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Variability of fur coloration in Savi's bat *Hypsugo savii* (Bonaparte, 1837)

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Abstract. Most identification guides describe Savi's bat as a species exhibiting a typical bicolor fur on its back, the base of hairs being dark while the tips show a blond or golden coloration. A check of 254 living individuals caught in Southern France ($n = 100$) and in South-Western Switzerland ($n = 154$) from 1985 to 1991 revealed in fact that as many as 19–24 % of the bats from these populations exhibit an entirely unicolour back fur. This is a possible source of misidentification.

Key words. Chiroptera, *Hypsugo savii*, identification.

Savi's bat has long been considered a rare species among European mammals (Stebbins 1986, Hainard 1987). However, recent investigations throughout Southern Europe [for instance Spain (Ibañez et al. 1992), Greece (v. Helversen, pers. comm.), France (Bertrand 1992) and Switzerland (Zingg & Arlettaz 1989)] have indicated this was mainly due to inappropriate census methods. In particular, most bat biologists have concentrated their activity in underground sites like caves, mines and cellars where *H. savii* is a rare visitor. This viewpoint is supported by our findings in the Upper Rhône valley (South-Western Swiss Alps, Province of Valais, 5000 km²). From 1985 to 1991, we recorded 314 Savi's bats, but only three of these were at underground sites (one mine and one cave), which represent as few as 0.96 % of all observations of *Hypsugo savii* recorded in that area. Furthermore, these three findings represent only 0.23 % (2/884) and 0.30 % (1/366) respectively of the bats observed within these two underground sites. The majority (88 %) of records of *H. savii* in that area result from mist netting efforts above water (ponds, still streams). Further visual and acoustic observations have indicated that *H. savii* inhabits crevices in rocky cliffs, but sometimes also buildings where it roosts behind shutters (Arlettaz, Lugon & Sierro, unpublished data). *Hypsugo savii* is generally described as a bat with golden tips of hairs on its back (Fig. 1; Hainard 1987, Schilling et al. 1983, Schober & Grimmberger 1987, Corbet & Ovenden 1984). The majority of these authors suggest this qualitative feature may help in identification, since it is not shared by European representatives of the genus *Pipistrellus*, within which *H. savii* was wrongly classified until recently, because of apparently strong morphological similarities (Horacek & Hanak 1985–86, Zingg 1988, Ruedi & Arlettaz 1991). In this note we shall focus on the problem of fur coloration in Savi's bat, because our observations diverge somewhat from previous descriptions. In Southern France [Minervois (43° 20' N, 2° 35' E) and Port Cros Island (43° 02' N, 6° 22' E)] and in the Southern Swiss Alps (Valais; 46° 15' N, 7° 30' E), Savi's bat has large phenotypic variability in its fur coloration. During the early years of our study, we noticed that not all individuals show the

typical golden tips of hairs described in the literature. Since 1985, we have systematically recorded the coloration of the fur of Savi's bats we found. Information was gathered on 254 living individuals captured between 1985 and 1991. Unfortunately, these checks started independently in both areas, the French being unaware of the same activity by the Swiss people, and vice versa. For this reason, we did not adopt immediately the same categories for the classification of fur coloration patterns. Nevertheless, the post hoc comparison of our categories on the basis of photographs and observations made during a visit by R. Arlettaz to Southern France, allowed us to group all individuals in approximately similar classes.



Fig. 1: A typical Savi's bat with bicolor fur: back hair base is brown whereas tips are golden. Photograph by R. Arlettaz.

Two main categories of fur coloration were defined: bicolor and unicolor (Table 1). A bicolor fur is the sole phenotype usually described in identification guides; this type of fur is characterized by a dark base of back hairs, with the tips much lighter in colour. The unicolor phenotype has hitherto only been mentioned by Médard & Guibert (1988) and Gebhard (1992, photograph p. 64). In this latter type back hairs do not present any contrast from the base towards tip. Both categories — bicolor and unicolor — were divided into subclasses. These subdivisions should be considered with some caution. First, because they are more subjective to the appreciation of the observer, and second because they attempt to group types within exclusive categories, while individuals actually show continuous clines in fur coloration. Bicolor was subdivided into three subclasses: 1.1 brown hair base with golden tips; 1.2 brown base with blond or beige tips; 1.3 grey base with silver tips. Unicolor was subdivided into: 2.1 red through auburn to chestnut brown; 2.2 anthracite (dark grey) (Fig. 2). Table 1 shows the proportion of these different phenotypes within the two French and Swiss populations. A statistical comparison of all five different classes shows a significant difference between France and Switzerland ($\chi^2 = 9.84$, d. f. 4, $p = 0.043$). This difference is clearly imputable to the (arbitrary?) splitting of brown



Fig. 2: Three different phenotypes caught during a single night in mist nets set above water (Switzerland). Upper left: common phenotype: brown hair base with golden tips; upper right: the single specimen of the class "grey base with silver tips" so far recorded; down: anthracite (dark grey). Photograph by R. Arlettaz.

Table 1: Proportions of the different Savi's bat phenotypes recorded in Southern France (n = 100) and South-Western Switzerland (n = 154) between 1985 and 1991. Note that 19–24 % of the bats exhibit unicolor fur.

Categories Subclasses	Southern France (Minervois, Languedoc-Roussillon) (Port-Cros Island, Côte d'Azur)		South-Western Switzerland (Alps of Valais)	
	n	%	n	%
Bicolor		81.0		76.1
Brown with golden tips	44	44.0	42	27.3
Brown with beige or blond tips	37	37.0	74	48.1
Grey with silver tips	0	0.0	1	0.7
Unicolor		19.0		24.1
Red, auburn, chestnut brown	18	18.0	30	19.5
Anthracite (dark grey)	1	1.0	7	4.6
Total	100		154	

bicolor furs into the first two subclasses (uppermost in Table 1). Because this sub-classification is just the most sensitive to observer bias (blond or beige tips versus golden tips) the observed difference would reflect inter-group as well as inter-population variation. A simple comparison of the two main categories bicolor and unicolor, which eliminates this possible bias, reveals no statistical difference between French and Swiss populations ($\chi^2 = 0.89$, d. f. 1, $p = 0.43$). Note that the relative proportion of these different categories is independent of age (yearlings vs adults). If our samples are representative of the populations inhabiting South-Western Europe, we must consider that as many as 19–24 % of Savi's bats from this area have a unicolor fur coloration. The existence of unicolor phenotypes within Savi's populations could effectively be a source of misidentification if people rely entirely on previously published descriptions. We suggest to check other discriminatory morphological characters (e. g. tragus shape, jaw structure, dark skin coloration, etc.) before rejecting a priori that a "pipistrelle" with unicolor back fur is not *Hypsugo savii*. To our knowledge such a high phenotypic variability has so far not been described among other European bats. The Serotine bat *Eptesicus serotinus* also shows diverse patterns of fur coloration, from chamois to dark brown (pers. obs.), but, in our opinion, it never exhibits a variability in fur coloration of the magnitude observed in Savi's bat.

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Zusammenfassung

Die meisten Bestimmungsbücher beschreiben die Alpenfledermaus *Hypsugo savii* als eine Art mit typisch zweifarbigem Rückenfell, wobei die Haarbasen dunkel, die Spitzen blond oder golden gefärbt sind. Die Überprüfung 254 lebender Tiere in Südfrankreich und im Südwesten der Schweiz zwischen 1985 und 1991 zeigte, daß 19–24 % der Tiere aus diesen Populationen ein vollkommen einfarbiges Rückenfell aufweisen. Dies ist eine mögliche Quelle für Fehlbestimmungen.

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