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**Investigations of Flights of Polish Bats, Mainly
Myotis myotis (Borkhausen 1797)**

**Badania nad przelotami krajowych nietoperzy,
głównie z gatunku *Myotis myotis* (Borkhausen 1797)**

(With 2 Tables)

I. MATERIAL AND METHODS

This work is related to the investigations made by Eisentraut (1937), who ringed — chiefly in Brandenburg — over 6 000 *M. myotis*. These bats were ringed mainly in the winter, during their hibernation in caves. Eisentraut obtained interesting data on the length and directions of flights made by this species, which leaves its winter hiding-places in the spring to fly in general in a north and east direction. The longest flight recorded was 260 km.

I myself ringed *M. myotis* not in its winter hiding-places, but in its summer ones; also the study area for my investigations was completely different, since it covered chiefly southern Poland (see Table 1).

In addition to this species I ringed others, but considerably smaller numbers; these data are given in Table 2.

Krzysztof Zdzitowiecki ringed 471 specimens of the total number of 7442 bats ringed.

I published a small part of the material used in these investigations in the work by Kowalski et al. (1957); I have, however, been obliged to include it in this publication in order to present a complete picture.

I began my investigations in December 1950, finishing them, for the most part, in August 1957. More detailed information as to the identification marks used for the bats is given in the work Kowalski et al. (l. c.); beginning in March 1955 I used ear-tags of my own construction (Krzysztof, 1956a). The numbers of *M. myotis* marked according to year and place of marking are given in Table 1; the remaining of the species are treated in Table 2.

II. RESULTS AND DISCUSSION

a. General section

It is worthy of note that as many as 14 species of bats were found at Puławy within an area of a few square km. Thirteen of these species are listed in my previous work (Krzanowski, 1956 b), while *Eptesicus nilssoni* (Keyserling et Blasius 1839) was added to this list later. Only *Vespertilio murinus* Linnaeus 1758 is therefore lacking to make this a complete faunistic list.

Of the bats given in table 2, almost all specimens, with the exception of *Rh. hipposideros* (Bechstein 1800) and *M. emarginatus* (Geoffroy 1806) were marked at Puławy; the two species, named above were marked in southern Poland.

The very low percentage of reports confirming the return of the specimens is remarkable; e. g., of 1035 specimens of *N. noctula* (Schreber 1774) marked, news was received of only two flights of this species, although it is well known to be migrant (Eisen-traut, l. c.; Bels, 1952; Lavrov, 1955). These figures improve slightly in the case of *M. myotis*: a cave species in the winter, it spends the summer in lofts, in both retreats it is often encountered by people. On the 4738 specimens marked, 25 reports were received of flights of over 10 km., which however constitutes only 0.5% of the total number marked. These ratios are better in Germany and Netherlands, as I indicated in the previous work (Kowalski et al., l. c.), but in Poland, bearing in mind the great difficulty and often danger involved in searching for the bats' hiding-places, in reaching them and catching these mammals — investigations on the migrations of bats are not in fact worth while.

b. Detailed section

Rh. hipposideros (Bechstein 1800): The longest flight was made by a specimen marked in the winter in a cave in the Cergova Mountain near Dukla; it was found in the summer in the Jaroslaw district, a distance of 94 km. This flight throws an interesting light on the northern boundary of distribution of this species, extending it considerably to the north. By comparison with relevant literature, this flight is somewhat exceptional, since this relatively well investigated species is known to be a non migratory one (Kowalski et al., l. c.; Bels, 1952; Hooper & Hooper, 1956; Heerdt & Sluiter, 1953; 1954; 1956; 1957; 1958; 1959; Issel, 1950). The only flight longer than the above is reported by Bels (l. c.) — 150 km.

Myotis nattereri (Kuhl 1818): longest flight 20.5 km. This is a relatively small distance, since of the 11 flights recorded in literature (Bels, l. c.,

Table 1.
Numbers of *Myotis myotis* tagged.

