

Ecography

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Supplementary material

SUPPLEMENTARY MATERIAL Appendix 1, 2 and 3

Spatial extinction or persistence: landscape-temperature interactions perturb predator-prey dynamics

Running title: Landscape, temperature, and predator-prey dynamics

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Type of paper: *Original research*

Appendix 1

Data obtained from the literature for Figure 1c: the effect of temperature on swimming speed of the predator and prey. Data were obtained from the text where possible or read from figures, using Grabit! (<http://www.datatrendsoftware.com/>). Data on the predator swimming speed were provided by the Author

Temperature (°C)	Swimming speed (mm s ⁻¹)	Source
<i>Paramecium caudatum</i>		
9.7	0.27	Tawada and Oosawa (1972)
15.1	0.38	
18.3	0.51	
19.2	0.54	
20.4	0.60	
22.2	0.74	
23.4	0.79	
26.2	0.86	
27.4	0.81	
30.0	0.74	
32.4	0.66	
16.0	0.48	
19.9	0.67	
23.5	0.72	
26.1	0.83	
28.2	1.10	
33.6	0.93	
31.0	1.01	
12.7	0.43	Tawada and Miyamoto (1973)
16.0	0.61	
23.0	0.92	
18.9	0.70	Toyotama and Nakaoka (1979)
20.9	0.84	
22.9	0.95	
24.9	1.05	
27.3	1.15	
29.9	1.22	
22.0	0.80	Bräuker et al. (1994)
<i>Didinium nasutum</i>		
5	0.67	Beveridge et al. (2010)
5	0.73	
5	0.53	
5	0.80	
5	0.91	
5	0.81	
5	0.50	
5	0.70	
5	0.95	
5	0.32	
5	0.56	

5	0.77	
5	0.65	
5	0.75	
5	0.45	
5	0.67	
10	0.82	
10	1.12	
10	1.24	
10	1.31	
10	0.91	
10	1.08	
10	1.05	
10	0.86	
10	1.07	
10	0.94	
10	1.18	
10	0.93	
10	1.05	
10	1.00	
10	1.23	
10	1.00	
10	1.20	
10	0.84	
10	1.27	
15	0.83	
15	0.37	
15	0.54	
15	0.65	
15	0.38	
15	0.39	
15	0.95	
15	0.46	
15	0.53	
15	0.84	
15	0.85	
15	0.25	
15	0.69	
15	0.41	
20	1.46	
20	1.39	
20	1.08	
20	1.36	
20	1.77	
20	1.74	
20	1.53	
20	1.30	
20	1.64	
20	1.00	

20	1.57	
20	1.65	
20	1.50	
20	1.07	
20	0.81	
20	1.64	
20	0.96	
20	1.59	
20	0.97	
20	1.41	

