

Supplementary Tables S7 – S22 for Braschler et al. “Subtle effects of experimental grassland fragmentation on density, species composition and functional dispersion of gastropods”

Table S7. Summary of ANOVA with repeated measures to combine data from all years on the density of gastropods and snails in experimental plots. Significant P-values are displayed in bold.

| Density of | Factor | df | F | P |
|---------------|-------------------------|-------|-------|----------------|
| a) Gastropods | | | | |
| | Fragmentation treatment | 1, 22 | 0.53 | 0.48 |
| | Year | 3, 66 | 83.95 | < 0.001 |
| | Frag. treatm. * Year | 3, 66 | 1.75 | 0.17 |
| b) Snails | | | | |
| | Fragmentation treatment | 1, 22 | 0.61 | 0.44 |
| | Year | 3, 66 | 19.89 | < 0.001 |
| | Frag. treatm. * Year | 3, 66 | 1.04 | 0.38 |

Table S8. Pairwise comparisons for density of gastropods and snails in fragments and control plots between years. Significant P-values are displayed in bold.

| Density of | Years | Mean difference | df | t | P |
|---------------|---------------|-----------------|----|-------|----------------|
| a) Gastropods | | | | | |
| | 1996 vs. 1997 | -0.004 | 23 | 0.10 | 0.92 |
| | 1996 vs. 1998 | -0.14 | 23 | 3.07 | 0.005 |
| | 1996 vs. 1999 | -0.87 | 23 | 9.17 | < 0.001 |
| | 1997 vs. 1998 | -0.13 | 23 | 3.16 | 0.004 |
| | 1997 vs. 1999 | -0.86 | 23 | 11.86 | < 0.001 |
| | 1998 vs. 1999 | -0.73 | 23 | 9.85 | < 0.001 |
| b) Snails | | | | | |
| | 1996 vs. 1997 | 0.04 | 23 | 1.43 | 0.17 |
| | 1996 vs. 1998 | -0.01 | 23 | 0.29 | 0.77 |
| | 1996 vs. 1999 | -0.20 | 23 | 4.96 | < 0.001 |
| | 1997 vs. 1998 | -0.06 | 23 | 1.79 | 0.086 |
| | 1997 vs. 1999 | -0.25 | 23 | 5.83 | < 0.001 |
| | 1998 vs. 1999 | -0.19 | 23 | 6.40 | < 0.001 |

Table S9. Summary of models testing the effects of experimental fragmentation on the plant biomass in the years 1996–1998. Significant P-values are displayed in bold. Mean biomass (dry weight; g per 0.25 m²) is shown for experimental plots with standard deviation in brackets.

| | 1996 | | | 1997 ¹ | | | 1998 ¹ | | |
|-------------------------|------------------|----------------------|----------------|-------------------|----------------------|------|-------------------|----------------------|--------------|
| | df | F | P | df | F | P | df | F | P |
| Fragmentation treatment | 1,11 | 20.79 | < 0.001 | 1,11 | 2.85 | 0.12 | 1,11 | 8.50 | 0.014 |
| | Fragments | Control plots | | Fragments | Control plots | | Fragments | Control plots | |
| | 71.17 (15.13) | 58.65 (11.55) | | 70.06 (15.08) | 64.79 (14.78) | | 64.67 (13.13) | 55.94 (16.64) | |

Table S10. Summary of models examining effects of experimental fragmentation and plant biomass on the density¹ of all gastropods (snails and slugs combined) or on snails only in the years 1997–1999. Significant P-values are displayed in bold. For the covariate plant biomass, the plant biomass of the preceding year² was used to correspond with the time during which the juveniles of many species with short generation times developed.

