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Subterranean Food-Web Dynamics: A 13-Year Dataset on Strinati's Cave Salamander (*Speleomantes strinatii*) and Its Prey

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GENERAL INFORMATION

Species name: *Speleomantes strinatii* (Aellen, 1959)

Geographic area: Italy, Central Liguria, Province of Genova, Municipality of Savignone (study site the Biospelological Station “Arturo Issel”).

Period: 2013-2025

Type of data: Three datasets are presented: two describe a predator-prey system over 13 consecutive years. The third provides the spatial distribution of invertebrate prey along the study site over the same time period. Abundance of the predator, Stinati’s cave salamander, *Speleomantes strinatii*, was estimated by three temporary removal samples each year, while the number of invertebrate prey items outside and inside the study site was obtained by entomological sticky traps.

Reference to the dataset: The complete files corresponding to this dataset are published on Zenodo with this DOI: 10.5281/zenodo.16261725. These files are publicly accessible from Zenodo: https://zenodo.org/records/16261725.

Keywords: *Speleomantes*, subterranean habitat, predator-prey-system, removal method, entomological traps, ecological time series.

ABSTRACT

Data Descriptor. Subterranean habitats are simplified ecosystems that have been proposed as models for studying ecological interactions in space and time. The present dataset was obtained inside an artificial subterranean tunnel dedicated to long-term research on the resident terrestrial salamander *Speleomantes strinatii*. To test the ecological interactions between salamanders and their invertebrate prey, abundances were

assessed using temporal removal methods and entomological sticky traps, respectively. During 13 consecutive years, salamander abundance was estimated by three temporary removal samplings, while invertebrates were captured each year by entomological sticky traps. The sticky traps were placed outside and inside the tunnel to asess the spatial distribution of prey at the site. The present dataset provides two complete times series describing a predator-prey system over 13 consecutive years. There are no missing data.

METHODOLOGY

This specific dataset is part of ongoing long-term research on the population dynamics, demography and behavioural ecology of a *Speleomantes strinatii* population inhabiting the Biospeleological Station "Arturo Issel" (Salvidio et al., 1994, 2025; Lindström et al., 2010; Oneto et al., 2010; Salvidio and Pastorino, 2002; Costa et al., 2024). The study site is an underground tunnel excavated during World War II, in the Municipality of Savignone (Province of Genova, NW Italy), to be used as an air-raid shelter by civilians (Salvidio et al., 1994). Since 1987, the site has been closed by an iron gate and managed by a speleological group, the "Gruppo Speleologico Ligure A. Issel". A permanent grid with a 1 x 1 m mesh was fixed from the entrance to 21 m inside the tunnel. In the study site, the simplified ecological food web is composed by two top predators (i.e. Strinati's cave salamanders and spiders of the genus *Meta*) and their invertebrate prey.

Strinati's cave salamander population abundance was estimated by the same observer annually by means of three temporary removal samplings, starting in July 1996 (Costa et al., 2024). Removal samples were obtained every other day (i.e., over 96 hours). Salamanders active on the cave walls were caught by hand, sexed and measured from the snout to the posterior part of the vent (snout-vent length, SVL). In addition, the individual position of salamanders within the permanent grid was recorded (Salvidio et al., 2025). After the third removal all individuals were released at the capture site. Population abundance was estimated each year separately, by model M_{bh} of CAPTURE software, which allows capture heterogeneity among capture occasions and evaluates model fitting by a χ^2 test (White et al., 1984). When the population is closed and the sampling effort is maintained constant, removal techniques are a special case of capture-mark-recapture and provide highly reliable estimates (White et al., 1984; Rodriguez de Rivera and McCrea, 2021). Overall, the salamander time series was fluctuating without any directional trend (Costa et al., 2024), and when analysed by autoregressive moving average (ARMA) modelling (Box and Jenkins, 1970), the most parsimonious model was an ARMA(2, 1) (Salvidio et al., 2024). In ecological time series, an ARMA(2,1) model could be describing a stochastic system in which two biological species are strongly interacting, as for example in a prey and predator system or as competitors (Abbott et al., 2009; Zeibarth et al., 2010). In the study case, the working hypothesis was that the two-species system could correspond to a predator-prey system, with invertebrates being the prey and Strinati's cave salamanders the predators. For this reason, starting in 2013 the abundance of the invertebrate prey found inside the tunnel was assessed in parallel while estimating the salamander population size. In fact, invertebrates show a similar pattern of activity as Strinati's salamanders with a clear maximum in August (Oneto and Salvidio, 2005). Every year in July, during the salamander removal experiment, nine sticky traps were used to estimate invertebrate prey outside and inside the Biospeleological Station. Sticky traps were obtained from 210 x 297 mm transparent acetate sheets laminated on one side with transparent entomological glue (Tem-O-Cid, produced by ADAMA Home & Garden). Traps were activated during the first salamander removal, one trap hanging in the open outside the tunnel at a high of 1.20 m, while eight traps hanging from the cave vault were located every three meters from the entrance up to 21 m (i.e., 0, 3, 6, 9, 12, 15, 18 and 21 m) inside the tunnel. All traps were transparent to avoid a well-known colour attractive effect on flying insects (e.g., Dearden et al., 2024). After the third salamander removal, all traps were removed, preserved between two transparent plastic sheets and brought to the laboratory. Invertebrates captured were observed at the stereomicroscope to be identified and classified into functional groups: Diptera (flies), Acarina (mites), Hemiptera (planthoppers), Formicidae (ants), Coleoptera (beetles) and Araneida (spiders). Unclassified prey items were pooled in the category “Indeterminate”.

