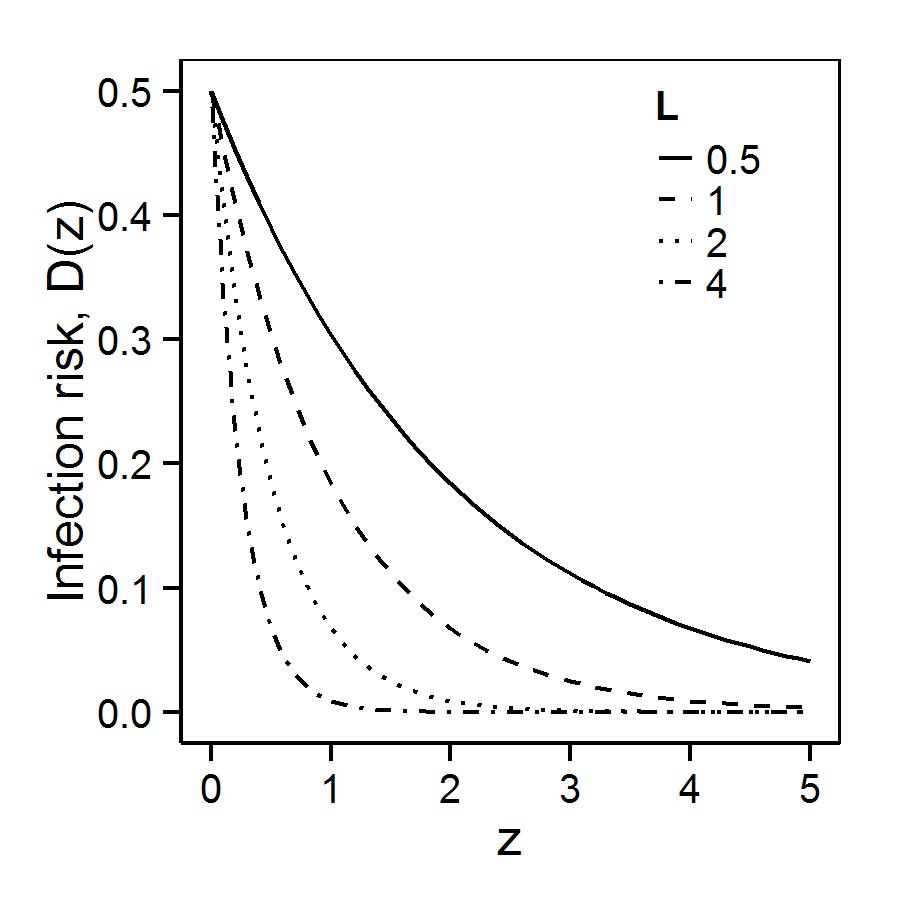
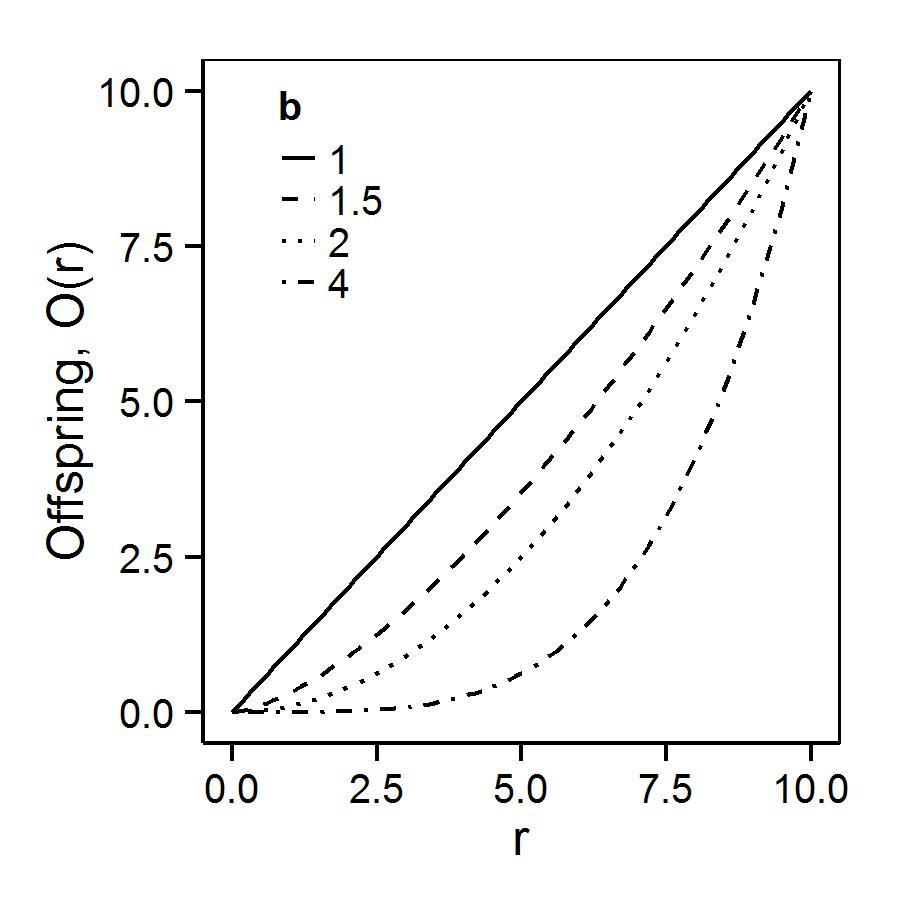
**Supplemental Material**

**Table S1:** Default values for the parameters in the model.

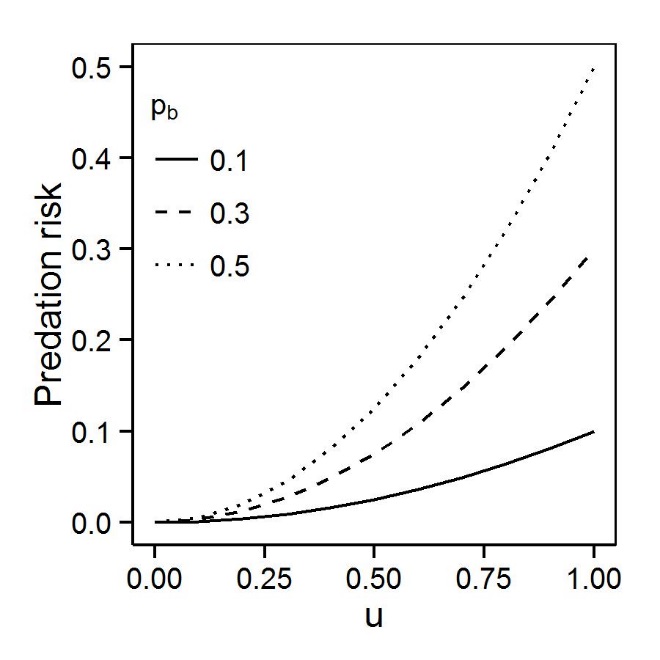
| **Symbol** | **Description** | **Value** |
| --- | --- | --- |
