

The chiropterofauna of the Polish Tatra Mts.

Krzysztof PIKSA

Cracow Pedagogical University, Institute of Biology, 31–054 Kraków, Podbrzezie 3.

Abstract. This paper reports the status of bats in the Polish Tatra Mountains. In the region of the Polish Tatras 13 bat species were reported: *Myotis myotis*, *M. bechsteini*, *M. nattereri*, *M. mystacinus*, *M. brandtii*, *M. daubentonii*, *Vespertilio murinus*, *Eptesicus nilssonii*, *Eptesicus serotinus*, *Nyctalus leisleri*, *Plecotus auritus*, *P. austriacus*, *Barbastella barbastellus*. The most frequent species are *M. mystacinus* / *brandtii* (over 30 sites), less frequent are *M. myotis* (over 20 sites) and *Eptesicus nilssonii* (over 20 sites). Only *M. mystacinus* (1906 m a. s. l.), and *Eptesicus nilssonii* (1710 m a. s. l.) – in winter and *Vespertilio murinus* (1715 m a. s. l.) – in the summer were observed above the tree-line.

Bats, status and distribution, Poland, Tatras Mts.

Introduction

The Tatra Mountains located in the centre of the Western Carpathians, constitute the highest mountain massif within the whole Carpathian range. At the same time, they are the highest mountain range between the Alps and the Caucasus as well as between Scandinavia and the Balkan peninsula. The Tatras themselves can be divided into four massifs. These are: the Siwy Wierch massif, the Western Tatras, the High Tatras and the Belanske Tatras. The Tatra Mts. constitute the international frontier between Poland and Slovakia. The minor part (about one fourth of the area) located on the northern slopes, lies in Poland. The Polish Tatra Mts. include only a part of the Western and High Tatras. The Tatra National Park includes the entire territory of the Polish Tatras with a small part of the adjacent flysh area. In 1992, both Tatra National Parks in Poland and in Slovakia, were declared as the Tatra Mountain International Biosphere Reserve by the MaB Committee (Mirek 1996).

Recently in the Polish part of the Tatras about 600 caves are known, among them the longest and the deepest is the Wielka Śnieżna cave (Great Snow Cave) (17 000 m of total passage length and 814 m of depth) (Głazek & Grodzicki 1996).

History of study

The first information about the occurrence of bats in the Polish Tatras was published by Kocyan (1867), a forester from Kocielisko, who recorded six bat species in this area. The data are rather of historical value and require updating. A significant

amount of information about bats living nowadays in the area of the Polish Tatra Mountains can be found in the works of Kowalski (1953 a, b, 1955, 1962). It concerns mainly the bats which can be found in caves. There are further data in the works of Wołoszyn (1967, 1970) and Ruprecht (1974, 1983), Kowalski & Ruprecht (1984). At present, annual censuses of bats hibernating in caves are carried out by PTOPIK "Salamandra" and the author of this paper. The results of this research have been presented in several publications (Kepel 1995, 1996, Kepel & Olejnik 1993, Piksa 1995).

Material and methods

The work aimed at collection of all available information concerning the occurrence of bats in the area of the Polish Tatras. Publications of the above mentioned authors served as the main source of information. Some other data used in this work were taken from a number of papers of authors not mentioned earlier, such as Bartkowska (1973), Cichocki (1993), Godawa (1989), Kowalski et al. (1957), Krzanowski (1963), Nowicki (1867), Postawa et al. (1994), Profus (1996), Ruprecht (1974), Skalski (1967), Wołoszyn (1996), Zdzitowiecki (1969a, b, 1970). The literature data were supplemented by unpublished observations made by the author in the winter and in the summer 1996. Results of research into Holocene chiropterofauna, which was studied by many researchers and became the subject of several publications (Nowosad et al. 1992, Wołoszyn 1961, 1963, 1967, 1969, 1970, 1988, 1989, Woźnica 1988), are not included in this report.

Distribution and status of each species

In course of the research, which began in 19th century and has been carried out till now in the region of the Polish Tatras the occurrence of 13 bat species was confirmed: *Myotis myotis*, *M. bechsteinii*, *M. nattereri*, *M. mystacinus*, *M. brandtii*, *M. daubentonii*, *Vespertilio murinus*, *Eptesicus nilssonii*, *Eptesicus serotinus*, *Nyctalus leisleri*, *Plecotus auritus*, *P. austriacus*, and *Barbastella barbastellus*.

