Myotis lucifugus from Kamchatka : a reassessment of the record

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Summary. – The US National Museum of Natural History specimen N° 37449 from Petropavlovsk, Kamchatka, previously identified by Hahn (1905) as *Myotis lucifugus*, has been compared with specimens of *M. lucifugus* from western Canada and Alaska, with *M. brandti* from Kamchatka and Magadanskaya Obl., and with *M. daubentoni* from Primorskaya Obl. and the Kurile Islands. A number of qualitative dental traits, as well as cranial and dental measurements, suggest that this specimen belongs to *M. brandti* – the most common *Myotis* species in Kamchatka.

Résumé. – Dans cet article nous discutons d'un spécimen du Muséum National d'Histoire Naturelle, Washington, D.C. (N° 37449 de Petropavlovsk, Kamchatka), qui a été identifié par Hahn (1905) comme *Myotis lucifugus*. Nous l'avons comparé à *M. lucifugus* du Canada occidental et d'Alaska, à *M. brandti* du Kamchatka et de la région de Magadan, et à *M. daubentoni* de Primorié et des îles Kouriles. Les caractères du crâne et du système dentaire prouvent que l'exemplaire examiné est référable à *M. brandti*, une espèce commune au Kamchatka.

INTRODUCTION

Museum collections have immense zoogeographical value as the ultimate reference for zoogeographical records. In this respect marginal and remote records are of particular importance, because they provide information on distributional limits and, possibly, dispersal trends of species. The precision of such records depends chiefly upon two basic factors : accuracy of label data and correctness of the identification of each given specimen.

In his work of 1905, W. L. Hahn referred to a bat (N° 37449/11189) from Petropavlovsk (Kamchatka, Russia) preserved in the collections of the Smithsonian Institution National Museum of Natural History (USNM), which he identified as *Myotis lucifugus*. He thus treated this finding as the first record of this otherwise North American species in the Palaearctic Region, supposing that it, most probably, had been transferred across the Pacific by ship. In the latter case, the record itself would have been of little zoogeographical importance ; however reference to Hahn (1905) has been used as support for range extension of *M. lucifugus* into the Palaearctic in several checklists covering

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the region (Corbet 1978 ; Pavlinov *et al.* 1995) and in the Mammalian Species account on this species (Fenton and Barclay 1980).

Although the carcass of this specimen, preserved in alcohol (N° 11189) was not found, and the skull is badly damaged, the dental characters, vital for species diagnostics, are retained. The purpose of this study was to confirm the taxonomic allocation of this specimen by comparing it with similar species of *Myotis* from adjacent geographic regions.

MATERIAL AND METHODS

To assess the taxonomic position of the specimen in question (USNM 37449), we compared it with 10 specimens of *Myotis brandti* from Kamchatka and Magadanskaya Oblast', with 30 specimens of *M. daubentoni* from Primorskii Region and Kurile Isls., and with 29 specimens of *M. lucifugus* from Alaska and western Canada (see Appendix). The geographic names used in this work (except for label data) follow The Times Atlas of the World (1988).

Skulls, and especially their dentitions were examined under a dissecting microscope. Camera lucida tracings of teeth were made for selected specimens. Thirteen measurements were taken on the right side of the skull (unless broken or otherwise damaged) with electronic calipers to the nearest 0.01 mm : 1) distance from the anterior rim of orbit to the anterior edge of the premaxilla (rostral length) ; 2) length of maxillary toothrow from the anterior edge of the cingulum of upper canine to the posterior edge of the third upper molar (C – M3 length) ; 3) length of upper molariform toothrow – distance between the anterior edge of the cingulum of the fourth upper premolar to the posterior edge of the third upper molar (P4 – M3 length) ; 4) crown length of the upper canine across the cingulum (C width) ; 5) distance between the tips of the upper canine and the fourth upper premolar (C – P4 length between tips) ; 6) width of the second upper molar (M2 width) ; 7) length of the mandible from the anterior edge of the symphysis to the posterior edge of the glenoid process (mandible length, glenoid) ; 8) length of the mandible from the anterior edge of the symphysis to the posterior edge of the angular process (mandible length, angular) ; 9) distance between the anterior edge of the lower canine and the posterior edge of the lower third molar (c-m3 length) ; 10) lower molariform toothrow – distance between the anterior edge of the lower fourth premolar and the posterior edge of the lower third molar (p4-m3 length) ; 11) distance between the tips of the lower canine and the fourth lower premolar (c-p4 length between tips) ; 12) height of the coronoid process ; 13) Distance between the bases of the upper canine and large premolar (C-P4 gap distance), which was calculated as 2) -3) -4). Principal component and three-group discriminant function analyses have been performed for the obtained measurements, using Statistica for Windows version 4.5.