DATASET DESCRIPTION

The first dataset (01_Speleomantes_strinatii_removal.txt) reports the data from the three removal occasions and, in the last column, the estimated abundance calculated by model M_{bh} of CAPTURE software (White et al., 1984). All data are integer numbers corresponding to salamander individuals. The second dataset (02_Speleomantes_strinatii_prey_distribution.txt) reports for each year the number of invertebrates trapped by entomological sticky traps outside and inside the Biospeleological Station. This dataset will allow the assessment of the spatial distribution of prey along the subterranean tunnel. Finally the third dataset (03_Speleomantes_strinatii_and_prey_time_series.txt) reports the complete time series of the subterranean predator-prey system over the 13-year period 2013-2025.

SUMMARY OF DATA

Over the 13-year study, spanning from 2013 to 2025, a total number of N = 1152 invertebrate prey were captured, both outside (N = 684) and inside (N = 468) the Biospeloelogical Station. During the same period, the estimated population of *Speleomantes strinatii* ranged from 126 in 2013 to 62 in 2024. The interannual variation in salamander and invertebrate abundances is illustrated in Fig. 1.

The invertebrate community trapped inside the tunnel was largely dominated by flies that represented 90% of all prey items. Conversely, outside the study site the invertebrate community was less dominated by flies (66%), with planthoppers (20%) and beetles (7%) also well represented (Figure 2). Strinati's cave salamanders do not exit subterranean habitats during the dry and hot summer typical of the region (Salvidio et al., 2024). Therefore, in future analyses, only prey groups trapped inside the Biospeleological Station should be considered as available prey to assess the Strinati's cave salamander' population dynamics.

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FIGURE LEGEND

Figure 1. Interannual variation over the period 2013-2025 of the cave salamander *Speleomantes strinatii* and invertebrates outside and inside the Biospeleological Station Arturo Issel.

Figure 2. Overall percentages of invertebrate functional groups captured outside and inside the Biospeleological Station Arturo Issel by sticky traps in July, over the period 2013-2025.