***Myotis myotis* (Borkhausen, 1797)**

Wołoszyn (1970) supposes that this species inhabited the Tatras recently, during the last decades or centuries. From the Polish part of the Tatras it is hitherto known from more than 20 localities (caves): Bandzioch Kominiarski (Piksa 1995), Czarna (Postawa et al. 1994), Groby (Kowalski 1953, Postawa et al. 1994), Goryczkowa (Kowalski 1953), Kalacka (Kepel 1995), Kasprowa Niznia (Kepel 1995, Kowalski 1953), Magurska (Kepel 1995, Kowalski 1953), Mylna (Kepel 1995, Kowalski 1953, Postawa et al. 1994), Mroźna (Kepel 1995, Kowalski 1953), Miętusia (Kepel 1995, Kowalski 1953), Naciekowa (Kepel 1995, Postawa et al. 1994), Piwnica Miętusia (Kowalski 1953), Poszukiwaczy Skarbów (Kowalski 1953, Postawa et al. 1994), Przeziurowa (author unpubl.), Szczelina Chochołowska (Kepel 1995, Kowalski 1953, Postawa et al. 1994, Skalski 1967, Wołoszyn 1967), Śpiących Rycerzy Wyżnia (Kepel 1995), Za Smrekiem (author unpubl.), Zimna (Kepel 1995, 1996, Kowalski 1953, Piksa 1995, Postawa et al. 1994). In the summer it was observed by Kocyan (1867) (he did not give their precise location), in Sucha Valley (Ruprecht 1983), in the Szczelina Chochołowska Cave (Kowalski 1953 a) and by author in summer 1996 (Przysłop Kominiarski, Bandzioch

Kominiarski Cave, Czarna Cave, Okna Zbójnickie Cave). It was also recorded from Chochołów, Zakopane (Kowalski et al. 1957) at the Tatra foothills. In the area of the Gubałówka Highland it was not detected (Harmata 1990). The highest locality of this species is the Bandzioch Kominiarski Cave 1456 m a. s. l. (Piksa 1995) and Magurska cave 1460 m a. s. l. (Kepel 1995, Kowalski 1953).

***Myotis bechsteinii* (Kuhl, 1817)**

It was only recorded from two localities; Kościeliska Valley (Kocyan 1867) (he did not give their precise location) and Zimna Cave 1120 m a. s. l. (Ruprecht 1983).

***Myotis nattereri* (Kuhl, 1817)**

A species quite regularly occurring all over the country (Kowalski & Ruprecht 1984). In the Tatras scarce, rare, recorded recently in 7 caves (in winter): Miętusia, Mylna (Kepel 1995), Naciekowa (author unpubl.), Raptawicka, Szczelina Chochołowska, Śpiących Rycerzy Wyżnia (Kepel 1995), Zimna (Kepel 1995, Piksa 1995). The highest locality of this species is the Śpiących Rycerzy Wyżnia Cave, 1420 m a. s. l. (Kepel 1995). Information about the occurrence of this bat is restricted to the area of the Western Tatras. There are no data about the occurrence of this bat in the High Tatras.

***Myotis mystacinus* (Kuhl, 1817) and *Myotis brandtii* (Eversmann, 1845)**

Eurytopic species, hibernating in caves (Kowalski & Ruprecht 1984). It is the only area in Poland where the abundance of these species is so high; they occur also in other parts of the country, but are rare. The species characterized by extensive morphological similarity were differentiated a short time ago, hence the data provided by Kowalski dating from 1950's as well as the data from the subsequent winter investigations concern (Kepel 1995, Piksa, 1995), unfortunately, both the bat species. *M. mystacinus* / *brandtii* is known from over 30 localities (Kepel 1995, Kocyan 1867, Kowalski, 1953a, b, c, 1955, Nowicki 1867, Skalski 1967, Wołoszyn 1967, 1970, Zdzitowiecki, 1969a, b, 1970). The extent of available data does not allow to establish the proportion of the two species in this area. The data by Ruprecht (1974) and Postawa et al. (1994), as well as unpublished data of the author, show that the whiskered bat is the more numerous species. *M. mystacinus* and *M. brandtii* are also the most abundant species in the subfossil material from caves in this area (Nowosad et al. 1992, Wołoszyn 1970, 1989, Woźnica 1988).