Locality Year	Kraków	Tarnów	Rzeszów	Przemysł	Puławy	Sando- mierz	other loc.	total
1950	-	-	-	-	-	-	1	1
1951	676	-	-	-	-	-	84	760
1952	415	513	-	-	26	-	49	1003
1953	110	302	497	93	14	-	2	1018
1954	95	171	98	74	26	-	-	464
1955	53	-	-	-	21	-	1	75
1956	149	294	-	-	32	-	1	476
1957	103	217	52	-	17	134	-	523
1958	-	-	-	-	13	-	-	13
1959	-	-	-	-	2	-	19	21
1960	-	-	-	-	5	-	379	384
Total	1601	1497	647	167	156	134	536	4738

Table 2.
Numbers of remaining species.

Year	<i>P. nathusi</i>	<i>P. pipistrellus</i>	<i>N. noctula</i>	<i>N. leisleri</i>	<i>E. barbastellus</i>	<i>P. auritus</i>	<i>E. nilssonii</i>	<i>E. serotinus</i>	<i>M. emarginatus</i>	<i>M. bechsteini</i>	<i>M. mystacinus</i>	<i>M. dasycneme</i>	<i>M. daubentoni</i>	<i>M. nattereri</i>	<i>Rh. hipposideros</i>
1950	-	-	-	-	-	9	-	1	-	-	-	-	-	-	6
1951	-	71	-	-	3	13	-	1	-	-	2	-	-	-	33
1952	38	57	128	21	18	32	-	26	-	2	3	10	47	42	18
1953	5	2	127	41	22	27	-	40	-	1	1	8	15	83	-
1954	3	-	156	-	22	25	-	39	-	-	-	1	7	80	-
1955	10	6	234	-	14	55	-	12	-	-	2	1	4	103	12
1956	3	-	336	16	15	37	2	10	-	-	2	1	7	119	9
1957	8	1	5	-	13	25	1	6	2	1	5	6	3	45	4
1958	-	-	-	-	4	14	-	2	-	-	1	-	3	51	-
1959	10	1	49	1	-	51	2	4	1	-	6	-	-	3	9
1960	-	-	-	-	-	4	-	-	1	-	-	1	3	50	12
Total	77	138	1035	79	111	292	5	141	4	4	22	28	89	576	103

Heerdt & Sluiter, 1954; 1956) as many as 9 are longer than this; the longest is 62 km.

Myotis dasycneme (Boie 1825): longest flight — 3 km. does not exhaust the „potentialities” of this species, as the Dutch bats are migratory and their longest known flight is 330 km. (Heerdt & Sluiter, 1958).

Eptesicus serotinus (Schreber 1774): longest flight 88 km., from Osowiec to Giżycko. This is the second longest flight recorded in literature on flights by this species: the longest is 145 km. (Topal, 1955).

Plecotus auritus (Linnaeus 1758): longest flight 15 km., this is also the longest known flight of this species.

Barbastella barbastellus (Schreber 1774): longest flight 42.5 km — the longest known flight of this species.

Nyctalus leisleri (Kuhl 1818): maximum flight about 418 km., and not 339 km as stated by Vachold (1959). This is also the only known flight of this rare species, and was made by an adult female marked on 15. 6. 1956 at Puławy; it was found on 17. 5. 1957 at Pila, in the Nova Bana district in Southern Slovakia, direction SW. Comparison of these dates leads to the assumption that this is a case of emigration, or a nomadic way of life, and not a seasonal migration, as in the case of birds. Facts of nomadic living by bats are fairly well known (Lavrov, l. c.; Bels, l. c. and others).