| *T* | maximum lifespan | 30 |
| *emax* | maximum amount of energy from food patch | 10 |
| *pb* | background predation risk | 0 - 0.5 |
| *pr* | reproduction predation risk | 0 - 0.5 |
| *wr* | weight reproduction | 0.1 |
| *b* | strength of sexual selection | 1 - 5 |
| *d0* | background disease risk | 0.3 |
| *L* | effectiveness of immune defense | 0.5 |



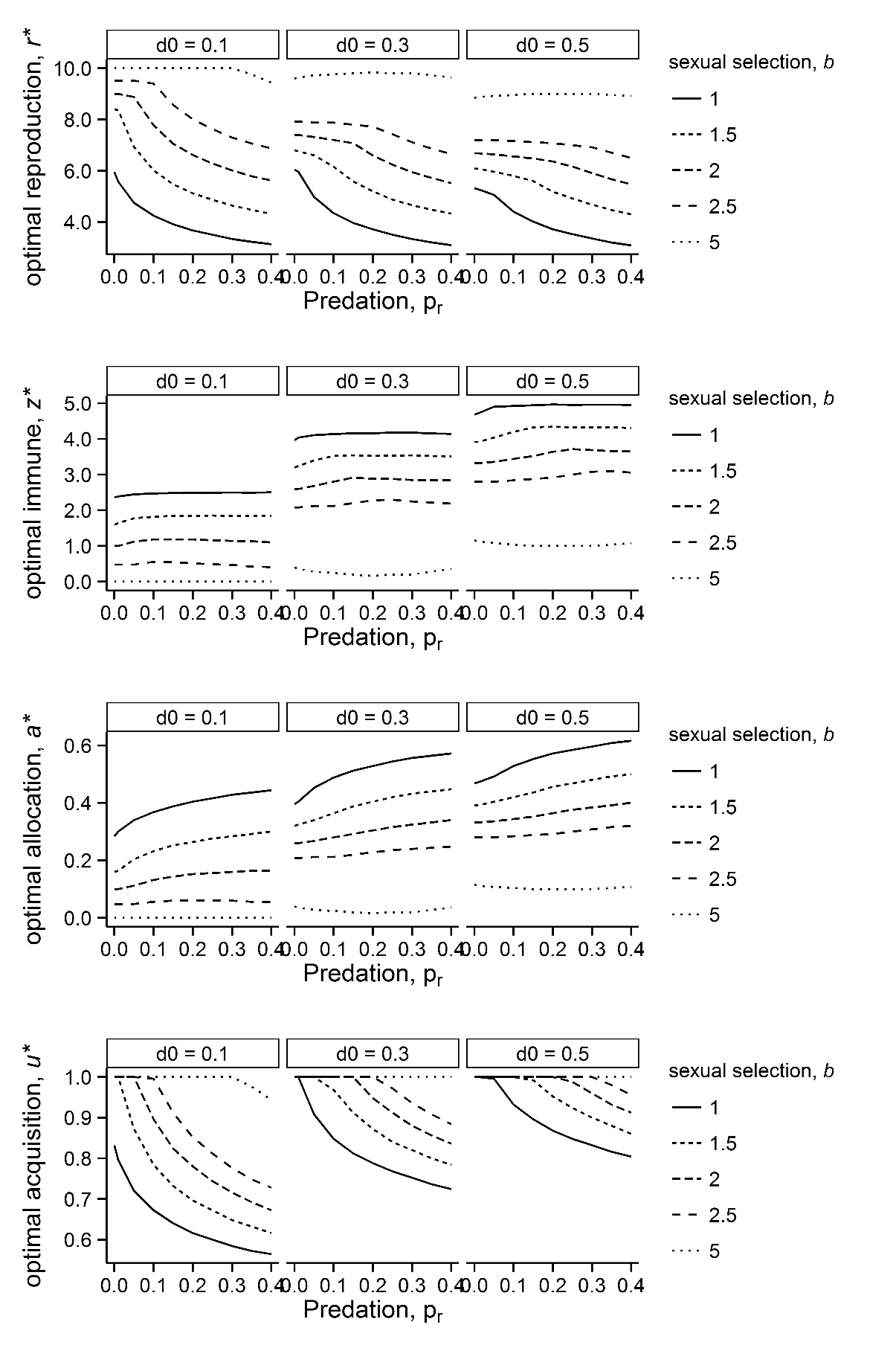
**Figure S1.** Relationship between immune function and mortality risk from disease, under various levels of immune effectiveness (*L*).



