eco.mont – Volume 15, Number 2, July 2023
ISSN 2073-106X print version – ISSN 2073-1558 online version: http://epub.oeaw.ac.at/eco.mont
https://dx.doi.org/10.1553/eco.mont-15-2s47

Small mammal Fauna in the Swiss National Park – developments over the last 100 years

Jürg Paul Müller

Keywords: Insectivores (Eulipotyphla), Rodents (Rodentia), Swiss National Park, developments

Abstract

When the Swiss National Park was founded, taking stock of the fauna and flora was a major goal. Various efforts were made to investigate insectivores and rodents, but little was published about the findings. In this article I will analyse the existing data in terms of how the small mammal fauna has developed over the last 100 years. The data reveal that species that are rare today were rare then and the common ones were quite numerous then too. The protection status has meant that former pasturing animals, mainly sheep, were replaced by wild animals like the red deer, so that the environment of the small mammals in this distinctly dry area has changed little.

Profile

Protected area

Swiss National Park

Mountain range

Alps, Switzerland

Figure 1 – Forest dormouse (Dryomys nitedula). © L. Hlasek

Introduction

Investigating the mountain environment was clearly a goal when the Swiss National Park (SNP) was founded in 1914 and efforts to that effect started immediately. Cataloguing the fauna and flora was seen as vital (Baur & Scheurer 2014). Capturing small mammals, i. e. insectivores and rodents, started in 1916, when Gustav von Burg from Olten was commissioned with the task. Until the mid-20th century, it was mainly zoologists from the university and the natural history museum in Geneva who researched small mammals in the park and its surroundings. 12 years ago, I started to intensify my studies of small mammals in the SNP. To this day, despite extensive field work, there have been few publications on the small mammals of the SNP (von Burg 1921, 1925; Dottrens 1962; Wittker 2008; Müller 2022).

Still, existing data are interesting for identifying possible changes since or because of the establishment of the park. Possible changes are relevant in terms of climate change. Its impact can, however, only be understood if we take into account the concurrent changes in land use, including conservation. In an effort to better assess the situation in the SNP, I included its surroundings, i. e. the Val Müstair and the Lower Engadin, in the study.

Study area

The study area (Lower Engadin and Val Müstair, without Samnaun, but including S-chanf) is 1280 km², of which 170 km² is national park (Figure 2). Geological, geomorphological and vegetation features of the study area have been described in detail, mainly by Haller et al. 2013. The Lower Engadin is drained by the River Inn, the Val Müstair by the Rombach and thus by the Adige River. Both valleys are eastward exposed, which is essential for the recolonization by the mammals after the glacial period and for the biogeography.

The area has been formed by the Eastern Alpine nappes, which were stacked and pushed towards the north and east during the Cretaceous period (c. 90–65 million years ago). The type of rock, along with the climate, is important for surface structure, soil formation and vegetation, which together provide for the basic needs of the small mammals. The crystalline rock in the area, but also the carbonate rock, weathers rather strongly. The large screes are mostly fine-grained and offer few refuge options for small mammals.

The study area is situated in a distinct inner-alpine dry zone with little precipitation, which can vary greatly depending on exposition and altitude. Apart from the creeks and rivers of the individual valleys, there are fewer small running waters, ponds, wetlands and bogs than in other parts of the Alps. In the SNP, 28% of the area is forest, mainly mountain pine. Alpine grasslands or pastures cover 21% of the area. 51% of the area is scree and rock or generally unusable high mountain without settlement.