| | 1997 | | | 1998 | | | 1999 | | |
|--------------------------|------|------|------|------|------|--------------|------|------|-------|
| | df | F | P | df | F | P | df | F | P |
| a) All gastropods | | | | | | | | | |
| Fragmentation treatment | 1,10 | 1.27 | 0.29 | 1,10 | 0.11 | 0.74 | 1,10 | 2.30 | 0.16 |
| Plant biomass | 1,10 | 0.28 | 0.61 | 1,10 | 0.02 | 0.88 | 1,10 | 2.41 | 0.15 |
| b) Snails | | | | | | | | | |
| Fragmentation treatment | 1,10 | 0.91 | 0.36 | 1,10 | 0.63 | 0.44 | 1,10 | 3.46 | 0.092 |
| Plant biomass | 1,10 | 0.15 | 0.71 | 1,10 | 6.38 | 0.030 | 1,10 | 0.01 | 0.93 |

¹Gastropod density was log(x+1)-transformed for analysis

² Plant biomass was only measured in the years 1996–1998, thus the analyses were not possible for 1996.

Table S11. Summary of ANOVA with repeated measures to combine data from all years on the species richness of gastropods and snails in experimental plots. Significant P-values are displayed in bold.

| Density of | Factor | df | F | P |
|----------------------|-------------------------|-------|-------|-------------------|
| a) Gastropods | | | | |
| | Fragmentation treatment | 1, 22 | 0.38 | 0.55 |
| | Year | 3, 66 | 19.99 | < 0.001 |
| | Frag. treatm. * Year | 3, 66 | 1.70 | 0.18 |
| b) Snails | | | | |
| | Fragmentation treatment | 1, 22 | 0.31 | 0.58 |
| | Year | 3, 66 | 16.18 | < 0.001 |
| | Frag. treatm. * Year | 3, 66 | 1.37 | 0.26 |

Table S12. Pairwise comparisons for species richness of gastropods and snails in fragments and control plots between years. Significant P-values are displayed in bold.

| Density of | Years | Mean difference | df | t | P |
|----------------------|---------------|-----------------|----|------|-------------------|
| a) Gastropods | | | | | |
| | 1996 vs. 1997 | 0.08 | 23 | 0.21 | 0.83 |
| | 1996 vs. 1998 | 0.21 | 23 | 0.64 | 0.53 |
| | 1996 vs. 1999 | -2.17 | 23 | 6.61 | < 0.001 |
| | 1997 vs. 1998 | 0.13 | 23 | 0.36 | 0.72 |
| | 1997 vs. 1999 | -2.25 | 23 | 5.38 | < 0.001 |
| | 1998 vs. 1999 | -2.38 | 23 | 6.41 | < 0.001 |
| b) Snails | | | | | |
| | 1996 vs. 1997 | 0.08 | 23 | 0.23 | 0.82 |
| | 1996 vs. 1998 | 0.46 | 23 | 1.85 | 0.078 |
| | 1996 vs. 1999 | -1.54 | 23 | 5.88 | < 0.001 |
| | 1997 vs. 1998 | 0.38 | 23 | 1.25 | 0.22 |
| | 1997 vs. 1999 | -1.63 | 23 | 4.08 | < 0.001 |
| | 1998 vs. 1999 | -2.00 | 23 | 7.08 | < 0.001 |

Table S13. Summary of models testing the effects of experimental fragmentation on species richness of gastropod and snail assemblages in experimental plots in the years 1996–1999.

| | 1996 | | | 1997 ¹ | | | 1998 | | | 1999 | | |
|--------------------------|------|------|------|-------------------|------|------|------|-------|-------|------|------|-------|
| | df | F | P | df | F | P | df | F | P | df | F | P |
| a) All gastropods | | | | | | | | | | | | |
| Fragmentation treatment | 1,11 | 1.84 | 0.20 | 1,11 | 0.80 | 0.39 | 1,11 | <0.01 | >0.99 | 1,11 | 2.71 | 0.13 |
| a) Snails | | | | | | | | | | | | |
| Fragmentation treatment | 1,11 | 1.54 | 0.24 | 1,11 | 0.17 | 0.69 | 1,11 | 0.56 | 0.47 | 1,11 | 3.57 | 0.085 |

Table S14. Summary of models testing the effects of experimental fragmentation and plant biomass of the preceding year on species richness of gastropods and snails in the years 1997–1999¹. Significant P-values are displayed in bold. Plant biomass of the preceding year was used as the covariate to correspond to the time during which the juveniles of the many species with short generation times developed.