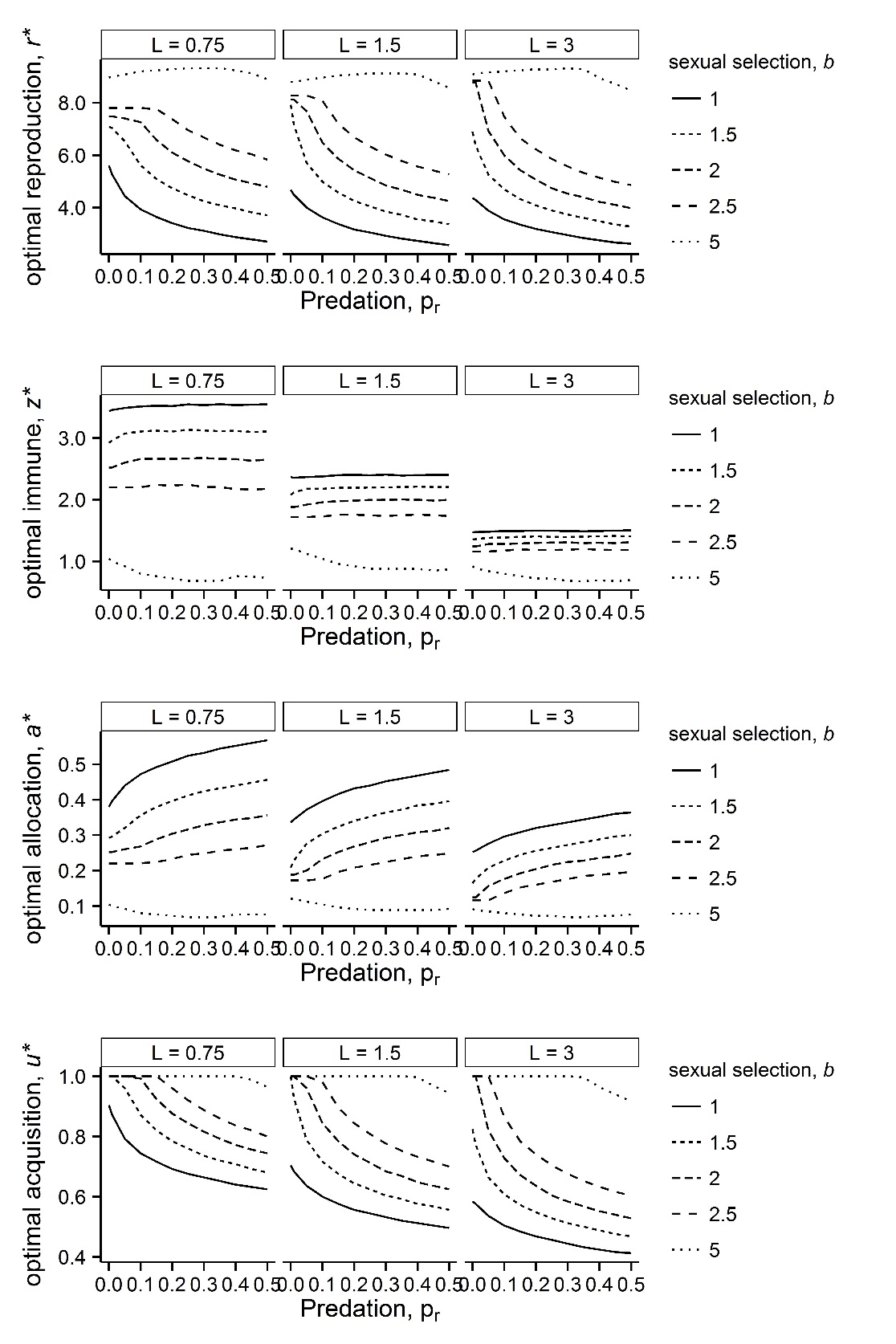
**Figure S2.** Relationship between reproductive effort and offspring production, under different levels of sexual selection (*b*).