M. mystacinus was observed in the caves (in winter): Czarna (author unpubl.), Groby (Bartkowska, 1973, Ruprecht 1974), Litworowa, Lodowa w Ciemniaku (author unpubl.), Kasprowa Niznia, Mylna, Naciekowa, Poszukiwaczy Skarbow, Przezirowa (Postawa et al. 1994), Szczelina Chochołowska (Postawa et al. 1994), Zimna (Ruprecht 1974). In the summer this species was observed in the Gąsienicowa Alp (Ruprecht 1974). The highest locality of *M. mystacinus* is the Litworowa Cave, 1906 m a. s. l.

Only locality of *Myotis brandtii* in the Polish Tatra Mts. is the Goryczkowa Cave 1236 m a. s. l.

***Myotis daubentonii* (Kuhl, 1817)**

In the Tatras scarce, recorded hitherto from 5 localities (caves): Czarna (Piksa 1995), Kalacka (Kepel 1995), Miętusia (Kepel 1995), Naciekowa (Kepel 1995), Szczelina Chochołowska (Godawa 1989). It was also observed by the author near Toporowe Stawki in the summer 1996. The highest locality of this species is the Czarna Cave, 1294 m a. s. l..

***Vespertilio murinus* (Linnaeus, 1758)**

A species quite common all over the country (Kowalski & Ruprecht 1984). Recorded from the Tatras only in summer, not during hibernation period. Mentioned by Kocyan (1867) from the Kościeliska Valley, Pisana Alp and the upper montane zone. Its presence was reported in Kondratowa Alp (Bartkowska 1973) and by the Kepel (1995) in the Lodowa w Ciemniaku Cave, 1715 m a. s. l., and by the author in the Lodowa Litworowa cave (summer 1996). It is a species encountered also in Zakopane (Krzanowski 1963).

***Eptesicus nilssonii* (Keyserling et Blasius, 1839)**

A species, hibernating in caves, known from the majority of regions in Poland (Kowalski & Ruprecht 1984). A boreal species, typical inhabitant of this area. Recorded from numerous localities in the Tatras in winter (caves): Bandzioch Kominiarski (Piksa 1995), Czarna (Piksa 1995, Wołoszyn 1967, 1996), Dziura Wyznia (Dziura Górna) (Kowalski 1953), Groby (Zdzitowiecki 1969a), Kalacka (Kepel 1995, Zdzitowiecki 1969a), Komin w Ratuszu (Piksa 1995), Magurska (Kowalski 1953), Mechata (author unpubl.), Mylna (Kepel 1995, Postawa et al., 1994, Ruprecht 1983, Wołoszyn 1967), Naciekowa (Kepel 1995, Postawa et al. 1994), Okna Zbójnickie Niżnie (Piksa 1995), Raptawicka (Kowalski 1953), Suchy Biwak (author unpubl. 1996) Szczelina Chochołowska (Kepel 1995), Śpiących Rycerzy Wyznia (Kepel 1995), Za Smrekiem (Postawa et al. 1994), Zakosista (author unpubl.), Zimna (Kepel 1995, Kowalski 1953, Piksa 1995, Postawa et al. 1994). It is also frequently observed in summer (Kocyan 1867), Gąsienicowa Alp – Murowaniec (Kowalski 1962) and also by the author from several localities (summer 1996): Białego Valley, Morskie Oko, Niżnia Palenica Pańszczykowa, Pod Kopieńcem Valley, Wysoka Cave. Furthermore, it has been recorded by Zdzitowiecki (1969a) from several localities in the Tatras, but he does not give their precise location. It has also recorded at Tatra foothills from Zakopane (Cichocki 1993), Kościelisko (Harmata 1990). It occurs above and below the tree-limit. The highest locality is the Mechata Cave, 1710 m a. s. l.

***Eptesicus serotinus* (Schreber, 1774)**

One of the most common Polish bats, synanthropic; its occurrence is connected with human settlements (Kowalski & Ruprecht 1984). Information about the occurrence of this species originated from Kocyan (1867). This record is rather of historical importance now, the data have not been hitherto confirmed. It is difficult to judge about the present-day population of the bat in this area. However, the presence of this species in the Slovak Tatras in summer and winter indicates that it can be found here as well.

***Nyctalus leisleri* (Kuhl, 1817)**

Recorded from the Pod Kopieńcem Wielkim Valley (Kowalski 1962) (collected by Prof. Fudalkowski in 1923). It is the only record of its presence in the Polish Tatras.