| | 1997 | | | 1998 | | | 1999 | | |
|--------------------------|------|------|------|------|-------|-------|------|-------|--------------|
| | df | F | P | df | F | P | df | F | P |
| a) All gastropods | | | | | | | | | |
| Fragmentation treatment | 1,10 | 0.76 | 0.40 | 1,10 | <0.01 | >0.99 | 1,10 | 3.05 | 0.11 |
| Plant biomass | 1,10 | 0.01 | 0.92 | 1,10 | 1.33 | 0.28 | 1,10 | 3.14 | 0.11 |
| a) Snails | | | | | | | | | |
| Fragmentation treatment | 1,10 | 0.16 | 0.70 | 1,10 | 0.65 | 0.44 | 1,10 | 4.66 | 0.056 |
| Plant biomass | 1,10 | 0.11 | 0.75 | 1,10 | 3.70 | 0.083 | 1,10 | 10.25 | 0.010 |

¹ Plant biomass was only measured in the years 1996–1998, thus the analysis is not possible for species richness in 1996.

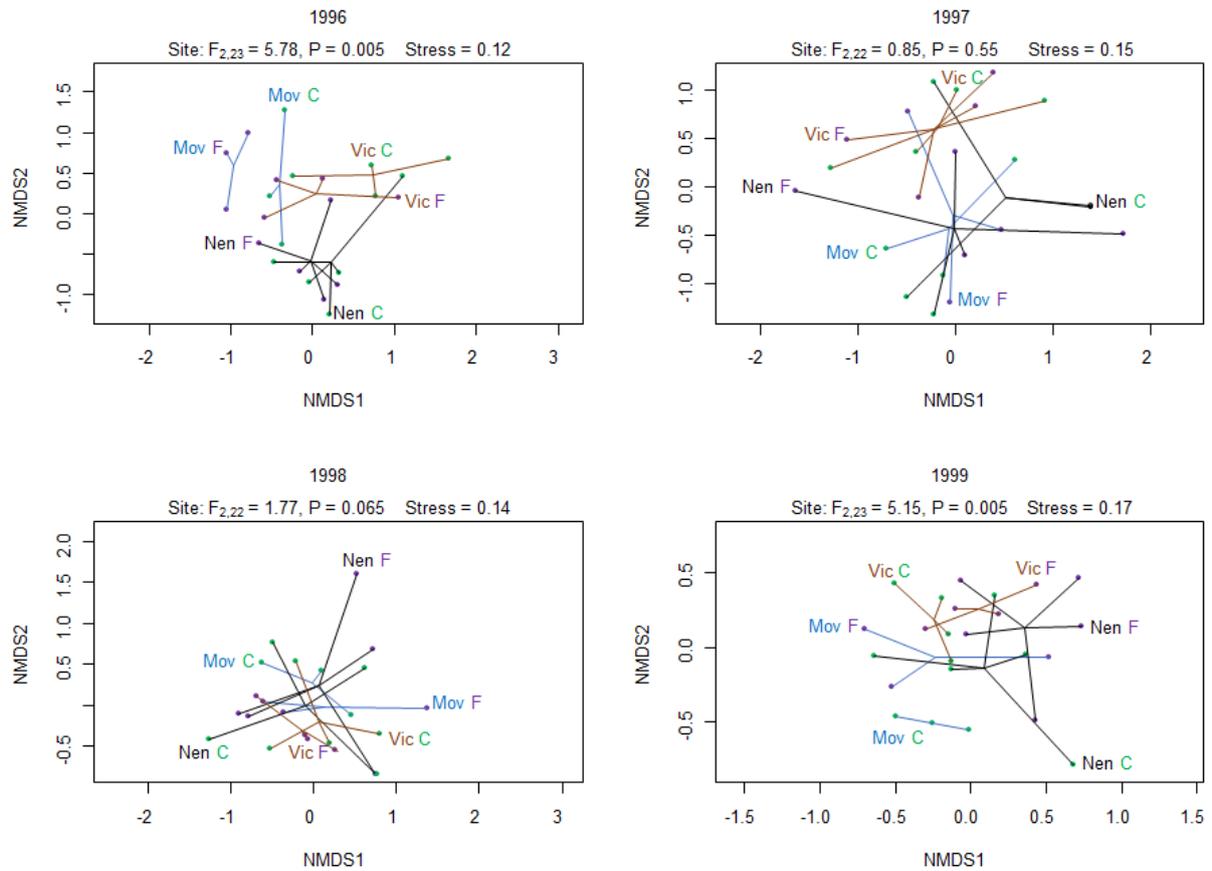


Figure S1. nMDS plots for species composition of snails in fragments and control plots for each year. Sites are differentiated by the colour of the ordispider connecting the site dots (Movelier: blue; Nenzlingen: black; Vicques: brown). Violet dots indicate fragments, while green dots indicate control plots. PERMANOVA statistics for site effects are shown on top of the panels. No significant fragmentation effect was found in any year. Two plots in Nenzlingen (a fragment in 1997 and a control plot in 1998) had no snails and are thus not included in the nMDS-plots.

Table S15. Summary of ANOVA with repeated measures to combine data from all years on FDis of gastropods and snails. For snails 2 blocks were omitted as one of the plots in each had no snails in one year, preventing computation of FDis. Significant P-values are displayed in bold.

| Density of | Factor | df | F | P |
|---------------|-------------------------|-------|------|--------------|