Nyctalus noctula (Schreber 1774): two flights of this species are recorded, made by females marked at Puławy. The first of them was marked on 5. 5. 1953, and was found on 15. 9. 1954 in the Forest Administration District of Węgrów — a flight of 119 km. in a northerly direction. Here also, as in the case of *N. leisleri*, it is probably a case of nomadic living. The second female, marked 22. 5. 1955, was found on 4. 7. 1955 in the village of Zajęczniki in the Siemiatycze district, having flown 120 km. to the northeast. This flight is worthy of note, since during this period the females are usually either in a state of very advanced pregnancy or have young which are not yet self-sufficient. It is, of course, not possible to rule out the possibility that this particular female was „childless”.

In the light of literature on this species (Bels, l. c.; Eisentraut, l. c.; Lavrov, l. c.) however, these flights are very modest, since the longest flights confirmed as being made by this species have been as much as 1000 km.

Myotis myotis (Borkhausen 1797): the only species to be marked in large numbers (Table 2); it was also responsible for a relatively large percentage of the return reports. On this account there is a temptation to make a certain synthesis in respect of its flights. In the comparison of material given below, young individuals should be taken to mean those not over two months in age. „Old” individuals are usually at least one year or more old.

Flights of young individuals.

Marked in Cracow: 34 individuals, males and females, marked in their summer colony, were found during the winter immediately following in the underground passages of old military fortresses situated several km. away from Cracow; only one of them was found at a greater distance — 15 km — in a cave. The 35th young individual was not found in these passages until after the fourth winter following its having been marked. This is worthy of note, because none of the above 34 individuals was encountered in here during the succeeding winters (i. e. the second, third, etc.).

The female marked on 11. 7. 1952, was found at Tarnów in the summer colony of this species on 3. 8. 1952 — this was therefore a flight of 75 km. to the east.

Flights of individuals of unknown age.

Marked in Cracow: Male marked 6. 8. 1951 was found at Chochołów near Zakopane on 27. 9. 1951, a flight of 77.5 km. in a SSW direction.

Another male, marked on 2. 8. 1952, was found in Hungary at Szokolya (Kom. Nograd) on 21. 10. 1952; a flight of 253 km. to the SSW.

Marked at Tarnów: A female marked in the summer colony on 23. 8. 1957 was found in the village of Żukowice Nowe at the end of May 1958; — a flight of 14 km. to the NE. Another female, marked in this same colony on 5. 8. 1953 was found at Góra Zbylitowska on 14. 5. 1955; it had therefore flown 6.5 km. in a WSW direction, which probably constituted the extent of its hunting range.

Flights undertaken in connection with the seasonal change of hiding-places would seem to be as follows:

1) Male marked on 13. 7. 1952 was caught at Rożnów on 6. 10. 1953: distance 35 km, direction SW.

2) Male marked on 13. 7. 1952 was caught at Stróże on 25. 8. 1952: distance 38 km., direction S.

3) Female marked on 14. 8. 1954, found on 5. 10. 1958 at Wapiennik near Cracow: distance 79.5 km., direction W.

4) Female marked on 24. 7. 1956 found on 4. 4. 1957 at Grywałd near Krościenko: distance 76 km, direction SW.

5) Male marked on 24. 7. 1956, found in the Jasovska Cave in Slovakia (25 km. to the west of Koszyce) on 8. 12. 1956: distance 144 km., direction S.

Marked in Rzeszów: Female marked 22. 8. 1957 was found on 11. 9. 1957 in the village of Budna Mała, a distance of 8 km. to N, and therefore certainly within the range of its hunting flights.

Another female marked on 15. 8. 1954 flew on 26. 9. 1958 to the village of Mokroluh, in the Bardejov district of Slovakia; a distance of about 100 km. to SW.

Marked in Przemyśl: Male marked on 16. 8. 1954 was found on 10. 12. 1959 in the underground passages at Kostrze near Cracow: a flight of 210 km. in a westerly direction.

Another male, marked on 16. 8. 1954 was found at the beginning of January 1955 in a cave near the village of Głęboka, lying 40 km. to the SE from Uzhorod: a flight of 156 km. to S.