In addition, skulls of other *Myotis* species have been examined (three to ten specimens of each), but not traced or measured : four from the eastern Palaearctic (*M. bombinus*, *M. frater*, *M. macrodactylus*, and *M. ikonnikovi*) and five from western North America (*M. californicus*, *M. volans*, *M. yumanensis*, *M. evotis*, and *M. keeni*).

RESULTS

Qualitative characters

The dentitions of *M. lucifugus*, *M. brandti*, and *M. daubentoni* are variable and not always easily distinguishable, which makes it difficult to allocate USNM 37449 (Fig. 1)

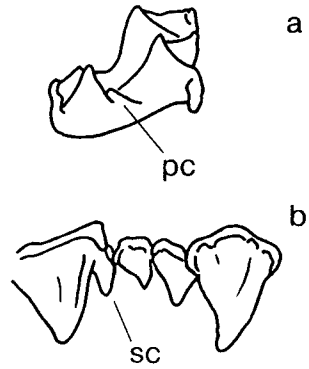

Fig. 1. – Dental characters of *Myotis* sp. USNM 37449 : a) first right upper molar (Ml), anteroventral view ; b) right upper canine and premolars (P2-P4), ventrolateral view. Used abbreviations : pc – paraconule, sc – supplementary cusp on the cingulum of P4.

to any of them, based on qualitative traits alone. In all three species, the upper molars possess distinct paraconules, sometimes less developed in *M. brandti* than in *M. lucifugus* and in *M. daubentoni*. Large upper premolars (P4) usually have supplementary lingual cusps (Figs. 2a-d), developed to various degrees. Small upper premolars (P2-P3) are subequal in size ; usually neither of them is displaced inward from the toothrow.

In *M. lucifugus*, the supplementary cusp on P4 is often poorly developed. When present, this cusp is usually pointed more lingually, and the anterior border of the P4 cingulum usually has a pronounced emargination, visible at ventral view (Fig. 2a), commonly enfolding the second small upper premolar and overlapping its posterior margin. The distance between the bases of P4 and canine is relatively short, and the small upper premolars are commonly relatively tightly fit between them (Fig. 2a-b) ; sometimes the second one is partly concealed by P4 at lateral view.

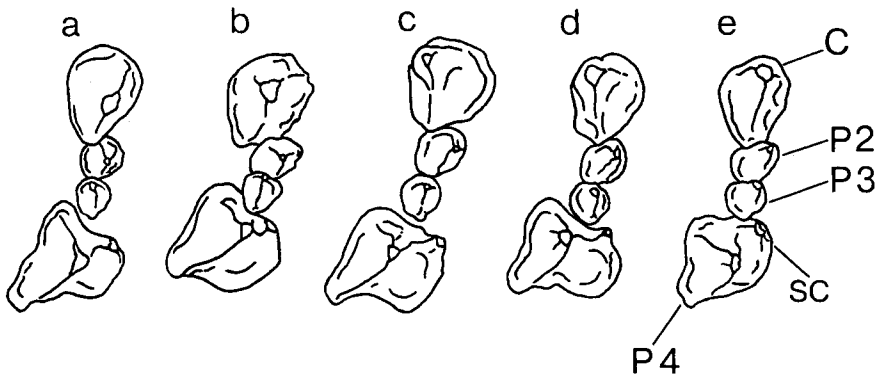

Fig. 2. – Ventral view of the right upper canine and premolars : a) *Myotis lucifugus*, USNM 62752, female ; b) *M. lucifugus*, USNM 62751, male ; c) *M. brandti*, UWBM 39239, male ; d) *M. brandti*, UWBM 39246, male ; e) *Myotis* sp., USNM 37449. Used abbreviations : sc – supplementary cusp on the cingulum of P4.