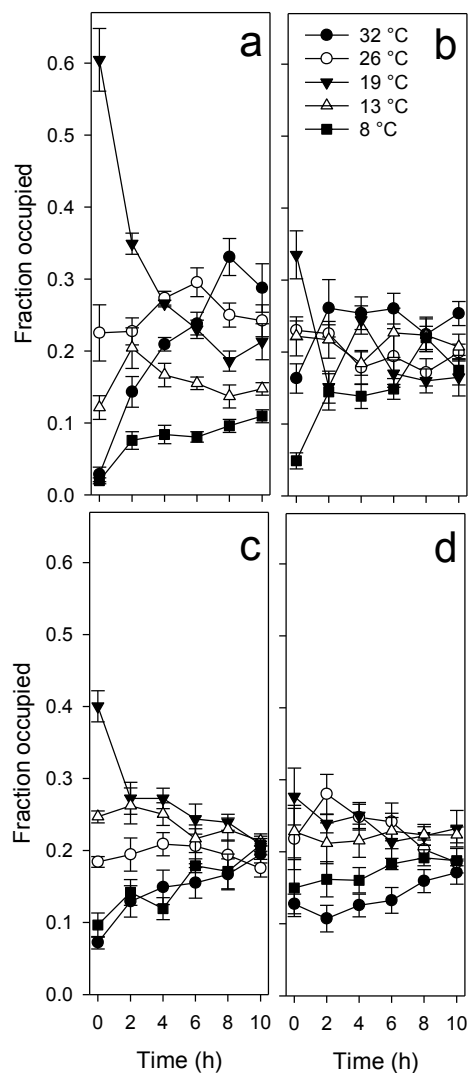
References

- Beveridge, O. S. et al. 2010. Mechanisms of temperature-dependent swimming: the importance of physics, physiology and body size in determining protist swimming speed. –J. Exp. Biol. 213: 4223–4231.
- Bräuker, R. et al. 1994. Graviresponses in *Paramecium caudatum* and *Didinium nasutum* examined under varied hyper gravity conditions. – J. Exp. Biol. 197: 271–294.
- Tawada, K. and Oosawa, F. 1972. Responses of *Paramecium* to temperature change. – J. Protozool. 19: 53–57.
- Tawada, K. and Miyamoto, H. 1973. Sensitivity of *Paramecium* thermotaxis to temperature change. – J. Protozool. 20: 289–292.
- Toyotama, H. and Nakaoka, Y. 1979. Effect of temperature on the swimming velocity of trito-extracted models of *Paramecium caudatum*. – Cell Struct. Funct. 4: 35–43.

Appendix 2

These are time-series for the migration experiments across a corridor of 5 wells (Fig. 2a); for details see main text, Materials and Methods, “The effect of temperature on swimming speed and distribution of prey and predator”. Data are mean abundance at each temperature (as a decimal fraction of total within the corridor); error bars are 1 SE (n = 5). Temperatures (see panel b for symbols) apply to panels a and b; for panels c and d the temperature across the corridor was constant at 20 °C, and the symbols simply represent the different wells across the corridor. These data were used to indicate that after 10 h the distribution of both species had begun to stabilise, indicating their temperature preferences.

The panels are as follows: a. Predator (*Didinium*) abundance over time in the temperature gradient (Fig. 2c). b. Prey (*Paramecium*) abundance over time in the temperature gradient (Fig. 2c). c. Predator (*Didinium*) abundance over time at 20 °C. d. Prey (*Paramecium*) abundance over time at 20 °C.



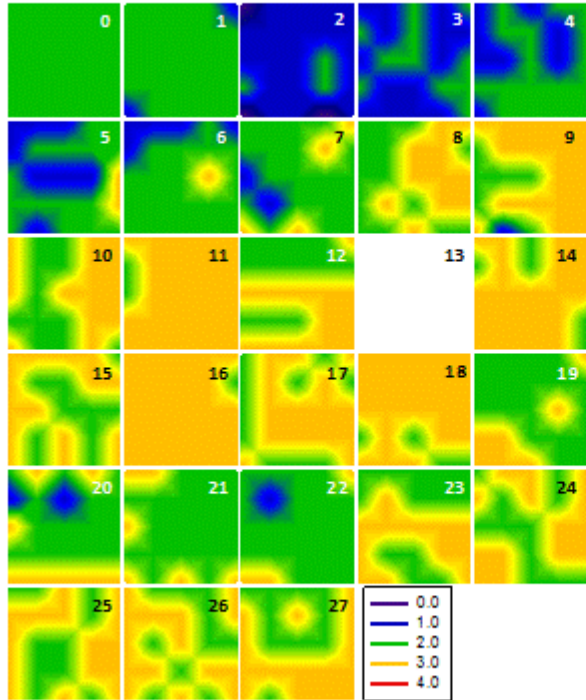
Appendix 3

Maps of abundance (as ranks, see Methods, and colour code on figures) at different temperatures of time-series data (i.e. that presented in Fig. 4). Both replicates of each treatment (10, 20, 30 °C, and the gradient; see Fig. 2b,c) are presented in full (blanks are days when counts were not made). Each panel represents a surface view of abundance in the fragmented landscape (Fig. 2b) on one day (day number is presented in the upper right corner of a panel).