***Plecotus auritus* (Linnaeus, 1829)**

Eurytopic species, hibernating in caves (Kowalski & Ruprecht 1984). In the Polish Tatra not numerous, it is hitherto known from localities (in winter): Bandzioch Kominiarski (Piksa 1995), Czarna (Piksa 1995, Ruprecht 1983, Wołoszyn 1965), Kalacka, Miętusia (Kepel 1995), Mylna (Postawa et al. 1994, Kepel 1995), Naciekowa (Kepel 1995), Poszukiwaczy Skarbów, Raptawicka (Wołoszyn 1965), Szczelina Chochołowska (Postawa et al. 1994), Wodna Pod Pisaną (Kepel 1995), Zbójnicka (Zbójecka Dziura) (Ruprecht 1983), Zimna (Kepel 1995, Kowalski 1953, Piksa 1995, Postawa et al. 1994). The highest locality of this species is the Bandzioch Kominiarski Cave 1456 m a. s. l.. It was observed in the summer in Kościeliska Valley and Kalatówki Alp (Wołoszyn 1996). It is a species encountered also in Zakopane (Bartkowska 1973, Ruprecht 1983). If we consider the data presented by Kowalski (1953) from 1950's when *P. auritus* and *P. austriacus* were not differentiated, the number of these localities would increase.

***Plecotus austriacus* (Fischer, 1829)**

Nowadays the only locality of this bat both in the Polish and Slovak Tatras is the Czarna Cave 1294 m a. s. l.. It is a species which occurs in quite large numbers in the area of the Gubałowska Highland (Harmata 1990), hence there is a big chance of recording more localities of this synanthropic species on the edge of the National Park.

***Barbastella barbastellus* (Schreber, 1774)**

An eurytopic species, hibernating in caves and cellars. From the Tatras recorded in general terms on the basis of Zdzitowiecki's (1970) data. Kowalski (1962) mentioned it as belonging to the Tatra's fauna. Nowadays recorded in winter time from two localities: in the Raptawicka Cave (Kepel 1995) and the Czarna Cave 1294 m a. s. l. (the highest-situated locality) – observed by the author in winter 1996. One specimen of this species was caught several years ago in the Okna Zbójeckie Cave (Profus 1996, Wołoszyn 1996); it was also observed by the author in the Lejowa Valley in summer 1996. It is a species encountered also in Zakopane (Cichocki 1993) and in the area of the Gubałowska Elevation (Harmata 1990).

The information given by a number of authors about the occurrence of *Myotis dasycneme* in the area of the Polish Tatras (quoted after Kocyan 1867) should be considered a mistake resulting probably from misinterpretation of the bat names mentioned by Kocyan (cf. Blasius 1857, Nowicki 1867, Walecki 1881, Lüttschwager 1939). It is not clear whether in the area of the Polish Tatra Mts. the lesser horseshoe bat occurs. An individual of this species was found in the Tatras by Blasius and count Alexander Keyserling in summer 1835. This information was given by Nowicki

(1867), but he did not specify from which region of the Tatra Mountains the bat originated.

The study of this mammal order, numerously represented in the national fauna, was restricted in the Polish part of the Tatras to the control of hibernacula. Hence, the majority of data concerning the distribution of bats is limited to the small area of sedimentary rocks of the Western Tatras which are subject to karstification. There are few data about the occurrence of bats in other areas of the Western and Eastern Tatra Mountains. The only records of bats in this area came from accidental observations. Research into this group of mammals has never been done in this area in summer, hence the small amount of data about the occurrence of bats which are not confined to caves.

Súhrn

Fauna netopierov poľských Tatier. Príspevok prezentuje stav poznania netopierov poľských Tatier. V tejto oblasti boli zistené nasledovné druhy netopierov: *Myotis myotis*, *M. bechsteinii*, *M. nattereri*, *M. mystacinus*, *M. brandtii*, *M. daubentonii*, *Vespertilio murinus*, *Eptesicus nilssonii*, *Eptesicus serotinus*, *Nyctalus leisleri*, *Plecotus auritus*, *P. austriacus*, *Barbastella barbastellus*. Najfrekvencovanejšími druhmi sú *M. mystacinus* a *M. brandtii* (viac ako 30 lokalít), menej častými sú *M. myotis* (viac ako 20 lokalít) a *Eptesicus nilssonii* (viac ako 20 lokalít). Nad hornou hranicou lesa boli zistené len *M. mystacinus* (1906 m n. m.) a *Eptesicus nilssonii* (1710 m n. m.) v zimnom období a *Vespertilio murinus* (1715 m n. m.) v letnom období.