Marked at Sandomierz: Male marked on 21. 8. 1957 was found 12. 2. 1959 in the village of Wesołówka — distance of flight 33 km. to N.

Female marked on 20. 8. 1957 was found 10. 10. 1957 in the village of Walentynów — distance of flight 48 km. to NNW.

Flights old individuals.

Marked in Cracow: 1) Female marked on 16. 5. 1951, found at Świątniki Górne on 15. 8. 1951; distance of flight 14 km. to S.

2) Female marked on 16. 5. 1951, found at Kobierzyn on 26. 5. 1951, distance of flight 7 km, direction SWS.

3) Female marked on 26.5.1951, found at Wieliczka on 4.6.1951. Distance of flight 12.5 km, direction ES.

4) 10 females marked in Cracow on 16.5. and 5.6.1951, found on 15.6.1951 at Nowa Huta; distance of flight 10 km. to E.

5) Female marked on 6.7.1955, found in a cave at Klepaczova in Slovakia on 23.2.1956; distance of flight 120 km to S.

Marked at Tarnów: Female marked on 3.8.1952 was found 29.12.1952 at Stos near Smolnicka Huta in Slovakia; distance of flight 149 km. to SSW.

A male marked on 24.7.1956 flew to Skawina, where it was found 15.6.1957. This was a flight of 85 km. to W.

Marked in Rzeszów: Female marked 13.7.1953, found on 4.10.1953 at Przewrotne, a distance of 20 km. to N from Rzeszów.

Another female, marked on 7.8.1954 was found 18.12.1955 in the Wierchowska Górna cave; distance of flight 160 km. to W.

Marked at Puławy: A female marked 29.4.1954, found on 25.8.1956 in the crypts of the convent at Wola Gułowska; distance of flight 37 km. in a NE direction. It is interesting to note that this same female was caught again at Puławy on 27.9.1957.

Other reports:

A certain adult female *M. myotis*, brought from Cracow to Puławy on 19.6.1954, remained permanently in Puławy, since from that date onwards it was found five times — the last time being on 8.4.1957.

A second female from the same transport, however, returned to Cracow, where it was found on 23.7.1956. It therefore covered a distance of 208 km. on the return journey.

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With regard to flights of up to 15 km. made during the summer and probably coming within the limits of night hunting, it is found that 14 of them took place in an easterly, southerly and westerly direction, only once was the direction to the north.

Consideration of flights over 15 km., however, reveals a certain difference in the behaviour of *Myotis myotis* at Puławy and Sandomierz on the one hand, and specimens of this species found in more southerly districts (Przemyśl, Rzeszów, Tarnów, Cracow): all three reports on flights of the northern group refer to northerly directions (NNW, N, NE) for distances of 33—48 km; there are no flights to the south. On the other hand, of the flights made by the bats in the southern group, 10 exhibit southerly directions (35—253 km.), in one case an easterly direction (75 km.), in three cases westerly directions (79.5—210 km.), and in one case only a northern direction, and then not for a great distance (20 km.).

To sum up the above facts: it would appear that with *M. myotis* of the northern group (Puławy, Sandomierz) flights of over 15 km.

take place more in a northerly direction, while with *M. myotis*, marked in districts more to the south of Poland, southerly directions predominate, northerly ones being rather the exception (1 case in 15), and for a very inconsiderable distance (20 km.). What is very interesting, in the case of short flights of up to 15 km. made by the southern group, is that northerly directions are only exceptionally encountered (see above).

The above facts suggest the possibility that there are two populations of *M. myotis* in Poland — a northern and a southern.