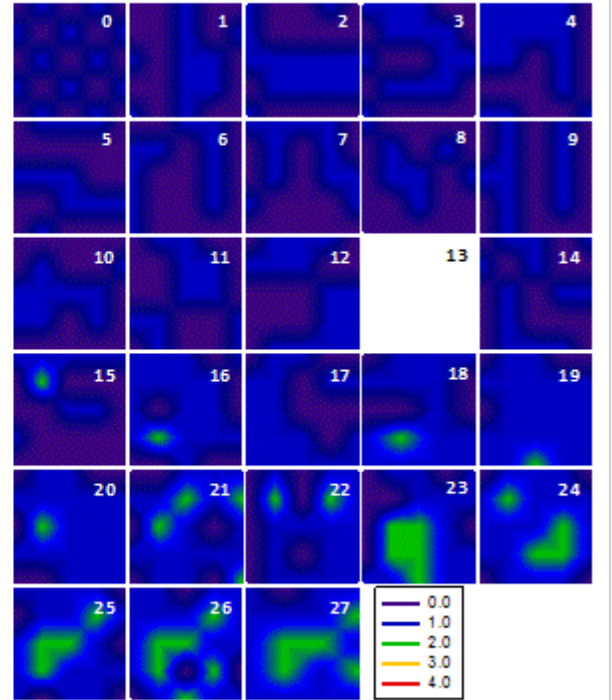
Of key importance is the clear indication of regular distribution of abundance in the constant temperature treatments and the accumulation of both predator and prey near the middle of the temperature fragmented landscape in the gradient treatment. Also note that during blooms, all fragments at 20, 30 °C experience high numbers, suggesting that under these conditions metapopulation dynamics do not occur (i.e. all fragments behave the same). These distributional patterns are similar in the two independent replicates.

