**Pintar, Matthew R. and W. J. Resetarits, Jr. Prey-driven control of predator assemblages: zooplankton abundance drives aquatic beetle colonization. *Ecology*. 2017.**

**Appendix S1**

**Table S1:** *F* statistics and *P* values from repeated-measures ANOVAs for the water change experiment: total beetle abundance, species richness, Dytiscidae, Hydrophilidae, and species with N > 100, in rank order of abundance by family (see Table 1). Bold indicates statistical significance (*P* < 0.05)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Between pools | |  | Within pool | |
|  | Age  df(1,18) | Block  (3,18) |  | Time  (33,693) | Age  × Time  (33,693) |
| Total abundance | 11.907 | 1.117 |  | 58.035 | 2.584 |
|  | **0.0029** | 0.3684 |  | **<0.0001** | **<0.0001** |
| Species richness | 11.018 | 1.195 |  | 45.704 | 1.814 |
|  | **0.0038** | 0.3398 |  | **<0.0001** | **0.0039** |
| Dytiscidae | 20.57 | 0.91 |  | 50.812 | 5.592 |
|  | **0.0003** | 0.456 |  | **<0.0001** | **<0.0001** |
| *Copelatus glyphicus* | 10.461 | 2.361 |  | 33.020 | 4.113 |
|  | **0.0046** | 0.1054 |  | **<0.0001** | **<0.0001** |
| *Laccophilus proximus* | 9.730 | 1.851 |  | 24.985 | 4.163 |
|  | **0.0059** | 0.1742 |  | **<0.0001** | **<0.0001** |
| *Hydroporus rufilabris* | 14.755 | 0.331 |  | 37.910 | 5.252 |
|  | **0.0012** | 0.8027 |  | **<0.0001** | **<0.0001** |
| *Uvarus granarius* | 8.119 | 0.355 |  | 12.247 | 3.199 |
|  | **0.0106** | 0.7863 |  | **<0.0001** | **<0.0001** |
| *Laccophilus fasciatus* | 5.369 | 4.677 |  | 4.830 | 1.160 |
|  | **0.0325** | **0.0138** |  | **<0.0001** | 0.249 |
| *Helophorus linearis* | 1.234 | 2.694 |  | 23.965 | 1.774 |
|  | 0.2813 | 0.0768 |  | **<0.0001** | **0.0053** |
| Hydrophilidae | 3.048 | 2.175 |  | 29.442 | 0.606 |
|  | 0.0979 | 0.1263 |  | **<0.0001** | 0.961 |
| *Paracymus* | 4.289 | 1.265 |  | 30.855 | 0.616 |
|  | 0.0530 | 0.316 |  | **<0.0001** | 0.956 |
| *Tropisternus lateralis* | 0.155 | 0.653 |  | 17.631 | 0.829 |
|  | 0.6980 | 0.592 |  | **<0.0001** | 0.741 |
| *Enochrus ochraceus* | 7.406 | 0.287 |  | 11.487 | 1.874 |
|  | **0.0140** | 0.834 |  | **<0.0001** | **0.0024** |
| *Berosus infuscatus* | 0.488 | 5.638 |  | 7.725 | 0.791 |
|  | 0.4937 | **0.0066** |  | **<0.0001** | 0.794 |

**Table S2:** PERMANOVA results from the water change experiment. Block was rolled into the error term when *P* > 0.25. Bold indicates statistical significance (*P* < 0.05)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | df | SS | MS | Pseudo-*F* | *P* | Unique perms |
| Period 1 | | |  |  |  |  |
| All beetles | | |  |  |  |  |
| Age  Residuals | 1  22 | 2139.9  12354 | 2139.9  561.5 | 3.8109 | **0.001** | 999 |
| Dytiscidae  Age  Block  Residuals | 1  3  19 | 2854.4  2491.5  12071 | 2854.4  830.5  635.3 | 4.4927  1.3072 | **0.001**  0.193 | 999  997 |
| Hydrophilidae  Age  Residuals | 1  22 | 2033.1  11812 | 2033.1  536.9 | 3.7865 | **0.014** | 995 |
| Period 2 | | |  |  |  |  |
| All beetles | | |  |  |  |  |
| Age  Block  Residuals | 1  3  18 | 1358.3  1742.2  6961.6 | 1358.3  570.7  386.8 | 3.5121  1.5015 | **0.005**  0.108 | 998  998 |
| Dytiscidae  Age  Residuals | 1  21 | 2270.2  8818.8 | 2270.2  419.9 | 5.4061 | **0.003** | 999 |
| Hydrophilidae  Age  Block  Residuals | 1  3  18 | 580.0  2393.5  5683.8 | 580.0  797.8  315.8 | 1.8368  2.5266 | 0.119  **0.005** | 999  998 |
| Period 3 |  |  |  |  |  |  |
| All beetles |  |  |  |  |  |  |
| Age | 1 | 970.6 | 970.6 | 1.3074 | 0.247 | 998 |
| Residuals | 21 | 15589 | 742.3 |  |  |  |
| Dytiscidae |  |  |  |  |  |  |
| Age | 1 | 1694.1 | 1694.1 | 1.6841 | 0.142 | 997 |
| Residuals | 21 | 21124 | 1005.9 |  |  |  |
| Hydrophilidae |  |  |  |  |  |  |
| Age | 1 | 555.5 | 555.5 | 0.8883 | 0.539 | 999 |
| Residuals | 21 | 13133 | 625.4 |  |  |  |