| a) Gastropods | | | | |
| | Fragmentation treatment | 1, 22 | 0.29 | 0.60 |
| | Year | 3, 66 | 5.12 | 0.003 |
| | Frag. treatm. * Year | 3, 66 | 0.14 | 0.94 |
| b) Snails | | | | |
| | Fragmentation treatment | 1, 18 | 3.36 | 0.084 |
| | Year | 3, 54 | 2.09 | 0.11 |
| | Frag. treatm. * Year | 3, 54 | 0.59 | 0.62 |

Table S16. Pairwise comparisons for FDis of gastropods¹ infragments and control plots between years. Significant P-values are displayed in bold.

| Density of | Years | Mean difference | df | t | P |
|---------------|---------------|-----------------|----|------|--------------|
| a) Gastropods | | | | | |
| | 1996 vs. 1997 | 0.34 | 23 | 2.77 | 0.011 |
| | 1996 vs. 1998 | 0.21 | 23 | 2.43 | 0.024 |
| | 1996 vs. 1999 | 0.23 | 23 | 2.65 | 0.014 |
| | 1997 vs. 1998 | -0.13 | 23 | 1.59 | 0.12 |
| | 1997 vs. 1999 | -0.11 | 23 | 1.42 | 0.17 |
| | 1998 vs. 1999 | 0.02 | 23 | 0.33 | 0.75 |

¹ In snails only no significant year effect was found in the overall model (Table S5).

Table S17. Summary of models testing the effects of experimental fragmentation on the mean shell size of snail assemblages (weighted by abundances of the various species) in experimental plots¹ in the years 1996–1999.

| | 1996 | | | 1997 ¹ | | | 1998 ¹ | | | 1999 | | |
|-------------------------|------|------|------|-------------------|------|------|-------------------|------|------|------|------|------|
| | df | F | P | df | F | P | df | F | P | df | F | P |
| Fragmentation treatment | 1,11 | 0.02 | 0.87 | 1,10 | 0.12 | 0.31 | 1,10 | 0.69 | 0.42 | 1,11 | 0.20 | 0.66 |

¹One block each was omitted in 1997 and 1998 for analyses because they contained no snails in one of the plots.

