

Sampling and estimating spider diversity in an alpine environment

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We sampled spiders at an alpine meadow (1430-2000 m a.s.l.) in the Allgäu Alps, Bavaria, Germany during a 6-year-project (2003-2009) with pitfall traps operating during the vegetation period from early June to late September.

The area is known for its extraordinary botanical diversity originating from the specific edaphic conditions: deep humid non-calcareous soils on laminated Jurassic marl. These mountains attract attention due to flower-rich mat-grass vegetation on their steep flanks up to the summits. However, vegetation in the study area had suffered considerable alteration by long lasting intense sheep grazing. The area along the ridge was used by sheep to lair and therefore became strongly eutrophic and dominated by the grass *Deschampsia cespitosa*. This type of land-use ended in 2000 and instead a controlled grazing by cattle was realized with the objective to regenerate the species-rich alpine mat-grass (*Nardus stricta*) vegetation.

For our study six pitfall traps were installed every year in each of 16 permanent plots in the grazed *Nardetalia* grassland and in 22 plots, presenting other vegetation types.

We captured 81,700 (69,480 adults) spiders and identified 158 species. We observed an extreme dominance (85%) of four lycosid species originating from an extremely high activity density of the males of these species during the first two weeks after snow melt. Species richness at single plots varied between 11 and 36 with a mean of 19 species per year. Pooled over 6 years between 22 and 54 species were captured at single plot. The most species-rich plots were in the lower calcareous grassland with dwarf pine, in ungrazed (and thermally favoured) plots, but also in the strongly altered (eutrophic and botanically degraded) ridge area.

We were interested to know how often and how long sampling with pitfall traps should be done to get a good estimate for the diversity of the spider assemblages. Several species estimators (ICE, Chao 2, Jackknife 2, Michaelis-Menten) were used to compare observed and estimated species richness for all and several subsets of samples. With the total data set, the Chao 2 and ICE estimators resulted in values very close to the observed ones, whereas Jackknife 2 seemed to overestimate and Michaelis-Menten underestimate species richness. For assessing completeness of sampling in the main habitat type we divided the estimated species number of subsets by the observed species number of all samples for this habitat. Resulting values should be close to 100%. Here we present only data estimated by Chao 2. For the characteristic vegetation type mat-grass sward 116 spider species were observed during the whole investigation and 138 estimated. This value is closest to the species richness

observed in the whole open grassland (136). Considering only the captures of the two-week spring periods (over 6 years) 92 species (79% of all observed) were observed and 118 estimated (102%). Considering only two spring periods 57% of the overall observed species were captured and 72% estimated. Considering samples of three two-week-periods from 2 consecutive years resulted in an estimate of 91% of the observed species. Sampling one year during the whole vegetation period from early June to end of September resulted in 96 species (83%) and an estimate of 147 species (108% of all species observed in open land and 127% of all species observed in all permanent plots).

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