**Table S3:** Results of zooplankton repeated-measures analyses from both experiments. Block was not significant (*P* > 0.25) in the water change experiment for all analyses and was rolled into the error term. Ostracod abundances were too low in the inoculation experiment (N = 10) for meaningful analysis but were included in the total zooplankton analysis. Bold indicates statistical significance (*P* < 0.05)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Between pools | |  | Within pool | |
|  | Treatment | Block |  | Time | Treatment  × Time |
| Water change experiment | df (1,21) | No test |  | (2,42) | (2,42) |
| All zooplankton | 44.53 |  |  | 36.52 | 17.44 |
| (N = 7866) | **<0.0001** |  |  | **<0.0001** | **<0.0001** |
| Cladocera | 13.45 |  |  | 22.021 | 6.153 |
| (N = 2442) | **0.0014** |  |  | **<0.0001** | **0.0045** |
| Copepoda | 33.0 |  |  | 13.046 | 4.484 |
| (N = 2294) | **<0.0001** |  |  | **<0.0001** | **0.0172** |
| Ostracoda | 4.593 |  |  | 0.021 | 0.733 |
| (N = 132) | **0.044** |  |  | 0.980 | 0.486 |
| Rotifera | 9.618 |  |  | 7.922 | 3.208 |
| (N = 3005) | **0.0054** |  |  | **0.0012** | 0.0505 |
| Inoculation experiment | df(1,17) | (5,17) |  | (1,22) | (1,22) |
| All zooplankton | 30.989 | 2.785 |  | 4.500 | 9.547 |
| (N = 3579) | **<0.0001** | **0.0515** |  | **0.0454** | **0.0054** |
| Cladocera | 12.022 | 1.403 |  | 3.787 | 0.615 |
| (N = 670) | **0.0030** | 0.2729 |  | 0.0645 | 0.4414 |
| Copepoda | 8.151 | 3.167 |  | 1.512 | 7.580 |
| (N = 2319) | **0.0110** | **0.0335** |  | 0.2318 | **0.0116** |
| Rotifera | 6.396 | 0.056 |  | 1.339 | 1.459 |
| (N = 580) | **0.0216** | 0.9976 |  | 0.260 | 0.240 |