In *M. brandti*, P4 usually has a prominent anteriorly pointed supplementary lingual cusp (Figs. 2c-d). The respective part of the cingulum of P4 is often expanded anteriorly (Fig. 2c). Small upper premolars are usually more or less loosely positioned between P4 and the upper canine (Fig. 2c) and are well visible at lateral view. The paraconules on upper molars are present but somewhat less prominent than in *M. lucifugus* and *M. daubentoni*.

In *M. daubentoni* the supplementary lingual cusp on the large upper premolar (P4) is usually less developed than in *M. brandti*, eventually absent. In many specimens P4 possesses an emargination, similar to that of *M. lucifugus*. In many cases the small upper premolars are more or less loosely positioned between P4 and the upper canine,

TABLE 1. – Selected measurements ($\bar{x} \pm$ SD, range ; in mm) of Myotis sp. (USNM 37449), compared to *M. lucifugus*, *M. brandti*, and *M. daubentoni*.

Character:	*M. lucifugus* *n*=23-29	*M. brandti* *n*=10	*M. daubentoni* *n*=29-30	USNM 37449
1) Rostral length	4.23±0.114 4.02—4.47	4.20±0.186 3.93—4.58	4.10±0.171 3.84—4.55	4.5
2) C—M3 length	5.27±0.130 4.92—5.53	5.16±0.125 4.99—5.96	5.06±0.157 4.76—5.42	5.05
3) P4—M3 length	3.93±0.104 3.72—4.17	3.72±0.056 3.63—3.79	3.66±0.115 3.41—3.89	3.62
4) C width	0.86±0.042 0.79—0.93	0.77±0.036 0.72—0.83	0.76±0.042 0.70—0.85	0.75
5) C—P4 length between tips	1.32±0.103 1.11—1.48	1.45±0.088 1.30—1.59	1.29±0.092 1.12—1.48	1.35
6) M2 width	1.47±0.051 1.38—1.59	1.43±0.035 1.36—1.47	1.36±0.044 1.26—1.44	1.41
7) Mandible length (glenoid)	10.30±0.433 9.73—12.02	9.99±0.286 9.62—10.47	10.11±0.314 9.66—10.84	9.78
8) Mandible length (angular)	10.46±0.251 9.92—10.93	10.21±0.301 9.71—10.65	10.34±0.295 9.91—11.04	10.31
9) c—m3 length	5.66±0.125 5.41—5.88	5.53±0.155 5.31—5.73	5.39±0.169 5.02—5.77	5.45
10) p4—m3 length	4.10±0.101 3.92—4.29	3.90±0.061 3.83—4.01	3.79±0.131 3.43—4.08	3.81
11) c—p4 length between tips	1.32±0.093 1.16—1.48	1.37±0.113 1.24—1.59	1.34±0.100 1.04—1.48	1.24
12) Coronoid height	2.99±0.124 2.78—3.24	2.96±0.100 2.78—3.12	2.92±0.138 2.50—3.16	3.14
13) C—P4 gap distance	0.49±0.082 0.31—0.63	0.67±0.105 0.53—0.86	0.64±0.082 0.50—0.86	0.68

similar to those of *M. brandti*. However specimens with these traits are distinguishable from *M. brandti* by larger paraconules.

In the unidentified specimen (USNM 37449), the lingual cusp and the respective portion of the cingulum of P4 are quite prominent (Fig. 2e). In fact, the cusp is shifted anteriorly, so that it is visible at the lateral view of the skull (Fig. 1b), and the P4 cingulum lacks any anterior emargination (Fig. 2e). This condition does not appear to link the specimen in question to either *M. lucifugus* or *M. daubentoni*. The distance between P4 and the upper canine is relatively large (Fig. 2e) and the small upper premolars, although not loosely positioned (due to expansion of the P4 cingulum), are not laterally concealed by P4. The paraconules are well visible, but not especially large (Fig. 1a).