Replicate 1 10°C

Paramecium

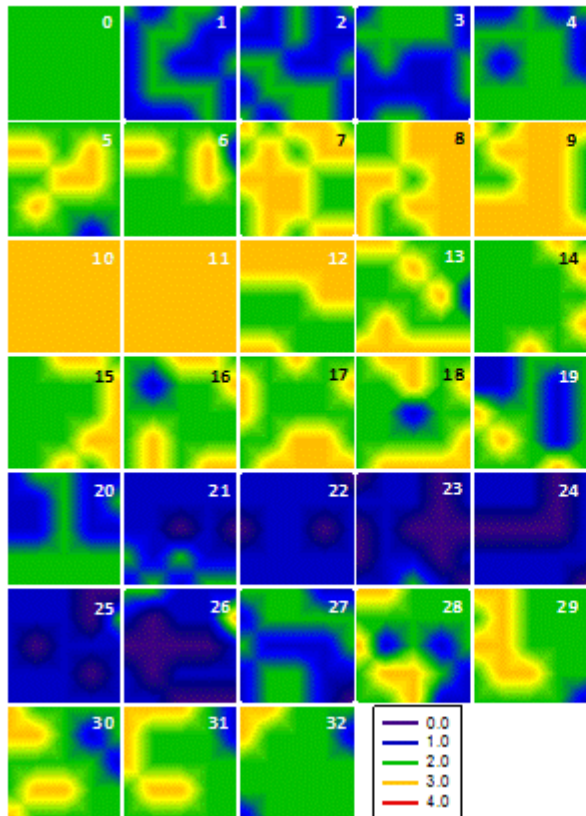


Didinium

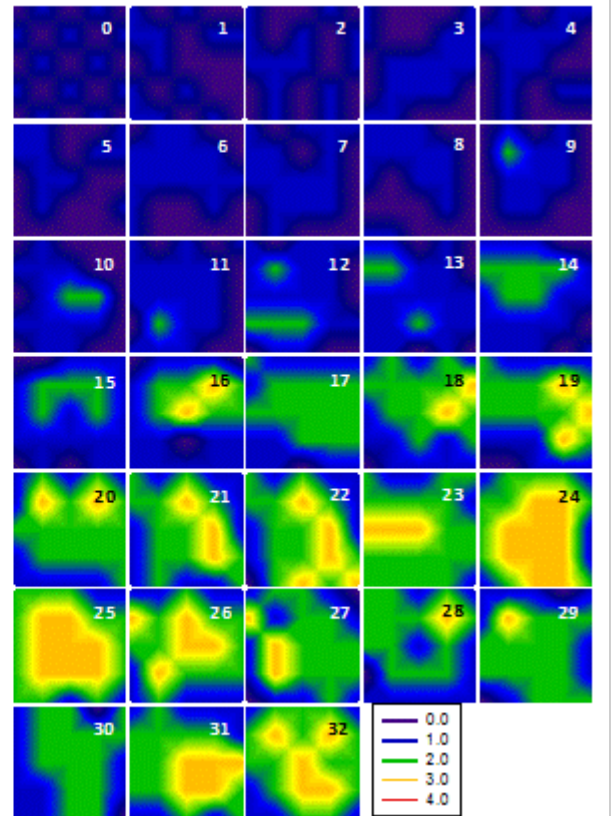


Replicate 2 10°C