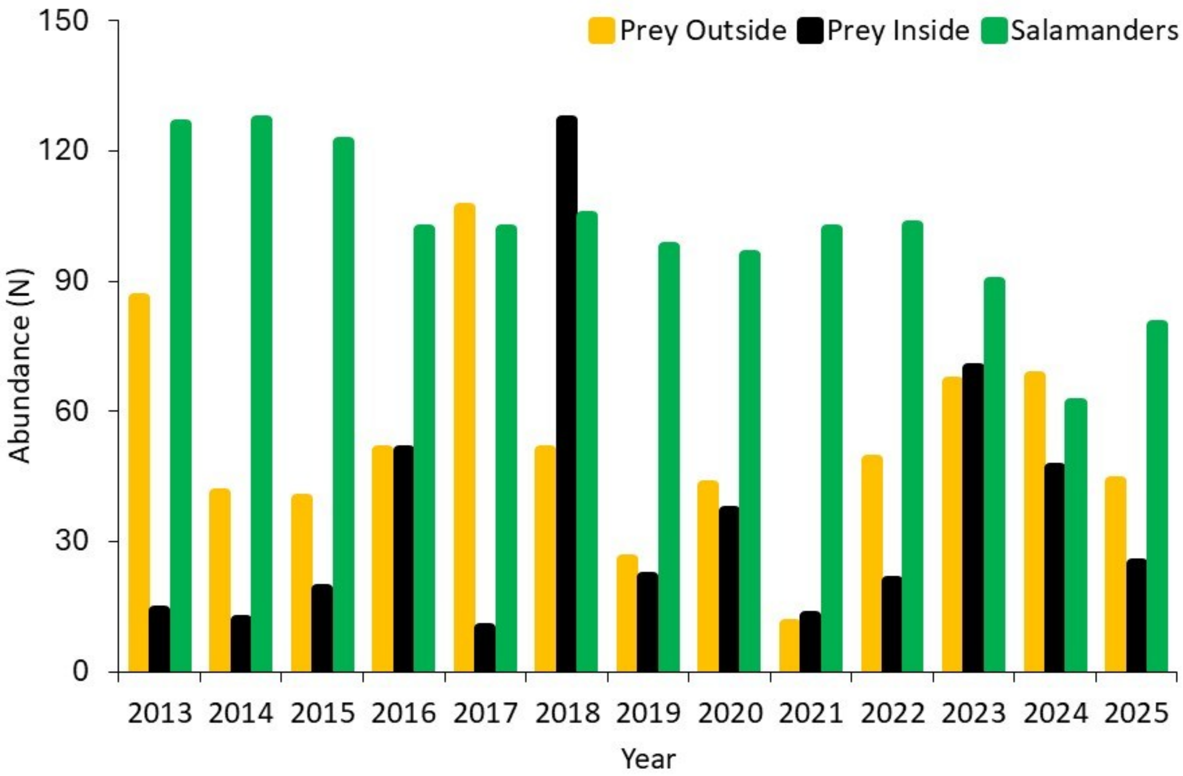
Prey Outside
Prey Inside
Salamanders
Abundance (N)
0
30
60
90
120
150
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Year

Figure 1.

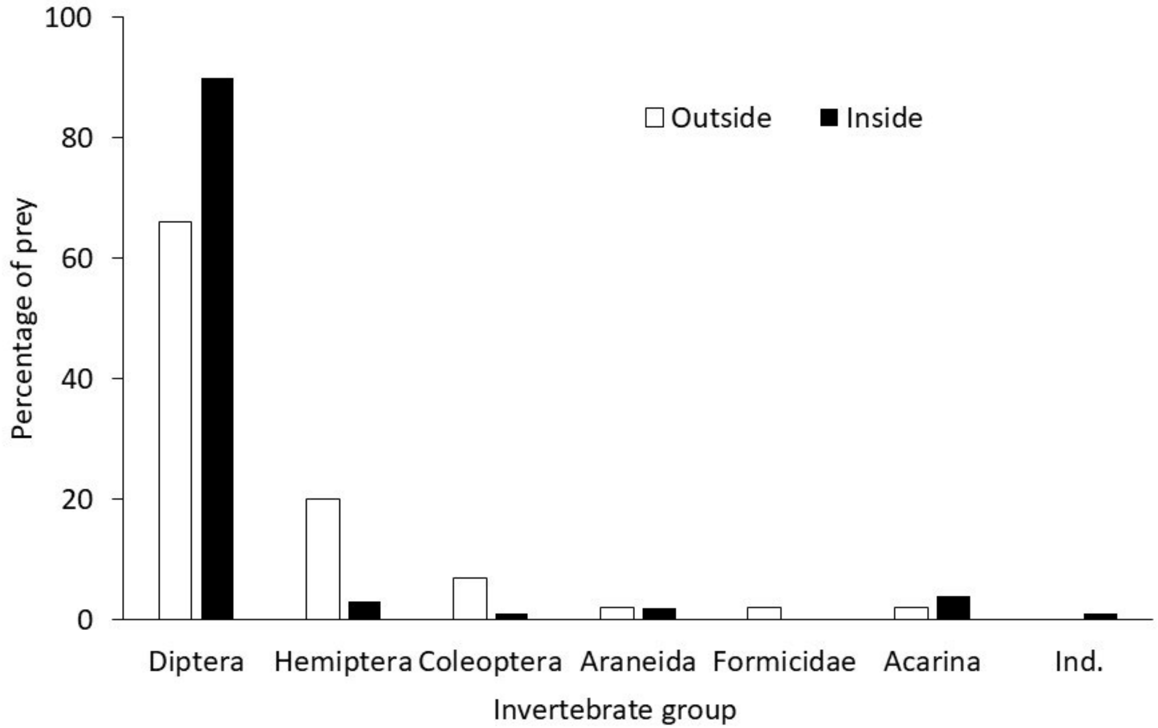
100
80
60
40
20
0
Percentage of prey
Outside
Inside
Diptera
Hemiptera
Coleoptera
Araneida
Formicidae
Acarina
Ind.
Invertebrate group

Figure 2.