**Table S4:** *F* statistics and *P* values from repeated-measures ANOVAs for the inoculation experiment: total beetle abundance, species richness, Dytiscidae, Hydrophilidae, and species with N ≥ 75 in rank order of abundance by family (see Table 1). Bold indicates statistical significance (*P* < 0.05)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Between pools | |  | Within pool | |
|  | Treatment  df(1,17) | Block  (5,17) |  | Time  (6,132) | Treatment  × Time  (6,132) |
| Total abundance | 9.796 | 23.334 |  | 47.569 | 1.866 |
|  | **0.0061** | **<0.0001** |  | **<0.0001** | 0.0913 |
| Species richness | 4.14 | 10.40 |  | 55.941 | 1.082 |
|  | 0.0578 | **0.0001** |  | **<0.0001** | 0.376 |
| Dytiscidae | 17.357 | 8.258 |  | 24.847 | 4.605 |
|  | **0.0006** | **0.0004** |  | **<0.0001** | **0.0002** |
| *Laccophilus fasciatus* | 9.773 | 6.601 |  | 23.502 | 5.419 |
|  | **0.0062** | **0.0014** |  | **<0.0001** | **<0.0001** |
| *Hydroporus rufilabris* | 34.02 | 20.81 |  | 4.948 | 1.482 |
|  | **<0.0001** | **<0.0001** |  | **0.0001** | 0.1892 |
| *Copelatus glyphicus* | 5.839 | 9.533 |  | 33.504 | 1.746 |
|  | **0.0272** | **0.0002** |  | **<0.0001** | 0.115 |
| Hydrophilidae | 1.279 | 21.990 |  | 42.995 | 1.038 |
|  | 0.274 | **<0.0001** |  | **<0.0001** | 0.404 |
| *Enochrus ochraceus* | 2.256 | 13.384 |  | 17.039 | 1.273 |
|  | 0.151 | **<0.0001** |  | **<0.0001** | 0.274 |
| *Tropisternus lateralis* | 0.845 | 23.785 |  | 12.566 | 0.578 |
|  | 0.371 | **<0.0001** |  | **<0.0001** | 0.747 |
| *Paracymus* | 0.127 | 19.425 |  | 7.932 | 0.979 |
|  | 0.726 | **<0.0001** |  | **<0.0001** | 0.442 |
| *Helochares maculicollis* | 0.214 | 13.341 |  | 14.576 | 0.146 |
|  | 0.649 | **<0.0001** |  | **<0.0001** | 0.99 |
| *Berosus infuscatus* | 0.203 | 11.114 |  | 22.022 | 0.097 |
|  | 0.658 | **<0.0001** |  | **<0.0001** | 0.997 |
| *Cymbiodyta chamberlaini* | 0.153 | 3.372 |  | 4.368 | 0.251 |
|  | 0.7003 | **0.0268** |  | **0.0005** | 0.9580 |
| *Enochrus pygmaeus* | 0.968 | 16.352 |  | 2.875 | 0.436 |
|  | 0.339 | **<0.0001** |  | **0.0115** | 0.8535 |
|  |  |  |  |  |  |

**Table S5:** PERMANOVA results for the inoculation experiment. The reduced number of residual degrees of freedom in the dytiscid analyses is due to pools with 0 beetles, which cannot be included in these analyses. Bold indicates statistical significance (*P* < 0.05)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | df | SS | MS | Pseudo-*F* | *P* | Unique perms |
| Early | | |  |  |  |  |
| All beetles | | |  |  |  |  |
| Treatment  Block  Residuals | 1  5  17 | 2026.3  21892  10371 | 2026.3  4378.4  610.1 | 3.3215  7.1769 | **0.012**  **0.001** | 999  998 |
| Dytiscidae  Treatment  Block  Residuals | 1  5  16 | 3714.9  21342  20003 | 3714.9  4268.4  1250.2 | 2.9715  3.4142 | **0.024**  **0.001** | 999  998 |
| Hydrophilidae  Treatment  Block  Residuals | 1  5  17 | 812.0  19207  7795.9 | 812.0  3841.4  458.6 | 1.7707  8.3868 | 0.141  **0.001** | 999  999 |
| Late | | |  |  |  |  |
| All beetles | | |  |  |  |  |
| Treatment  Block  Residuals | 1  5  17 | 574.6  26174  15.689 | 574.6  5234.8  922.9 | 0.6627  5.6724 | 0.729  **0.001** | 998  997 |
| Dytiscidae  Treatment  Block  Residuals | 1  5  16 | 1848.6  24627  23679 | 1848.6  4925.5  1479.9 | 1.2491  3.3282 | 0.293  **0.002** | 999  999 |
| Hydrophilidae  Treatment  Block  Residuals | 1  5  17 | 296.1  25643  10177 | 296.1  5128.5  598.6 | 0.4947  8.5673 | 0.751  **0.001** | 998  999 |

**Fig S1:** Multiple regression of (a) all beetles, (b) beetle species richness, (c) *Laccophilus proximus*, and (d) *Uvarus granarius* from the water change experiment against total zooplankton abundances in New and Old pools. Beetles were collected on 25 June and zooplankton on 22 June. Statistics are summaries of multiple regression results, with *P* values for effects of zooplankton abundance. N = total number of beetles for that sample date.

