

**Table S1.** Field- and experimental assemblages of amphibian host species. Compositions were drawn from five amphibian species at one of three richness levels (1, 2 or 4 species). For each composition, we present the number of instances in which that assemblage structure was observed empirically (No. pond-years) and what percentage of observations it constituted (relative to all pond-years at a given richness value). For assemblages used in the experimental manipulation (n=14 compositions), the number of replicates is shown in the last column. Species combinations that were not observed in the field nor used in the experiment are not presented. Species codes for the host species are as follows: P = Pacific chorus frogs (*Pseudacris regilla*), T = California newts (*Taricha torosa*), B = western toads (*An. boreas*), G = rough-skinned newts (*T. granulosa*), and R = American bullfrogs (*Ra. catesbeiana*). In total, 147 ponds were sampled between 2009 and 2015 (426 pond-by-year combinations, of which 400 had one or more species detected).

Richness	Composition	No. pond-years	Frequency	Replicates
1	B only	1	1.7%	6
1	R only	7	11.7%	6
1	P only	41	68.3%	5
1	T only	10	16.7%	7
1	G only	1	1.7%	7
2	B + P	25	18.3%	8
2	B + T	0	0.0%	0
2	R + T	4	2.9%	0
2	P + R	1	0.7%	5
2	P + T	96	70.1%	5
2	P + G	5	3.6%	5
2	T + G	6	4.4%	0
2	B + R	0	0.0%	5
4	P + T + B + R	14	37.8%	5
4	P + T + B + G	23	62.2%	6
4	P + B + R + G	0	0.0%	5
4	P + T + R + G	0	0.0%	4

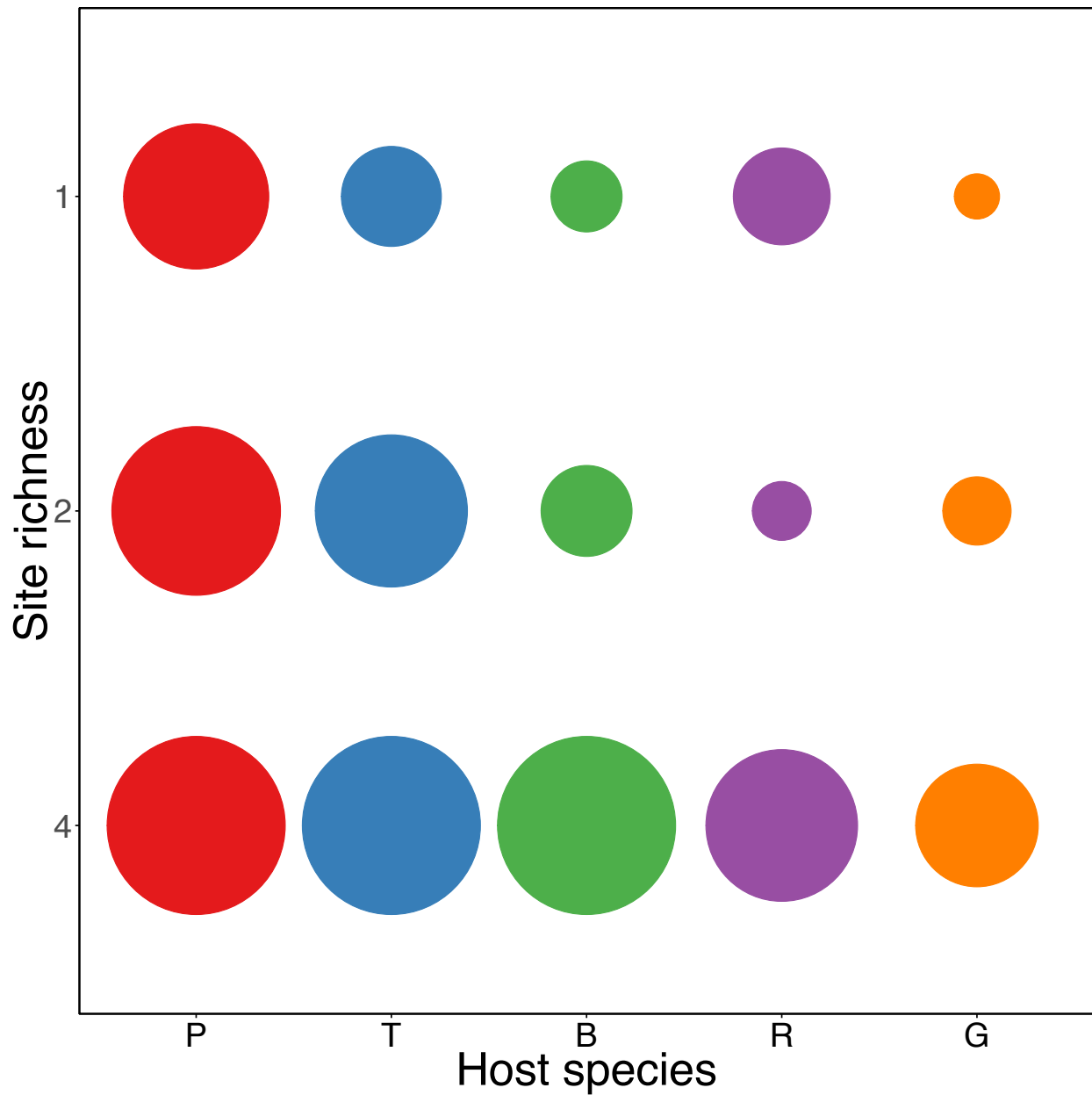
**Table S2.** Mean ( $\pm 1$  SE) sizes (snout-vent length, SVL in mm) and wet mass (in mg) for each of the five amphibian species used in the experimental assemblages.