Morphometric comparisons

A comparison of the cranial measurements of *M. lucifugus*, *M. brandti*, and *M. daubentoni* (Table 1) suggests that specimens of *M. lucifugus* are generally larger than those of *M. brandti* and *M. daubentoni* in most measurements, except the distance between the canine and the large premolar in both maxilae and mandibles. However considerable overlap is evident in many cases. *M. lucifugus* also appears to have more massive dentition. USNM 37449 either falls or nearly falls within the range of univariate overlap between *M. lucifugus*, *M. brandti*, and *M. daubentoni* or groups with the latter two species.

Projection of the first two principal components (Fig. 3) does not support the grouping of USNM 37449 with *M. lucifugus*. The first principal component is most

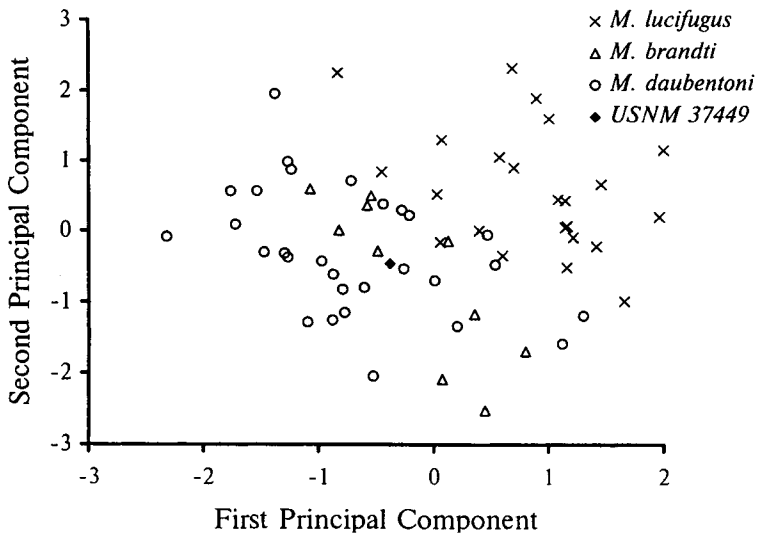

Fig. 3. – Projection of the first two principal components for *Myotis lucifugus*, *M. brandti*, *M. daubentoni*, and USNM 37449, based on a set of 13 metric characters. Six specimens of *M. lucifugus* and one specimen of *M. daubentoni* were excluded from the total sample, due to missing data.

influenced by measurements related to overall size (Table 2) and emphasizes the relatively large dimensions of *M. lucifugus*. The second principal component relates to the length of the gap between the canines and fourth premolars (Table 2) which is longer in *M. brandti* and *M. daubentoni* and somewhat shortened in *M. lucifugus*.

TABLE 2. – Results of the principal component analysis of 13 measurements for a sample of 63 specimens of *Myotis*. Missing data pairwise deleted.

Principal component	1	2
Eigenvalue	6.51	2.77
% of total variance explained	50.1	21.3
Component loadings:		
1) Rostral length	0.564	-0.179
2) C—M3 length	0.931	-0.158
3) P4—M3 length	0.897	0.311
4) C width	0.815	0.374
5) C—P4 length between tips	0.336	-0.695
6) M2 width	0.759	0.415
7) Mandible (glenoid)	0.660	-0.341
8) Mandible (angular)	0.741	-0.344
9) c—m3 length	0.935	-0.075
10) p4—m3 length	0.874	0.310
11) c—p4 length between tips	0.271	-0.783
12) Coronoid height	0.604	-0.353
13) C—P4 gap distance	-0.331	-0.863

Three-group discriminant function analysis revealed a high level of discrimination between *M. lucifugus*, *M. brandti*, and *M. daubentoni* (Fig. 4). Based on a subset of 13 cranial measurements, 91.3 % of *M. lucifugus*, 100 % of *M. brandti* and 96.7 % of *M. daubentoni* were associated correctly. Entered as an unknown, the Kamchatka specimen (USNM 37449) was classified as *M. lucifugus*, *M. brandti*, and *M. daubentoni* with probabilities of 0.01 %, 99.76 %, and 0.23 %, respectively.