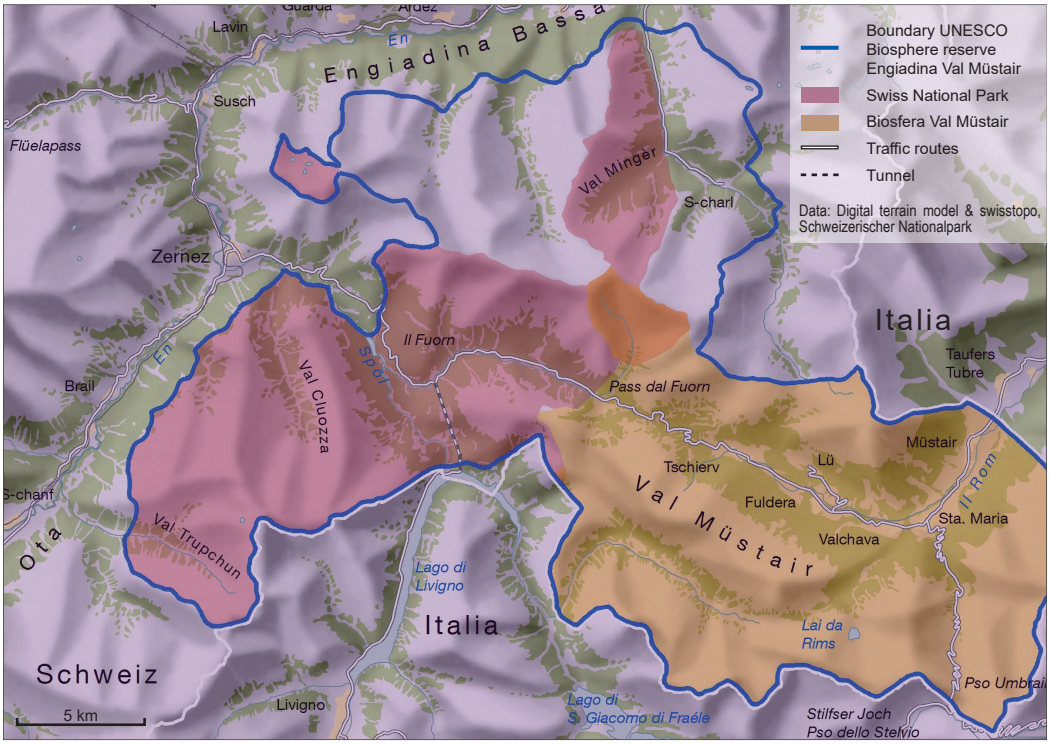

Figure 2 – Study area in the Swiss National Park in the Unterengadin and the Münstertal. © Schweizerischer Nationalpark 2022/02

Data and methods of data capture

Overview of the main capture initiatives

The capture initiatives that form the basis for this article are listed in Müller (2022) in the comprehensive Tables 1 and 2. The main initiatives are referred to below, along with the detection methods.

- Very little exists of the supposedly comprehensive material collected mainly in the vicinity by third-party helpers for Gustav von Burg (Müller 2022). The published statements (von Burg 1921 and 1925) are difficult to interpret.
- From 1933 to 1948, Peter Revilliod, Emile Dottrens and Georges Bär collected comprehensive material in the SNP and its vicinity and stored it in the *Muséum d'histoire naturelle de Genève*. According to literature, it comprises 476 individual small mammals (Dottrens 1962).
- In the years 1971 and 1972, André Meylan and Jean-Claude Praz studied the small mammals on a transect near Ramosch and collected 566 individuals (Praz & Meylan 1973). Müller and his colleagues caught another 490 small mammals in the hedges near Ramosch in the years 1988 and 1989.
- In 1999 Regula Tester studied the dormouse fauna in the Lower Engadin, where four species occur.
- Christian Wittker (2008) studied the ecology of the field mouse in the area of Stabelchod, which is heavily grazed by red deer.
- From 2010 to 2019, I carried out 28 capture initiatives with various helpers and detected 662 animals.
- All detections, even of smaller initiatives and individual detections by third-party, were entered into the database of the CSCF (*Centre Suisse de Cartographie de la Faune*, Neuchâtel). This resulted in Table 1, which gives an overview of the species and their detection in the parts of Lower Engadin, SNP and Val Müstair.

Detection methods

Various methods were used in the different capture initiatives, so that the results are not comparable in every aspect. However, they provide valuable indications about the occurrence and distribution of the species over time.

In the initiatives of the Geneva group (Revilliod et al.), the term *capture* denotes the number of individual animals, as they used snap traps. Meylan and Praz (1973) used live traps, first mostly and later exclusively, as did everyone in all later initiatives. They usually registered the number of captures and rarely that of the individual animals.

Species identification

In my capture initiatives from 2010 to 2019 I focused on species identification. With cryptic species that could not be identified by external characteristics, tissue and hair samples were taken for DNA analysis. In the study area this applied to the genus Apodemus and Sorex and in some cases also to Microtus and Neomys. The samples were kept in 96% ethanol. In 2010 some samples were identified by Meret Signer of Peter Wandeler's group at the University of Zu-

Table 1 – List of species of insectivores and rodents for the three regions of Lower Engadin (UE), National Park (SNP) and Val Müstair (MT) with the area in square kilometres with the number of insectivores. The numbers cannot be compared fully as they depend on how good a species can be observed and captured, but they give an impression of how common they are. The same information can be read off the last year of detection. Frequent and regularly occurring species will have been observed in the years from 2010 to 2019. Summary of the table: CSCF (Centre Suisse de Cartographie de la Faune, Neuchâtel).