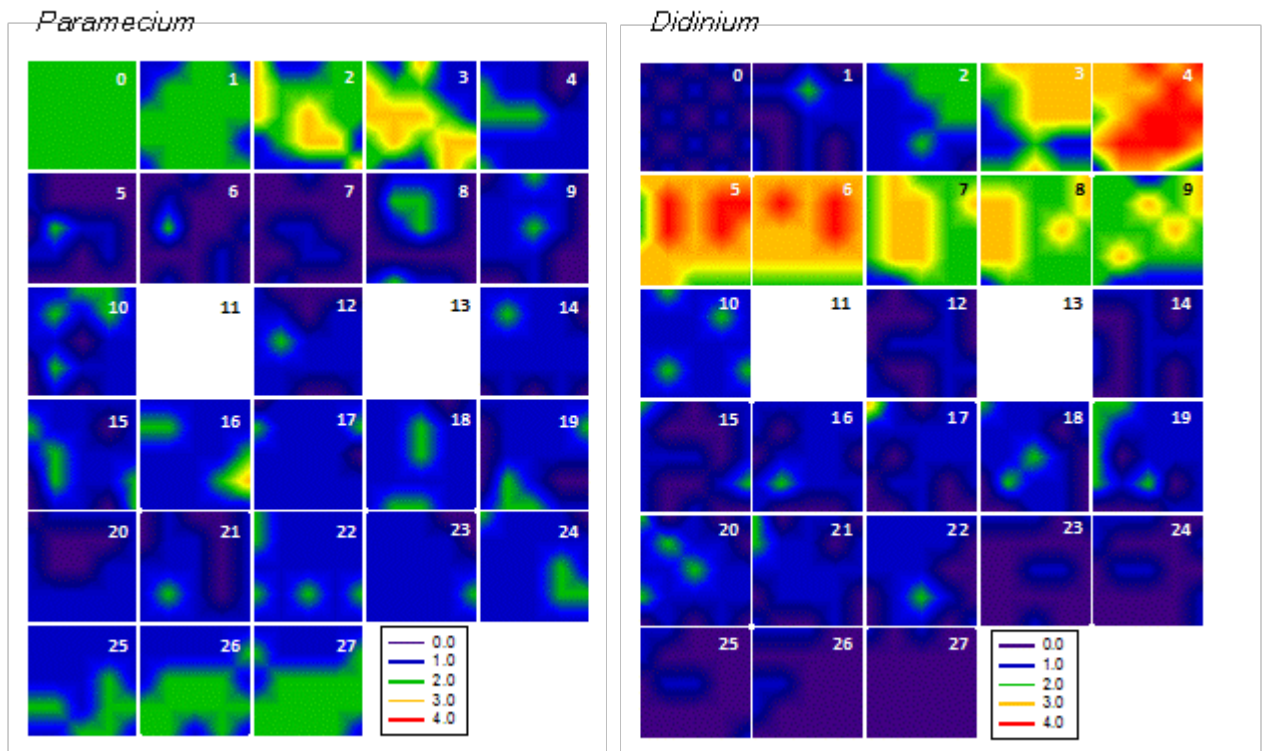
Paramecium



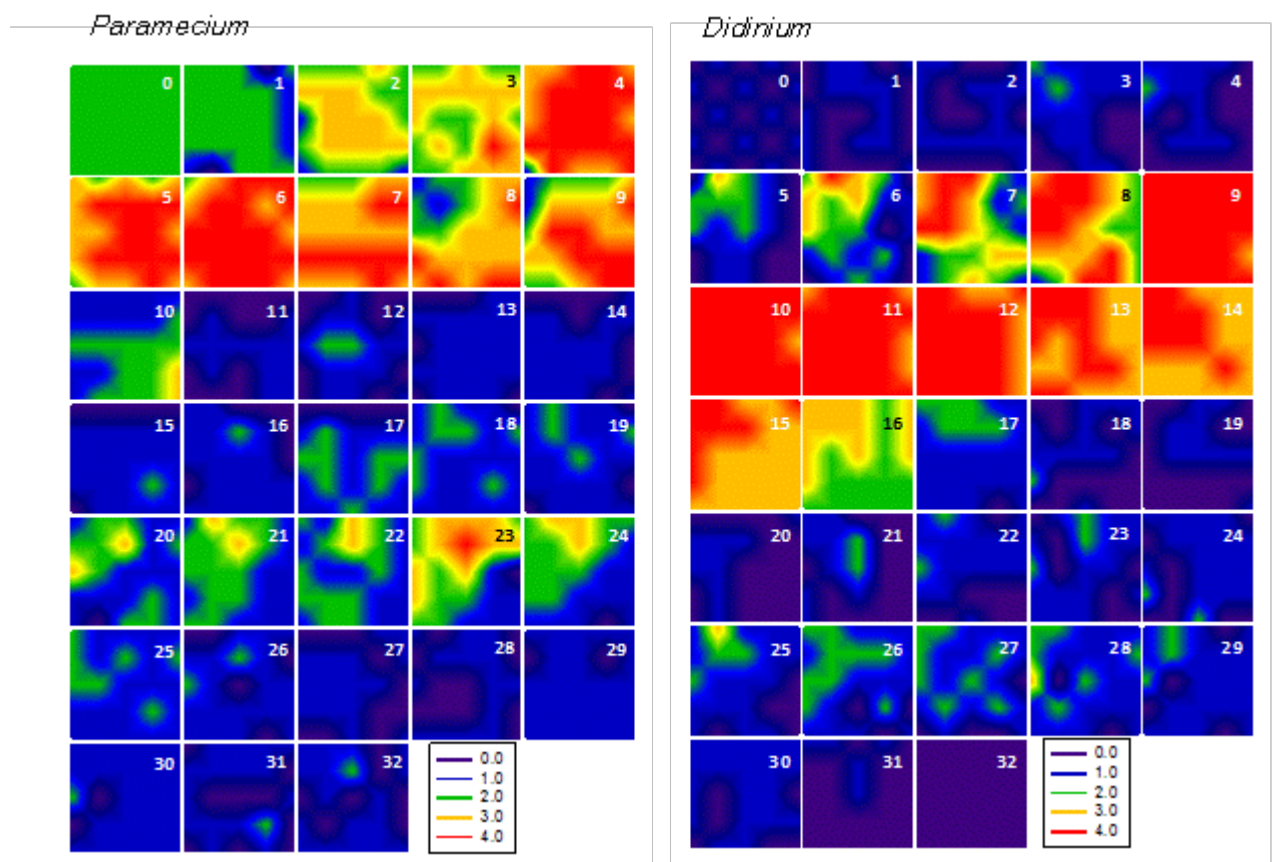
Didinium



Replicate 1 20°C

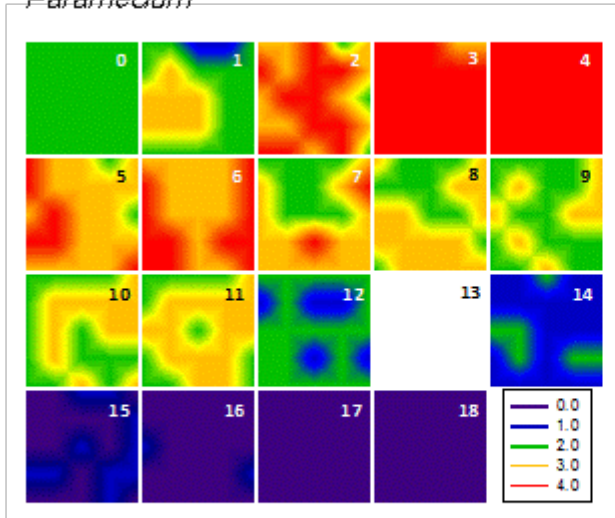