DISCUSSION

The quantitative and qualitative characters studied here confirm one another and suggest that the unidentified specimen belongs to *M. brandti* and in any case do not support the previous identification (Hahn 1905) of USNM 37449 as *M. lucifugus*. Moreover, we find no support for Hahn's (1905, p. 254) conviction, that « this bat is not closely related to any known Palaearctic species and... does not appear to differ in

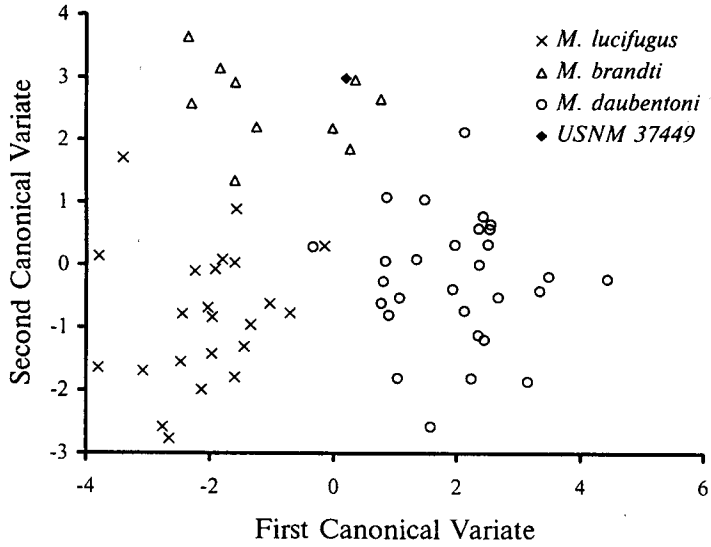

Fig. 4. – Two-dimensional plot of canonical discriminant scores of specimens of *Myotis lucifugus*, *M. brandti*, *M. daubentoni*, and USNM 37449, based on a set of 13 metric characters. Squared Mahalanobis distances of USNM 37449 from group centroids of *M. lucifugus*, *M. brandti*, and *M. daubentoni* are 35.2, 17.1, and 29.3, respectively. Six specimens of *M. lucifugus* and one specimen of *M. daubentoni* were excluded from the total sample, due to missing data.

any essential way from the *Myotis lucifugus* of North America. » However, in view of the fragmented condition of its skull, one cannot be fully confident about the identification of USNM 37449, especially given the considerable variation in dental characters of many small species of *Myotis*. A combination of cranial and dental characters with external ones would have provided much better discrimination between the three considered species, therefore we would have liked to confirm our identification by examining the alcoholic part of this specimen, if it will be found.

As shown in the above analysis, *M. brandti* and *M. daubentoni* display greater similarity to each other than either of them to *M. lucifugus*. This is contradictory to the opinion of Kuzyakin (1950), who suggested close relationships between *M. lucifugus* and *M. daubentoni*, and is more consistent with Findley (1972), who assigned *M. daubentoni* and *M. lucifugus carissima* to different species groups. However it may be an artifact of the limited number of characters analyzed herein. Even though it appears unlikely to confuse *M. lucifugus* with any representative of the bat fauna of north-eastern Palaearctic.

It has been shown for European *M. brandti* and *M. daubentoni* that there is considerable variation in dentition patterns, particularly in the presence and size of the cusp on P4 (*e.g.*, Baagøe 1973 ; Strelkov and Buntova 1982 ; Strelkov 1983 ; Bogdanowicz and Wojcik 1986), and this can be confirmed by our observations on the eastern representatives of these species, as well as on *M. lucifugus*. However it appears that the qualitative dental characters of USNM 37449 more strongly resemble those of the observed *M. brandti* in most respect, which was confirmed also by discriminant analysis. It

has been suggested that in the northern part of the Russian Far East *M. brandti* are represented by the nominal subspecies, as in the European part of Russia (Tiunov 1989).

