelsel Slavante in de St. Pietersberg, waar vroeger kwekerijen waren.

d. In de overige monstergrotten is de rust ook in de periode 1958/'62 gehandhaafd, doordat zich daar geen nieuwe exploitatie-pogingen gedurende de wintermaanden hebben voorgedaan. Belangrijk voor de vleermuizen zijn in deze categorie vooral de gangenstelsels behorende tot het Voogdijgesticht te Heer en die in de Riessenberg, welke laatste onlangs is aangekocht als Staatsnatuurreservaat. Tenslotte moet ook de Muizenberg te Neercanne genoemd worden als een steeds belangrijker wordende vleermuizengrot, dank zij het staken van de champignonteelt.

2. Verspreiding over de grotten.

Uit de verdeling van de jaarvangsten in de afzonderlijke geografische secties van het grottengebied (fig. 1) blijkt de voorkeur voor een of meer van deze secties bij de soorten verschillend te zijn (tabel 2).

Tevens blijkt, dat bepaalde voorkeuren veranderen als men ze over een zeer lange periode beschouwt b.v. die van 1946/'62. Een nadere analyse van dit verschijnsel geeft o.a. te zien, dat althans de *Myotis*soorten in Slavante gedurende deze periode steeds minder talrijk zijn geworden terwijl hun aantallen in grotten gelegen aan de overzijde van het Maasdal (Heer, Riessenberg) gelijktijdig constant blijven of toenemen (fig. 3—9). De conclusie hieruit zou kunnen zijn, dat laatstgenoemde grotten min of meer als wijkplaats dienen voor vleermuizen, die in het verleden uit de St. Pietersberg verdreven zijn.

In enkele gevallen kan worden aangetoond, dat de voorkeur voor een bepaalde grot t.o.v. de andere grotten binnen een bepaalde sectie ook veranderd is sedert 1946. Voorbeelden hiervan zijn de relatieve stijging van de jaarvangsten van enkele *Myotis*soorten in de Schenkgroeve t.o.v. de Raven- en de Leeraarsgrot (fig. 10) en de relatieve daling van jaarvangsten in de Gemeentegrot t.o.v. de andere monstergrotten in de sectie Valkenburg (Fluwelen- en Plenkertgrotten, fig. 11).

In een speciaal geval kan het optreden van dergelijke verschuivingen gedurende de recente periode 1958/'62 binnen één grot worden aangetoond, nl. in het stelsel Slavante in de St. Pietersberg (fig. 12). Deze grot behoort nog steeds tot de allergrootste, maar de afbraak vanuit de groeve van de ENCI fabriek gaat gestadig verder. Kennelijk tengevolge van dit naderend onheil, trekken de meeste vleermuizen zich dieper in het gangenstelsel terug, daarbij

profiterende van het feit, dat de champingnonteelt in dit deel van het stelsel in de laatste jaren is verminderd. Deze verschuiving wordt aangetoond in fig. 13.

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NIELS STENSEN
Anatoom en geoloog
1638—1686
(with a summary)

door
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De aanleiding tot het schrijven van dit artikel is het feit, dat het op 4 december driehonderd jaar geleden is, dat de Leidse universiteit Stensen promoveerde tot Doctor Medicinae. Het merkwaardige van dit gebeuren in 1664 was, dat de promotie plaats vond tijdens de afwezigheid van Stensen, die toen in het buitenlang vertoefde. De reden, waarom wij deze herdenking aangrijpen om over Stensen te schrijven, is dat de *medicus* Stensen door zijn wetenschappelijk onderzoek zeer belangrijke bijdragen heeft geleverd zowel aan de biologie als aan de geologie.

Stensen is natuurlijk geen onbekende in ons land, daar hij zijn wetenschappelijke arbeid in Nederland is begonnen, maar toch is hier weinig over hem geschreven. De bekende schrijver van de geschiedenis der biologie, Dr. A. Schierbeek, heeft meermalen het werk en de betekenis van Stensen naar voren gebracht, doch

Nicolaus Stenonius
Dit is het enige portret, dat van Steno bekend is. Het bevindt zich te Florence (Palazzo degli Uffici). Schilder onbekend.

alleen in verband met zijn samenwerking met Jan Swammerdam (1637—1680) en Malpighi (1628—1694), met wie Stensen in vriendschap was verbonden (Schierbeek 1923, 1946). Een biografie van Stensen is in ons land niet te vinden, laat staan een samenvatting van zijn wetenschappelijk werk. In 1953 publiceerde Schlichting in het Deense tijdschrift Centaurus een artikel over een manuscript van Stensen, dat pas ontdekt was in de Nationale Bibliotheek van Florence. Dit manuscript is bekend als het Chaos-manuscript, zo genoemd naar het woord Chaos, dat Stensen op de titelpagina gezet had, om aan te duiden, dat het geschrift zou handelen over onderwerpen van zeer uiteenlopende aard. In het Nederlandse Tijdschrift voor Geneeskunde verschee-