Table S18. Summary of models testing the effects of experimental fragmentation and plant biomass of the preceding year on the shell size of snails in the years 1997–1999. Significant P-values are displayed in bold. Plant biomass of the preceding year² was used as the covariate to correspond to the time during which the juveniles of the many species with short generation times developed.

| | 1997 ¹ | | | 1998 ¹ | | | 1999 ² | | |
|-------------------------|-------------------|------|-------|-------------------|------|--------------|-------------------|-------|--------------|
| | df | F | P | df | F | P | df | F | P |
| Fragmentation treatment | 1,9 | 1.18 | 0.31 | 1,9 | 1.09 | 0.32 | 1,10 | 0.21 | 0.65 |
| Plant biomass | 1,9 | 4.73 | 0.058 | 1,9 | 6.60 | 0.030 | 1,10 | 11.04 | 0.008 |

¹ One block was omitted in 1997 and 1998 because there were no snails in one of the plots.

² Plant biomass was only measured in the years 1996–1998, thus the analysis is not possible for mean snail shell size in 1996.

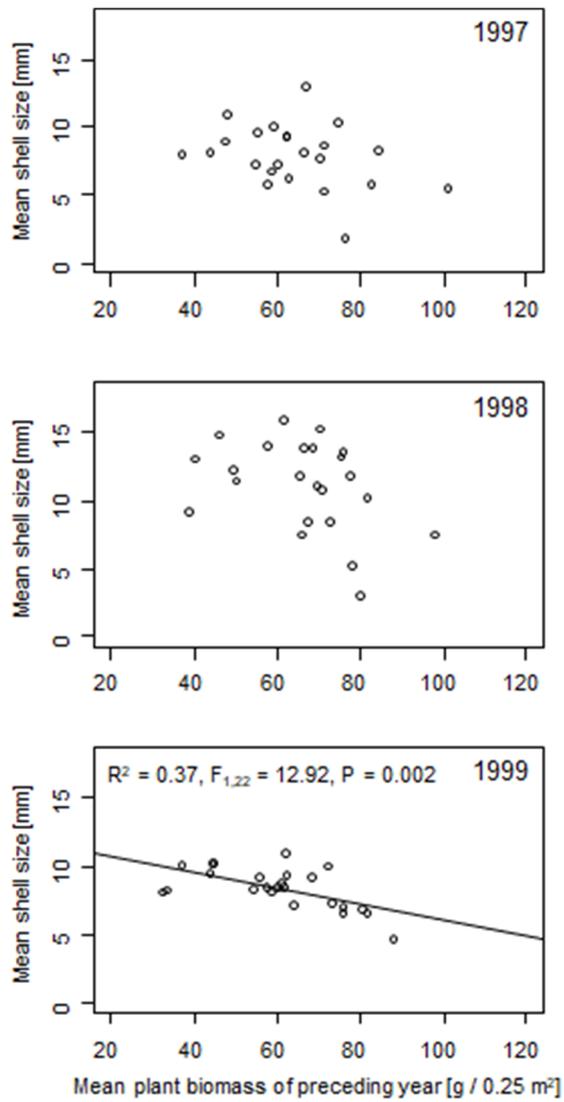


Fig. S2. Relationships between mean shell size of snail species assemblages in experimental plots (fragments and control plots combined) and plant biomass of the preceding year. Plant biomass was only measured in 1996–1998, thus the analysis could not be made for mean snail shell size in 1996. Significant relationships are indicated by a regression line with the statistics.

Table S19. Difference in proportion of age at sexual maturity classes (≤ 1 year, > 1 year) of gastropods and snails respectively in fragments and control plots in the years 1996–1999 with Fisher’s exact tests. Significant P-values are displayed in bold.

| | | 1996 | | | 1997 | | | 1998 | | | 1999 | | |
|--------|----------|---------------|------------|------|---------------|------------|----------|---------------|------------|------|---------------|------------|--------------|
| | | ≤ 1 year | > 1 year | P | ≤ 1 year | > 1 year | P | ≤ 1 year | > 1 year | P | ≤ 1 year | > 1 year | P |
| Gastr. | Fragm. | 288 | 23 | 0.87 | 250 | 4 | > 0.99 | 424 | 3 | 0.32 | 1020 | 1 | 0.026 |
| Gastr. | Controls | 234 | 20 | | 321 | 5 | | 381 | 6 | | 1214 | 9 | |
| Snails | Fragm. | 181 | 7 | 0.46 | 107 | 4 | > 0.99 | 174 | 2 | 0.29 | 321 | 1 | 0.049 |
| Snails | Controls | 158 | 10 | | 144 | 5 | | 188 | 6 | | 409 | 9 | |