Only two *Myotis* species have been definitely recorded from Kamchatka : *M. brandti* and *M. daubentoni*, however, to date there exists only one record of *M. daubentoni* from this peninsula (Krivosheev 1984 ; Bogdanowicz 1994). Aside from the two species discussed above, four other *Myotis* species have been recorded from the Russian Far East (not from Kamchatka) : *M. bombinus*, *M. frater*, *M. macrodactylus*, and *M. ikonnikovi* (Krivosheev 1984 ; Pavlinov *et al.* 1995). Another 6 species : *M. formosus*, *M. pruinosus*, *M. ozensis*, *M. fujiensis*, *M. hosonoi*, and *M. yesoensis*, occur in Japan (Yoshiyuki 1989).

Specimens of the species from the Far East have also been examined, but not the Japanese ones, for which, however, good descriptions are available (Wallin 1969 ; Yoshiyuki 1989). None of the examined specimens display resemblance to *M. brandti* in dental charactes. Judging by the descriptions, the only Palaearctic form that might be confused with some Far Eastern specimens of *M. brandti* is *M. fujiensis* from Honshu (Japan). In its dentition (Yoshiyuki 1989) this form is most similar to Japanese *M. brandti* ; however, the antero-lingual cusp on P4 is absent, which readily distinguishes *M. fujiensis* from the specimen N° 37749 and all *M. brandti* observed in this study.

The most geographically imminent part of the distribution range of *M. lucifugus* covers British Columbia, most of Yukon and Alaska, and adjacent islands of the Pacific (Hall 1981 ; Nagorsen and Brigham 1993). Other North American bat species whose ranges approach the considered area are *M. californicus*, *M. volans*, *M. yumanensis*, *M. evotis* and *M. keeni*, whose distribution areas extend through to the coastal parts of British Columbia (Hall 1981 ; Nagorsen and Brigham 1993). All the examined specimens of these North American species (this study) uniformly lack the supplementary cusp on the cingulum of P4, except for *M. yumanensis*. The latter appears indistinguishable from *M. lucifugus* in qualitative dental features and is smaller in size (maxillary toothrow 4.6-5.2 mm ; Hall 1981 ; maxillary toothrow 4.75-5.2 mm, upper molariform toothrow 3.4-3.75 mm ; Herd and Fenton 1983), hence overlapping with USNM 37749 from Kamchatka. This species, however, does not penetrate as far north as *M. lucifugus*.

Reidentification of USNM 37749 from Kamchatka removes any vouchered evidence for the occurrence of *M. lucifugus* in the eastern Palaearctic. This seems logical from a zoogeographical standpoint since none of these (or any other) bat species penetrate northward anywhere near the Bering Strait (e.g., Hall 1981 ; Krivosheev 1984). The « natural » faunal exchange between Kamchatka and Alaska across the North Pacific (*i.e.* via the Aleutian Range) would still seem less probable, than, *e.g.*, between Kamchatka and Japan. However *M. lucifugus* is known to undertake seasonal migrations of up to several hundred kilometers (Fenton and Barclay 1980).

The other reports of *M. lucifugus* in the Palaearctic region are both from the western part : one is that of an immature male collected in 1944 in Reykjavik, Iceland (Koopman and Gudmundsson 1966), the other record was made in Great Britain (Hutson 1993) ; both of them were supposed to be accidental. Besides, there are records of this species being found in cargo transferred from Canada to Europe by ship (Voute 1982 ; Fenton 1983) and even by aircraft (Kock 1994). Therefore, given the intense transport connections between the Russian Far East and North America, there is always a very small probability of artificial intercontinental transfer of species, which, undoubtedly, has to be taken into account in regional zoogeographical studies.

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BIBLIOGRAPHY

BAAGØE. H. J., 1973. – Taxonomy of two sibling species of bats in Scandinavia *Myotis mystacinus* and *Myotis brandti* (Chiroptera). *Vidensk. Meddr dansk naturh. Foren.* 136 : 191-216.