With regard to the causes of this probable difference in the behaviour of these two populations, the fact is noteworthy that the greater part of the southern population of *M. myotis* flies over the Carpathian Mountains to the caves of Slovakia and Hungary for the winter: of 15 reports of flights of over 15 km., 6 flights are „abroad”, while 4 further ones may have been made *en route* to or from „abroad” (Cracow—Chochołów, Tarnów—Grywałd, Tarnów—Stróże, Tarnów—Rożnów). It might therefore be presumed that the specimens from the more northern districts do not find it, as it were, „worth their while” to make flights as far as over the other side of the Carpathians, since such flights would of course be correspondingly longer; for bats from the Sandomierz district over 138 km., while from the Puławy district the distance would be over 233 km. It is true that the maximum distance recorded as made by this species during my investigations was 253 km; but this was an exceptional flight only.

With the southern group the above-mentioned fact is worthy of note, that of 35 bats found in winter hiding-places near Cracow, as many as 34 were young specimens: further, these young specimens were never found there during the following winters. On the other hand, there were several young specimens which spent the first winter of their lives beyond the southern frontier of Poland. The conclusion is therefore that both old and young specimens make distant flights „abroad”. Despite this, specimens which hibernate near their birth-place, are almost always the young ones, that is, bats about 6 months old.

III. SUMMARY

During the period 1950—1960 as many as 7442 bats were marked, belonging to 16 species; 4738 of these were *M. myotis* (Borkhausen 1797).

Fourteen of the 15 possible species of bats were found within an area of only a few square km. in the Puławy district.

Interesting flights were made by *Rh. hipposideros* — 94 km. and *Nyctalus leisleri* — 418 km.

With regard to *M. myotis*:

Maximum flight was 253 km.

It is probable that bats living at Sandomierz and Puławy belong to a different population from that of individuals from the more southern districts of Poland (Przemyśl, Rzeszów, Tarnów, Cracow). Bats of the northern population appear to favour northerly directions in their flights; bats of the southern population, even for short flights of a few km, favour southerly directions. In the southern population a considerable proportion of the old specimens (i. e. at least one year old) spend the winter beyond the Carpathian Mountains, in the caves of Slovakia and Hungary; instances of hibernation near the summer colony are exceptional in their case. The young specimens, on the other hand, (i. e. about 6 months in age) of the southern population may spend their first winter either in the immediate vicinity of the summer colony, or beyond the Carpathian Mountains.

Of a certain group of these bats brought from Cracow to Puławy, one specimen settled permanently in Puławy, the second returned to Cracow (208 km.).

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STRESZCZENIE

W okresie 1950—1960 poznakowano 7 442 nietoperzy, należących do 16 gatunków; w tym było 4 738 *M. myotis* (Borkhausen 1797).

Na obszarze kilku km² w Puławach znaleziono 14, z pośród możliwych 15 gatunków nietoperzy.

Ciekawsze przeloty wykonały: *Rh. hipposideros* — 94 km, oraz *Nyctalus leisleri* — 418 km.

Odnosnie *M. myotis* stwierdzono:

1. Największy przelot wyniósł 253 km.
2. Prawdopodobnie nietoperze żyjące w Sandomierzu i Puławach należą do innej populacji, niż osobniki z bardziej południowych okolic Polski (Przemyśl, Rzeszów, Tarnów, Kraków).
3. Nietoperze populacji północnej wydają się w przelotach faworyzować kierunki północne; nietoperze populacji południowej faworyzują, nawet w małych — kilkukilometrowych przelotach — kierunki południowe.

4. W populacji południowej okazy stare (t.j. co najmniej roczne) w znacznym procencie zimują poza Karpatami, w jaskiniach słowackich i węgierskich; wypadki zimowania w pobliżu kolonii letniej są u nich wyjątkowe. Natomiast okazy młode (t.j. półroczne) populacji południowej mogą pierwszą zimę spędzać zarówno w bliskim sąsiedztwie kolonii letniej, jak też poza Karpatami.

5. Z pewnego transportu nietoperzy tego gatunku przewiezionych z Krakowa do Puław, 1 okaz osiedlił się na stałe w Puławach, drugi zaś powrócił do Krakowa (208 km).

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