Table S20. Differences in proportions of longevity classes of gastropods and snails respectively in fragments and control plots in the years 1996–1999 with Fisher’s exact tests. Species were classified according to their lifespans (1–2 years, > 2 years). Significant P-values are displayed in bold.

| | | 1996 | | | 1997 | | | 1998 | | | 1999 | | |
|--------|----------|-----------|-----------|-------|-----------|-----------|------|-----------|-----------|--------|-----------|-----------|-------------------|
| | | 1–2 years | > 2 years | P | 1–2 years | > 2 years | P | 1–2 years | > 2 years | P | 1–2 years | > 2 years | P |
| Gastr. | Fragm. | 242 | 69 | 0.12 | 197 | 57 | 0.15 | 323 | 104 | 0.36 | 774 | 247 | 0.007 |
| Gastr. | Controls | 183 | 71 | | 235 | 91 | | 304 | 83 | | 985 | 238 | |
| Snails | Fragm. | 136 | 52 | 0.088 | 58 | 53 | 0.62 | 128 | 48 | > 0.99 | 126 | 196 | < 0.001 |
| Snails | Controls | 107 | 61 | | 73 | 76 | | 141 | 53 | | 222 | 196 | |

Table S21. Differences in proportions of individuals with certain habitat preferences (habitat generalists vs. openland species) of gastropods and snails respectively in fragments and control plots in the years 1996–1999 with Fisher’s exact tests. Significant P-values are displayed in bold. The few forest specialist individuals present were not considered for this analysis.

| | | 1996 | | | 1997 | | | 1998 | | | 1999 | | |
|------------|---------------|----------|--------|--------|----------|--------|------|----------|--------|-------|----------|--------|-------------------|
| | | General. | Openl. | P | General. | Openl. | P | General. | Openl. | P | General. | Openl. | P |
| Gastropods | Fragments | 157 | 138 | > 0.99 | 201 | 57 | 0.76 | 302 | 127 | 0.054 | 903 | 118 | < 0.001 |
| Gastropods | Control plots | 129 | 115 | | 242 | 73 | | 257 | 145 | | 995 | 225 | |
| Snails | Fragments | 50 | 138 | 0.35 | 54 | 57 | 0.80 | 48 | 127 | 0.63 | 204 | 118 | < 0.001 |
| Snails | Control plots | 53 | 115 | | 76 | 73 | | 48 | 145 | | 191 | 225 | |

Table S22. Differences in proportions of individuals with certain humidity preferences (wet, moist, dry) of gastropods and snails respectively in fragments and control plots in the years 1996–1999 with Fisher’s exact tests. Significant P-values are displayed in bold.

| | | 1996 | | | | 1997 | | | | 1998 | | | | 1999 | | | |
|--------|----------|------|-------|-----|--------------|------|-------|-----|------|------|-------|-----|------|------|-------|-----|--------------|
| | | Wet | Moist | Dry | P | Wet | Moist | Dry | P | Wet | Moist | Dry | P | Wet | Moist | Dry | P |
| Gastr. | Fragm. | 30 | 268 | 13 | 0.020 | 13 | 219 | 22 | 0.96 | 9 | 312 | 110 | 0.41 | 27 | 944 | 50 | 0.035 |
| Gastr. | Controls | 45 | 199 | 10 | | 17 | 283 | 26 | | 9 | 275 | 119 | | 40 | 1093 | 90 | |
| Snails | Fragm. | 30 | 145 | 13 | 0.045 | 13 | 76 | 22 | 0.89 | 9 | 57 | 110 | 0.93 | 27 | 245 | 50 | 0.082 |
| Snails | Controls | 45 | 113 | 10 | | 17 | 106 | 26 | | 9 | 66 | 119 | | 40 | 288 | 90 | |