<b>Host species</b>	<b>Snout-vent length (mm)</b>	<b>Wet mass (mg)</b>
<i>Pseudacris regilla</i>	8.54 $\pm$ 0.084	0.143 $\pm$ 0.0044
<i>Taricha torosa</i>	10.67 $\pm$ 0.265	0.069 $\pm$ 0.0047
<i>Anaxyrus boreas</i>	9.62 $\pm$ 0.178	0.117 $\pm$ 0.0069
<i>Taricha granulosa</i>	12.83 $\pm$ 0.297	0.104 $\pm$ 0.006
<i>Rana catesbeiana</i>	31.51 $\pm$ 5.79	0.345 $\pm$ 0.108

**Table S3.** Mean ( $\pm 1$  SE) of infection load per host for each of the three trematode parasites within larvae of the five amphibian species exposed experimentally. Significantly different infection loads among species based on Tukey's pairwise comparisons are indicated by letter groupings, which only apply within a column (for a specific parasite species). Note: experimental assemblages were exposed to 100 cercariae of *C. americanus* and *A. marcinae* but 115 cercariae of *R. ondatrae*.

<b>Host species</b>	<b>Parasite species</b>		
	<i>Ribeiroia ondatrae</i>	<i>Cephalogonimus americanus</i>	<i>Alaria marcinae</i>
<i>Pseudacris regilla</i>	5.31 $\pm$ 0.46 <sup>a</sup>	7.53 $\pm$ 0.88 <sup>a</sup>	4.72 $\pm$ 0.61 <sup>a</sup>
<i>Taricha torosa</i>	16.9 $\pm$ 1.20 <sup>b</sup>	0.14 $\pm$ 0.065 <sup>b</sup>	0.036 $\pm$ 0.025 <sup>c</sup>
<i>Anaxyrus boreas</i>	4.38 $\pm$ 0.61 <sup>a</sup>	3.29 $\pm$ 0.44 <sup>c</sup>	0.59 $\pm$ 0.21 <sup>d</sup>
<i>T. granulosa</i>	14.9 $\pm$ 1.18 <sup>b</sup>	0.62 $\pm$ 0.13 <sup>d</sup>	0.018 $\pm$ 0.018 <sup>bc</sup>
<i>Rana catesbeiana</i>	0.48 $\pm$ 0.16 <sup>c</sup>	0.048 $\pm$ 0.036 <sup>b</sup>	0.11 $\pm$ 0.041 <sup>cd</sup>

**Figure S1.** Diagram of the frequency in which each amphibian species was observed as a function of host richness. The size of the circles reflect the relative frequency in which a given species was observed at ponds with the specified richness value (i.e., Pacific chorus frogs were present in 68.3% of pond-years with exactly 1-species whereas western toads were present in only 1.7% of such systems). The host species codes and colors are presented in Figure 1.



**Figure S2.** Effects of larval bullfrog presence on per-host infection loads in (A) Pacific chorus frogs and (B) western toads. Presented is the mean parasite load per host  $\pm$  1 standard error as a function of whether larval bullfrogs (*Rana catesbeiana*) were also present in the assemblage. Bullfrog presence, more so than overall host species richness, caused a decrease in the average parasite load per chorus frog or toad host.