BOGDANOWICZ, W., 1994. – *Myotis daubentonii. Mammalian Species*, 475 : 1-9.

BOGDANOWICZ, W and A. M. WOJCIK, 1985-1986. – Morphological and electrophoretic differentiation between *Myotis daubentoni* (Kuhl, 1819) and *Myotis nathalinae* Tupinier, 1977. *Myotis*, 23-24 : 17-30.

CORBET, G. B., 1978. – *The mammals of the Palaearctic region : a taxonomic review.* British Museum (Natural History), London, 314 p.

FENTON, M. B., 1983. – *Just bats.* Toronto Univ. Press. Toronto, 166 pp.

FENTON, M. B. and R. M. R. BARCLAY, 1980. – *Myotis lucifugus. Mammalian Species*, 142 : 1-8.

FINDLEY, J. S., 1972. – Phenetic relationships among bats of the genus *Myotis. Systematic Zoology*, 21: 31-52.

HAHN, W. L., 1905. – *Myotis lucifugus* in Kamchatka. *Proceedings of the Biological Society of Washington*, 18 : 254.

HALL, E. R., 1981. – *The Mammals of North America.* Vol. 1. John Wiley & Sons, New York, 60 p.

HERD, R. M. and M. B. FENTON, 1983. – An electrophoretic, morphological, and ecological investigation of a putative hybrid zone between *Myotis lucifugus* and *Myotis yumanensis* (Chiroptera : Vespertilionidae). *Canadian Journal of Zoology*, 61: 2029-2050.

HUTSON, A. M., 1993. – *Action Plan for the Conservation of bats in the United Kingdom.* The Bat Conservation Trust, London. 49 pp.

KOCK, D., 1994. – Exoten in der hessischen Fledermaus-Fauna. Pp. 78-79, *in : Die Fledermäuse Hessens.* Geschichte, Vorkommen, Bestand und Schults. Verl. M. Hennecke Remshalden-Buoch.

KOOPMAN, K. F and F. GUDMUNDSSON, 1966. – Bats in Iceland. *American Museum Novitates*, 2262 : 1-6.

KRIVOSHEEV, V. G., ed. 1984. – Land mammals of USSR Far East (an identification guide). Nauka, Moscow, 358 pp. (In Russian)

KUZYAKIN, A.P., 1950. – The Bats. Sovetskaya Nauka, Moscow, 443 pp. (In Russian)

NAGORSEN, D. W. and R. M. BRIGHAM, 1993. – *Bats of British Columbia.* Royal British Columbia Museum Handbook. Vol. 1, The Mammals of British Columbia. UBC Press, Vancouver. 166 pp.

PAVLINOV, I. YA., A. V. BORISSENKO, S. V. KRUSKOP and E. L. YAKHONTOV, 1995. – *Mammals of Eurasia. II. Non-Rodentia.* Archives of Zoological Museum Moscow State University, O.L.Rossolimo, ed., Vol. 33, 336 p. (In Russian)

STATISTICA for Windows, ver. 4.5, © StatSoft, Inc., 1993.

SRELKOV, P. P., 1983. – The whiskered bat (*Myotis mystacinus*) and Brandt's bat (*Myotis brandti*) in the USSR and the relationships of these species. Report 2. *Zoologicheskii Zhurnal*, 62 : 259-269. (In Russian, with English summary)

SRELKOV, P. P. and E. G. BUNTOVA, 1982. – The whiskered bat (*Myotis mystacinus*) and Brandt's bat (*Myotis brandti*) in the USSR and the relationships of these species. Report 1. *Zoologicheskii Zhurnal*, 61 : 1227-1241. (In Russian, with English summary)

The Times Atlas of the World. – VIIth comprehensive ed. Times Books, New York, 1988, 123 pl., 228 pp.