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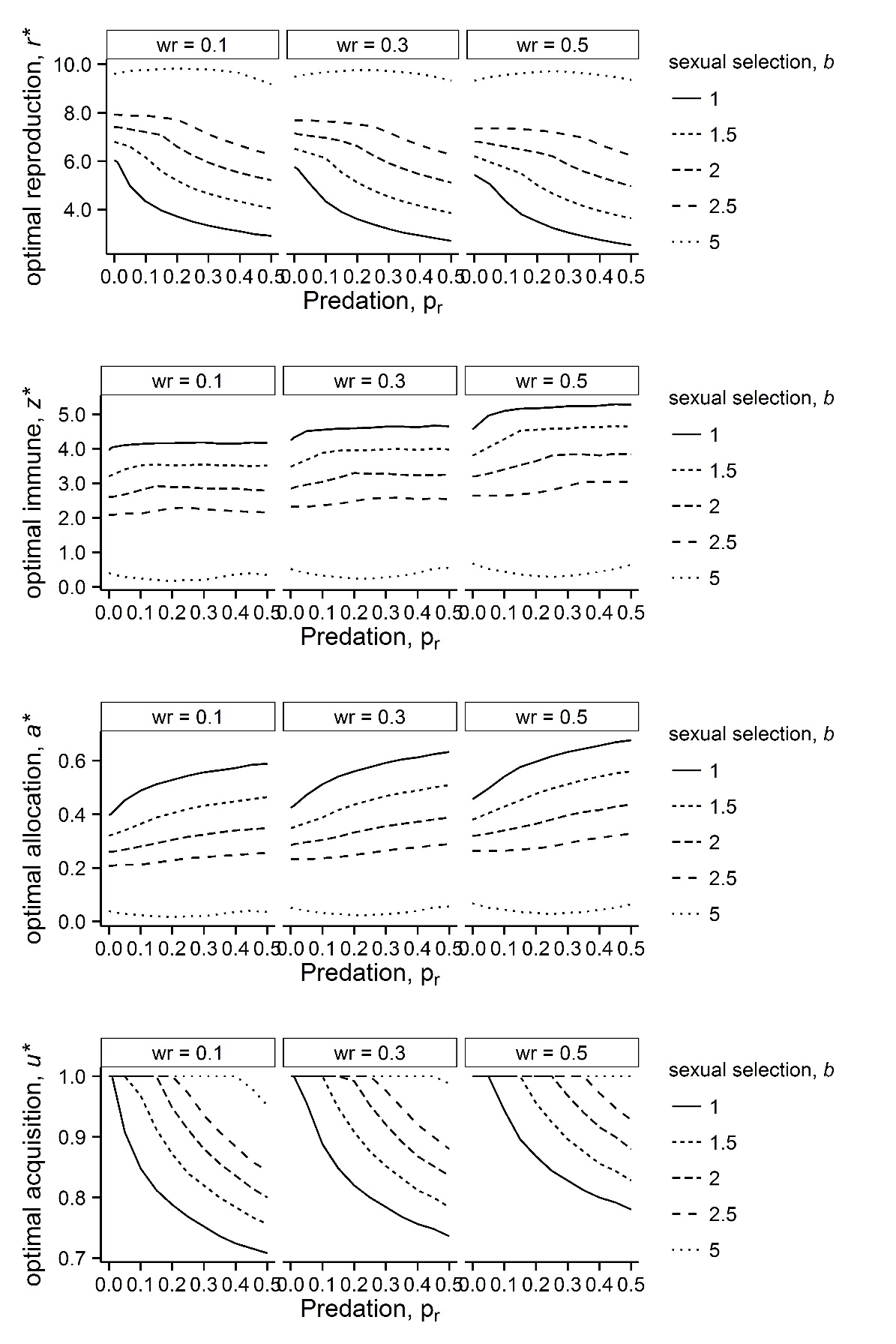
**Figure S3.** Relationship between predation risk (pb) and foraging activity (u).

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**Figure S4.** Effect of disease rate (d0) for scenario 5 (*Morphological*). Each row shows a different response variable and each column a different disease rate. Predation risk associated with sexual trait is along the x-axis. Different line types indicate different level of sexual selection.

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**Figure S5.** Effect of disease efficiency (L) for scenario 5 (*Morphological*). Each row shows a different response variable and each column a different disease efficiency. Predation risk associated with sexual trait is along the x-axis. Different line types indicate different level of sexual selection.



**Figure S6.** Effect of reproduction duration (wr) for scenario 5 (*Morphological*). Each row shows a different response variable and each column a different wr. Predation risk associated with sexual trait is along the x-axis. Different line types indicate different level of sexual selection.