Family	Species	English name	UE – 872 km²		SNP – 220 km²		MT – 181 km²	
			km²	Year	km²	Year	km²	Year
Erinaceidae	*Erinaceus europaeus*	European hedgehog	4	2014			4	2011
Soricidae	*Neomys anomalus*	Miller's water shrew	3	1988	1	1933	2	2019
Soricidae	*Neomys fodiens*	Water shrew	19	2016	6	2016	4	2002
Soricidae	*Sorex alpinus*	Alpine shrew	8	2016	4	2011	2	2013
Soricidae	*Sorex araneus*	Common shrew	23	2014	12	2018	9	2019
Soricidae	*Sorex minutus*	Eurasian pygmy shrew	25	2018	6	2013	5	2013
Talpidae	*Talpa europaea*	European mole	9	2018				
Gliridae	*Dryomys nitedula*	Forest dormouse	8	2019	5	2016	4	2018
Gliridae	*Eliomys quercinus*	Garden dormouse	74	2019	27	2016	24	2019
Gliridae	*Glis glis*	Fat dormouse	14	2016				
Gliridae	*Muscardinus avellanarius*	Common dormouse	12	2019			6	2018
Cricetidae	*Arvicola amphibius*	Water vole	1	2019				
Cricetidae	*Chionomys nivalis*	Snow vole	28	2019	21	2018	12	2018
Cricetidae	*Clethrionomys glareolus*	Bank vole	75	2019	39	2018	20	2018
Cricetidae	*Microtus lavernedii*	Mediterranean field vole	11	2014				
Cricetidae	*Microtus arvalis*	Common vole	45	2018	24	2018	18	2017
Cricetidae	*Microtus subterraneus*	Common pine vole	9	2014	2	2015	2	2012
Muridae	*Apodemus alpicola*	Alpine field mouse	26	2016	14	2015	10	2019
Muridae	*Apodemus flavicollis*	Yellow necked field mouse	2	2012	1	2012	1	2019
Muridae	*Apodemus sylvaticus*	Wood mouse	3	2014	4	2016	5	2019
Muridae	*Mus domesticus*	Western house mouse	1	2014			2	1988
Muridae	*Rattus norvegicus*	Brown rat	3	2004			1	2019
Muridae	*Rattus rattus*	Black rat	1	1968				
Sciuridae	*Marmota marmota*	Alpine marmot	639	2019	140	2019	179	2019
Sciuridae	*Sciurus vulgaris*	Red squirrel	102	2019	74	2019	26	2019

rich, later by Marilena Palmisano of the Institute of Natural Resource Sciences (IUNR) at ZHAW Wädenswil. Genus-specific markers of the cytochrome B were used for the small mammal samples and later sequenced. For some small mammal samples, for instance for the Sorex species, the cytochrome C oxidase was sequenced again with the markers of Pfunder et al. (2004). The sequence data were then compared against the Genbank NCBI.

Table 2 – Number of genetically identified animals per species.

Species	Number
Apodemus alpicola	61
Apodemus sylvaticus	14
Apodemus flavicollis	3
Microtus lavernedii	2
Microtus arvalis	32
Pitymys subterraneus	3
Neomys fodiens	6
Sorex araneus	13
Total	134

Species diversity: Any changes over time?

Forest species regularly caught in the SNP are: Alpine field mouse (*Apodemus alpicola*), bank vole (*Clethrionomys glareolus*), garden dormouse (*Eliomys quercinus*) and the common shrew (*Sorex araneus*). The garden dormouse is quite common in the SNP. This contrasts with its unexplained decline in Central and Eastern Europe (Zanini & Blant 2021). The common shrew often is the third-most common species in northern and central Grisons. It is considerably rarer in the SNP. All mentioned forest species are among the regularly detected common species since the establishment of the park. A rare species in the area is the yellow-necked field mouse (*Apodemus flavicollis*), which is common at low altitudes. Since the alpine mouse (*Apodemus alpicola*) was only elevated to species status in 1989 and genetic species determinations were not made until 2010, it is uncertain wether *Apodemus flavicollis* was also rare in the past. To our knowledge, a morphometric determination of the museum material is still pending.

In *grassland*, i.e. the pastures of the SNP, only the common vole (*Microtus arvalis*) is a common species, in the *stone runs* it is the snow vole (*Chionomys nivalis*). This constellation has not changed since the establishment of the park.

Surprisingly, the water shrew (*Neomys fodiens*) has been detected again and again, even though the area has few bodies of water, but those are of good quality.

Along with the common species, there is a great number of species that have only been detected oc-

casionally and must be considered rare since the establishment of the park. They will be listed below in systematic order. It is difficult to associate them with *larger habitats* because of their often very specific habitat requirements. The Miller's water shrew (*Neomys anomalus*) has only been detected once in the SNP. It is a relict species and rare across the entire Alpine space. This is also true for the Alpine shrew (*Sorex alpinus*), which probably requires very specific habitats. The Eurasian pygmy shrew (*Sorex minutus*) is widely distributed across the Alps but rarely caught. In the SNP and the neighbouring valleys, no white-toothed shrew of the Crocidura genus has ever been detected.

Of the dormice, there is the frequently found garden dormouse, but also the forest dormouse (*Dryomys nitedula*). Over the last 100 years, ever new locations have become known, but few over long periods. In the SNP, the species is at the westernmost part of a huge distribution area that reaches as far as the Caucasus and Asia Minor.