Replicate 2 20°C

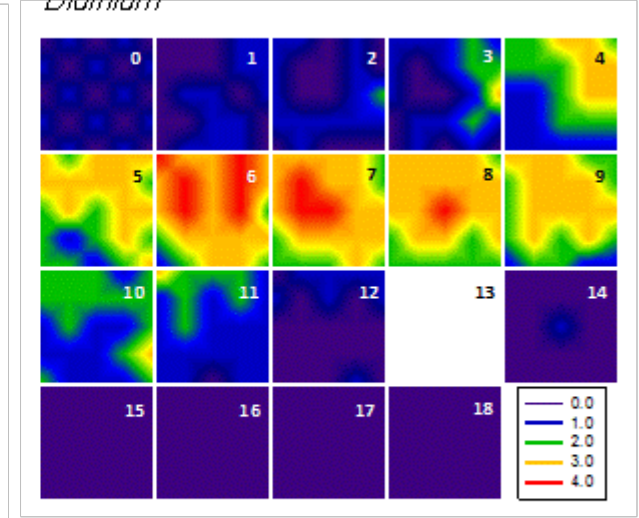


Replicate 1 30 °C

Paramecium

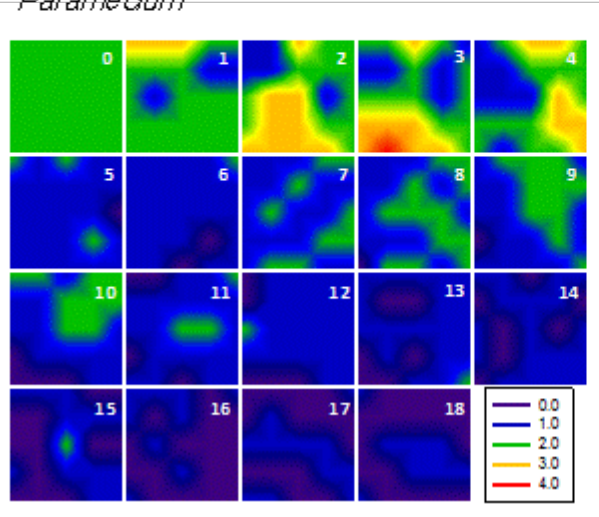


Didinium