Literature

- BLASIUS J. H., 1857: *Naturgeschichte der Säugethiere Deutschlands*. Vieweg und Sohn, Braunschweig, 549 pp.
- BARTKOWSKA K., 1973: Siphonaptera Tatr Polskich. *Fragm. Faun.*, **19**(10): 227–286
- CICHOCKI W., 1993: Ssaki. In: MIREK Z. & PIĘKOŚ-MIRKOWA H. (eds.): *Przyroda Kotliny Zakopiańskiej – poznanie, przemiany, zagrożenia i ochrona. Tatry i Podtatrze*, **2**: 221–225.
- GLĄZEK J. & GRODZICKI J., 1996: Kras i jaskinie. In: MIREK Z. et al. (eds.): *Przyroda Tatrzańskiego Parku Narodowego. Tatry i Podtatrze*, **3**: 139–168.
- GODAWA J., 1989: Nowe Stanowisko *Myotis daubentoni* w Tatrach. *Biuletyn CIC*, **1**(5): 13.
- HARMATA W., 1990: Badania nad występowaniem, etologią i ekologią nietoperzy Chiroptera na Wzniesieniu Gubałowskim (Karpaty). Wzniesienie Gubałowskie. *Studia Ośr. Dok. Fizj.*, **18**: 263–273.
- KEPEL A., 1995: Nietoperze zimujące w jaskiniach tatrzańskich – wyniki spisów przeprowadzonych w sezonach 1992/93, 93/94, 94/95. *Prz. Przyr.*, **6**(2): 75–80.
- KEPEL A., 1996: Wyniki spisu nietoperzy zimujących w wybranych jaskiniach tatrzańskich w sezonie 1995/96 na tle rezultatów z lat ubiegłych. Abstracts. *X Ogólnopolska Konferencja Chiropterologiczna w Warszawie*: 14.

- KEPEL A. & OLEJNIK E., 1993: Sprawozdanie ze spisu nietoperzy zimujących w jaskiniach tatrzańskich w 1993 roku. *Biuletyn C.I.C.*, **2**(15): 12–13.
- KOCYAN A., 1867: Zapiski o ssakach tatrzańskich. *Spraw. Kom. Fizjogr. c. k. Tow. Nauk. Krak.*, **1**: 126–129.
- KOWALSKI K., 1953a: *Jaskinie Polski. T.2. Jaskinie Tatr Polskich*. Wyd. Państw. Muz. Archeol., Warszawa, 186 pp.
- KOWALSKI K., 1953b: Materiały do rozmieszczenia i ekologii nietoperzy jaskiniowych w Polsce. *Fragm. Faun. Mus. Zool. Pol.*, **6**(21): 541–567.
- KOWALSKI K., 1953c: Nietoperze jaskiniowe Polski i ich ochrona. *Ochr. Przyr.*, **21**: 58–77.
- KOWALSKI K., 1955: Fauna jaskiniowa Tatr Polskich. *Ochr. Przyr.*, **23**: 283–333.
- KOWALSKI K., 1962: Ssaki. In: SZAFER W. (ed.): *Tatrzański Park Narodowy*, **21**: 365–388.
- KOWALSKI K., KRZANOWSKI A. & WOJTUSIAK R., 1957: Sprawozdanie z akcji obrączkowania nietoperzy w Polsce w latach 1939–1953. *Acta Theriol.*, **1**(5): 109–158.
- KOWALSKI K. & RUPRECHT A. L., 1984: Nietoperze – *Chiroptera*. In: PUCEK Z. & RACZYŃSKI J. (eds.): *Klucz do oznaczania ssaków Polski*, **21**: 85–138
- KRZANOWSKI A., 1963: Kompletna lista nietoperzy Puław. *Prz. Zool.*, **7**(3): 284–286.
- LÜTTSCHWAGER H., 1939: *Die Säugetiere des Danziger Gebietes und der früheren Provinz Westpreußen. Zoologischen Ver.*, Danzig, **61**: 42–48.
- MIREK Z., 1996: Tatry i Tatrzański Park Narodowy – wiadomości ogólne. In: MIREK Z. et al. (eds.): *Przyroda Tatrzańskiego Parku Narodowego – poznanie, przemiany, zagrożenia i ochrona. Tatry i Podtatrze* **3**: 17–26.
- NOWICKI M., 1867: Zapiski z fauny tatrzańskiej. *Spraw. Kom. Fizjogr. c. k. Tow. Nauk. Krak.*, **1**: 179–206.
- NOWOSAD A., JAGIELSKA A. & STRZELCZYK J., 1992: Szczątki kostne nietoperzy i kuny z Jaskini Lodowej w Ciemniaku (Tatry Zachodnie). *Prz. Zool.*, **36**: 199–205.
- PIKSA K., 1995: Monitoring nietoperzy w wybranych jaskiniach tatrzańskich w latach 1994–1995. *Biuletyn C.I.C.*, **18/19**: 46–47.
- POSTAWA T., GALOSZ W. & WOŁOZYN B. W., 1994: Wyniki zimowych spisów nietoperzy zebrane z pojedynczych stanowisk z różnych rejonów Polski. Pp.: 175–185. In: WOŁOZYN B. W. (eds.): *Zimowe spisy nietoperzy w Polsce*. Publikacje CIC ISEZ Kraków.
- PROFUS P., 1996: Ssaki. W: MIREK Z. et al. (eds.): *Przyroda Tatrzańskiego Parku Narodowego. Tatry i Podtatrze*, **3**: 435–454
- RUPRECHT A., 1974: The occurrence of *Myotis brandtii* Eversmann 1845 in Poland. *Acta Theriol.*, **19**(6): 81–90.
- RUPRECHT A., 1983: Nietoperze Chiroptera. Pp.: 63–82. In: PUCEK Z. & RACZYŃSKI J. (eds.): *Atlas rozmieszczenia ssaków w Polsce*. PWN, Warszawa.
- SKALSKI A., 1967: Charakterystyka współczesnej fauny Szczeliny Chochołowskiej w Tatrach. *Pr. Muz. Ziemi*, **36**(11): 281–287.
- WALECKI A., 1881: Fauna zwierząt ssących Warszawy i jej stosunek do fauny całego kraju. *Pam. Fizjograf.*, **1**: 268–291.
- WOŁOZYN B. W., 1961: Die postglazialen Fredermäuse (Chiroptera) aus der Zimna Höhle in der Hohen Tatra. *Die Höhle*, **12**: 90–91.