Of the voles, a few specimen of the common pine vole (*Microtus subterraneus*) have been captured. The species settles in marginal biotopes, possibly as a result of competition with the common vole.

To sum up, the composition of the small mammal fauna has not substantially changed over the past 100 years, i. e. since the establishment of the SNP. Formerly rare species have remained rare. Formerly common species still make up the largest share of the small mammal fauna. The total protection by the national park ensures a practically natural development of the ecosystems with their fungi, plants and animals. The species diversity of the small mammals is not greater than in other parts of the Alps with similar location and structure (Müller 2022). In contrast, the species diversity and stock must count as low. Even Dottrens, Revilliod and Bär came to that conclusion (cf. the annual reports of WNPK 1934, 1935 and 1945). The comparative rarity of small mammals in the SNP can be largely explained by the dryness of the area. Unlike the small mammals, large species like the red deer have increased as a result of the establishment of the SNP. Their numbers locally result in overgrazing (Wittker 2008), which means a lack of food and cover, as well as trample damage for the common vole.

Acknowledgement

The author owes great thanks to the many people who supported him in the field, the laboratory, in museums and in the analysis and publication of the data.

References

Baur, B. & T. Scheurer (eds.) 2014. *Wissen schaffen. 100 Jahre Forschung im Schweizerischen Nationalpark*. Bern.

Dottrens, E. 1962. *Microtus nivalis* et *Microtus arvalis* du Parc National Suisse. *Ergebnisse der wissenschaftlichen Untersuchungen im schweizerischen Nationalpark*. Band VII: 329–352.

Gilliéron, J. 2009. Nouvelles données sur la distribution du *Mulot alpestre* (Apodemus alpicola Heinrich, 1952). *Revue Suisse de Zoologie* 116 (3-4): 427–436.

Haller, H., A. Eisenhut & R. Haller 2013. *Atlas des Schweizerischen Nationalparks: Die ersten 100 Jahre. Nationalpark Forschung in der Schweiz*. Bern.

Marchesi, C., J.P. Müller & T. Briner 2014. Die Kleinsäugerfauna eines alpinen Lebensraumes in den Schweizer Alpen (Alp Flix, Sur, Graubünden). *Jahresbericht der Naturforschenden Gesellschaft Graubünden* 118: 143–157.

Müller, J.P. 2021. *Die Mäuse und ihre Verwandten. Das verborgene Leben der Insektenfresser und Nagetiere*. Bern.

Müller, J.P. 2022. Die Insektenfresser (Eulipotyphla) und Nagetiere (Rodentia) des Schweizerischen Nationalparks und seiner Umgebung. *Arbeitsbericht zuhanden der Forschungskommission des Schweizerischen Nationalparks*. Doi: 10.5281/zenodo.6241539

Pfunder, M., O. Holzgang & J.E. Frey 2004. Development of microarray-based diagnostics of voles and shrews for use in biodiversity monitoring studies, and evaluation of mitochondrial cytochrome oxidase I vs. Cytochrome b as genetic markers. *Molecular Ecology* 13(5): 1277–1286. Doi: 10.1111/j.1365-294X.2004.02126.x

Praz J.-C. & A. Meylan 1973. Insectivores et Rongeurs de Base-Engadin (Note préliminaire). *Revue Suisse de Zoologie* 80: 675–680.

Tester, R. & J.P. Müller 2000. Verbreitung und Habitatdifferenzierung der Schläfer (Gliridae) im Unterengadin (Schweiz). *Jahresbericht der Naturforschenden Gesellschaft Graubünden* 109: 93–112.

Von Burg, G. 1921. *Die Säugetiere des Engadins, Puschlavs, Bergells und Münstertales*. Separatabzug aus Weidmann 3, Graf, Bülach.

Von Burg, G. 1925. Säugetiere im Gebiet des Nationalparkes, festgestellt in den Jahren 1917 bis 1925. *Archiv des Schweizerischen Nationalparkes*. Zernez.

Wittker, C. 2008. *Extinction of Microtus arvalis in the Swiss National Park? A case study on the effects of vegetation change and climate variability*. Masterarbeit, Department Umweltwissenschaft ETH Zürich.

Zanini, M. & M. Blant 2021. Gartenschläfer. In: Graf, R.F. & C. Fischer (eds.), *Atlas der Säugetiere. Schweiz und Liechtenstein*: 386–389. Schweizerische Gesellschaft für Wildtierbiologie SGW. Bern.

Author

Jürg Paul Müller

grew up in Chur (Grisons)and studied biology at the University of Zurich. 1971–1973 director of the Semien Mountains National Park in Ethiopia. 1973–2010 director of the Bündner Naturmuseum in Chur. He is spezialised in systematics and ecology of small mammals.