TIUNOV, M. P., 1989. – On the geographical variability of Brandt's mouse-eared bat in the Far East. Pp. 42-45, *in : Theriological studies of the southern Far East.* Kostenko, V.A., ed. Dal'nevostochnoe otdelenie AN SSSR, Vladivostok. (In Russian)

VOUTE, A. M., 1982. – First recorded accidental transatlantic bat transport. *Bat Research News*, 23 : 16-18.

WALLIN. L., 1969. – The Japanese bat fauna. *Zoologiska Bidrag Fran Uppsala*, 37 : 223-440.

YOSHIYUKI, M., 1989. – *A systematic study of the Japanese Chiroptera.* National Science Museum, Tokyo, 242 pp.

APPENDIX

Specimens examined

Myotis lucifugus, Smithsonian Institution National Museum of Natural History (USNM) :

35603/38898 ; Canada : British Columbia, Queen Charlotte Islands, Massett ; 1892 ; alcohol, skull extracted

100675-100678 ; Canada : British Columbia, Queen Charlotte Islands, Skidegate, Graham Island ; 1 1-17 July 1900 ; skins and skulls

242906 ; Canada : British Columbia, Field, Mount Stephen House ; 20 July 1922 ; skin, skull and skeleton

290737 ; Canada : British Columbia, Okanagan ; 5 June 1938 ; skin and skull

290739 ; Canada : British Columbia, Prince George, 32 Mi N, Summit Lake ; 28 June 1944 ; skin and skull

99363, Canada : Yukon, Caribou Crossing, Yukon River ; 27 June 1899 ; skin and skull

99364, Canada : Yukon, Fort Selkirk, 50 Mi Below, Yukon River ; 29 July 1899 ; skin and skull

74947, 76499-76501 ; USA : Alaska, Loring ; 17-22 Sept. 1895 ; skin and skull (74947), alcohol, skulls extracted (remainder)

77411, 77414, 77415, 77417, 77418 ; USA : Alaska, Sitka ; 27 July-07 Aug. 1895 ; alcohol, skulls extracted

154980, 154981 ; USA : Alaska, Ketchikan ; Oct. 1909 ; alcohol, skulls extracted

13701/22514 ; USA : Alaska, Kodiak Island ; no date ; alcohol, skull extracted

14089/38601 ; USA : Alaska, Lake Iliamama ; 1882 ; alcohol, skull extracted

62749, 62751, 62752 ; USA : Alaska, Kodiak Island ; 12 Feb. 1883 ; alcohol, skulls extracted

91563-91565 ; USA : Alaska, Kodiak Island ; 11 June 1894 ; skins and skulls

Myotis brandti, Burke Memorial Washington State Museum, University of Washington (UWBM) :

39239 ; Russia : Magadan Obl., 59 km N along Khosyn River, 150°57'E, 60°5'N ; 17 July 1992 ; skin and skull

39240-39245 ; Russia : Kamchatka, Koryaki, 29 km W, 23 km S, elev. 1500 m ; 157°46' E, 53°05' N ; 22-26 July 1992 ; skins, skulls, and skeletons

Myotis daubentoni, Zoological Museum of Moscow State University (ZMMU) :

S-60140-60142 ; Russia : Kurile Isls, Iturup Isl. 22-24 July, 1956 ; skins and skulls

S-86496-86508 ; Russia : Primorskii Krai ; Khasan ; August 1969 ; skins and skulls

S-103866, 103870-103874, 103877-103899 ; Russia : Vladivostok ; July, 1915 ; alcohol, skulls extracted

S-104337, 104338, 104343, 104344 ; Russia : Primorskii Krai ; Khasan ; 19 August 1969 ; alcohol, skulls extracted

Myotis cf. brandti : USNM 11189/37449 ; Russia : Kamchatka, Petropavlovsk-Kamchatskii, Western Union Company's Overland International Telegraph Expedition, «Picked up by Nikolai Fletcher», F. Whymper, transmitted to USNM through W. H. Dall (see Hahn, 1905), no date, possibly, end of XIX century, alcohol (carcass not found), skull extracted. [Original label data : 37449/11189, Petropaulski, Kamtschatka, W. U. Overland Intn'l Teleg. Exped., F. Whymper.]