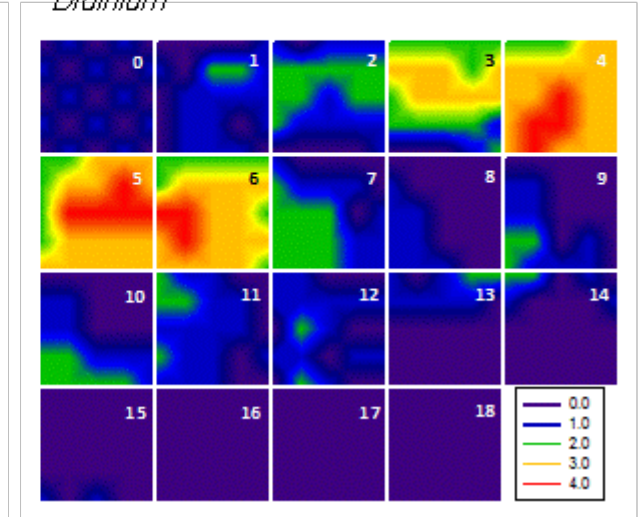


Replicate 2 30 °C

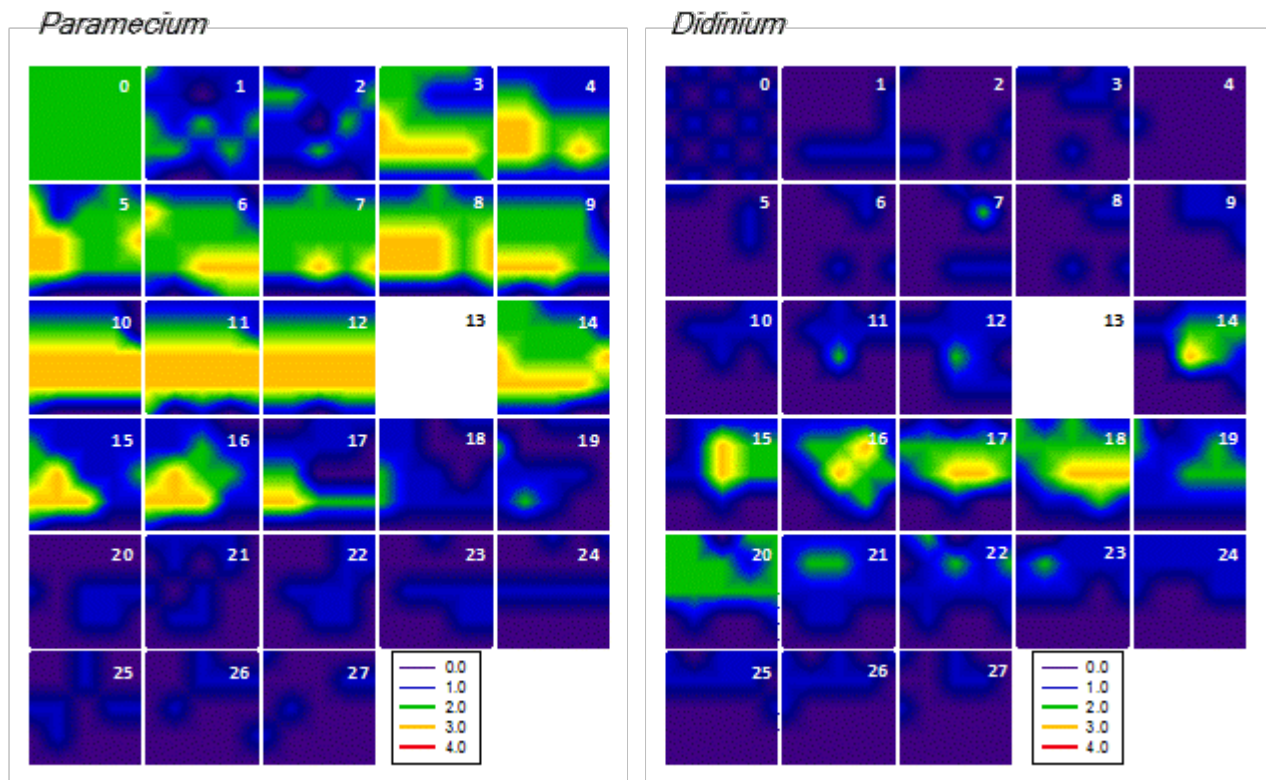
Paramecium



Didinium



Replicate 1 8-32°C



Replicate 2 8-32°C