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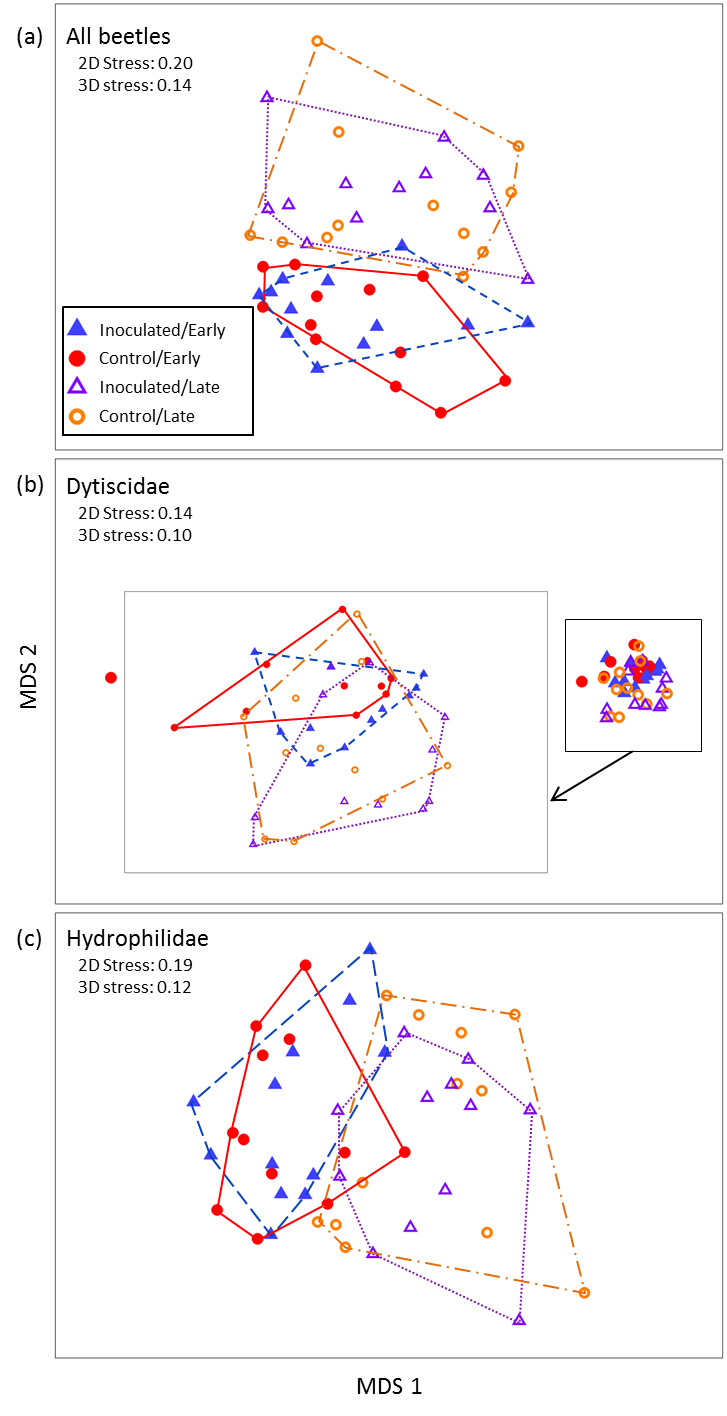
**Fig. S2:** Multiple regression of (a) all beetles, (b) beetle species richness, and (c) dytiscids from the water change experiment against total zooplankton abundances in New and Old pools. Beetles and zooplankton were both collected on 30 April. Statistics are summaries of multiple regression results, with *P* values for effects of zooplankton abundance. N = total number of beetles for that sample date.

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**Fig S3:** Multiple regression of (a) all beetles, (b) beetle species richness, (c) hydrophilids, and (d) *Tropisternus lateralis* from the water change experiment against total zooplankton abundances in New and Old pools. Beetles were collected on 14 October and zooplankton on 16 October. Statistics are summaries of multiple regression results with *P* values for effects of zooplankton abundance. No dytiscids (N = 13) were abundant enough for analysis on 14 October.

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**Fig. S4:** NMDS plots for (a) all beetles, (b) Dytiscidae, and (c) Hydrophilidae in the inoculation experiment. The box in (b) shows an inset of the data for clarity due to the outlier at the left side of the figure. Points are sorted by group and treatment and outlined in minimum convex polygons (outlier not included in (b)). Large block effects make it difficult to visualize significant effects of treatment in these graphs (see Table S5).

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**Fig S5:** Multiple regression of (a) all beetles, (b) beetle species richness, (c) *Enochrus ochraceus*, (d) *Helochares maculicollis*, and (e) *Tropisternus collaris* from the inoculation experiment against total zooplankton abundances in New and Old pools. Beetles were collected on 5 November and zooplankton on 7 November. Statistics are summaries of multiple regression results with *P* values for effects of zooplankton abundance. There were large, significant block effects in all analyses in the inoculation experiment.

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**Fig S6:** Multiple regression of (a) total beetle abundance, (b) beetle species richness, and (c) *Hydroporus rufilabris* from the inoculation experiment against total zooplankton abundances in New and Old pools. Beetles were collected on 19 November and zooplankton on 21 November. Statistics are summaries of multiple regression results with *P* values for effects of zooplankton abundance. There were large, significant block effects in all analyses in the inoculation experiment.

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