- WOŁOŻYŃ B. W., 1963: Postglacialna fauna (Chiroptera) z Jaskini Zimnej w Tatrach. *Przegl. Geol.*, **3**: 110.
- WOŁOŻYŃ B. W., 1965: Współczesne występowanie *Plecotus auritus* (L., 1758) i *Plecotus austriacus* (Fischer, 1829) w Polsce. *Materiały na VIII zjazd PTZool.*: 83–85.
- WOŁOŻYŃ B. W., 1967: Współczesna i holocenińska fauna ssaków z jaskini Szczelina Chochołowska w Tatrach. *Pr. Muz. Ziemi*, **11**: 291–298.
- WOŁOŻYŃ B. W., 1970: Holocenińska fauna nietoperzy (Chiroptera) z jaskiń tatrzańskich. *Folia Quatern.*, **35**: 1–52.
- WOŁOŻYŃ B. W., 1988: Pliocene and Pleistocene bats of Poland. *Acta Paleont. Pol.*, **32**(3–4): 207–325.
- WOŁOŻYŃ B. W., 1989: Nietoperze – Chiroptera. In: KOWAŁSKI K. (ed.) *Historia i ewolucja lądowej fauny Polski. Folia Quatern.*, **59–60**: 129–141.
- WOŁOŻYŃ W., 1996: Fauna jaskiń tatrzańskich. In: MIREK Z. et al. (eds.) *Przyroda Tatrzańskiego Parku Narodowego – poznanie, przemiany, zagrożenia i ochrona. Tatry i Podtatrze*, **3**: 525–533.
- WOŹNICA S. A., 1988: Wstępne wyniki badań szczątków kostnych ssaków systemu jaskiniowego Wysoka – Za Siedmioma Progami w Tatrach. *Gacek*, **22**(43): 86–88.
- ZDZITOWIECKI W., 1969a: Helminths of bats in Poland. I. Trematodes of the subfamily Lecithodendriinae. *Acta Parasit. Pol.*, **18**(24): 207–226.
- ZDZITOWIECKI W., 1969b: Helminths of bats in Poland. III. Trematodes of the family Lecithodendriidae except for Lecithodendriinae. *Acta Parasit. Pol.*, **18**(25): 227–237.
- ZDZITOWIECKI W., 1970a: Helminths of bats in Poland Cestodes and Trematodes of the family Plagiorchiidae. *Acta Parasit. Pol.*, **19**(20): 175–188.

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