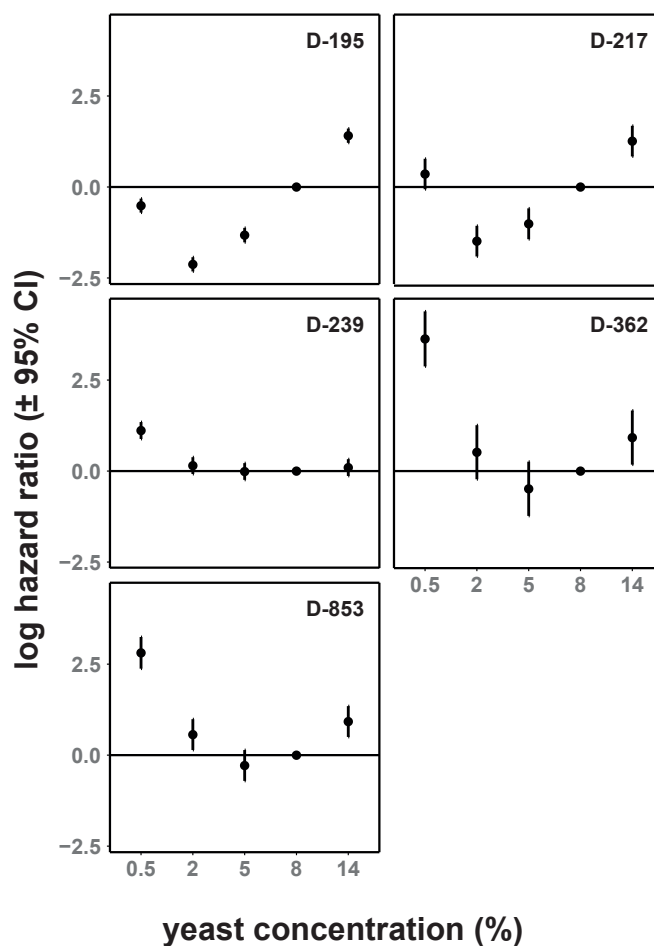## Supplementary information

## Figures



**Fig. S1. Log hazard ratios of diet within water-treated cages in a panel of DGRP genotypes.**
Reaction norms to diet still differ in water-treated circumstances. Hazard ratios represent the inverse of typical survival reaction norms to diet. 8% yeast treatment was treated as a reference and as such, no CIs are available. Rates here are relative to 8% yeast diet, and lines represent this standard. N = 12,737 females total; 2,396-2629 per genotype. Hazard ratios have the benefit over median lifespan in that they are directly related to the appropriate statistics used for time-to-event data. In addition, they are directly comparable in a quantitative fashion across genotypes of different lifespans, as they express a relative risk.
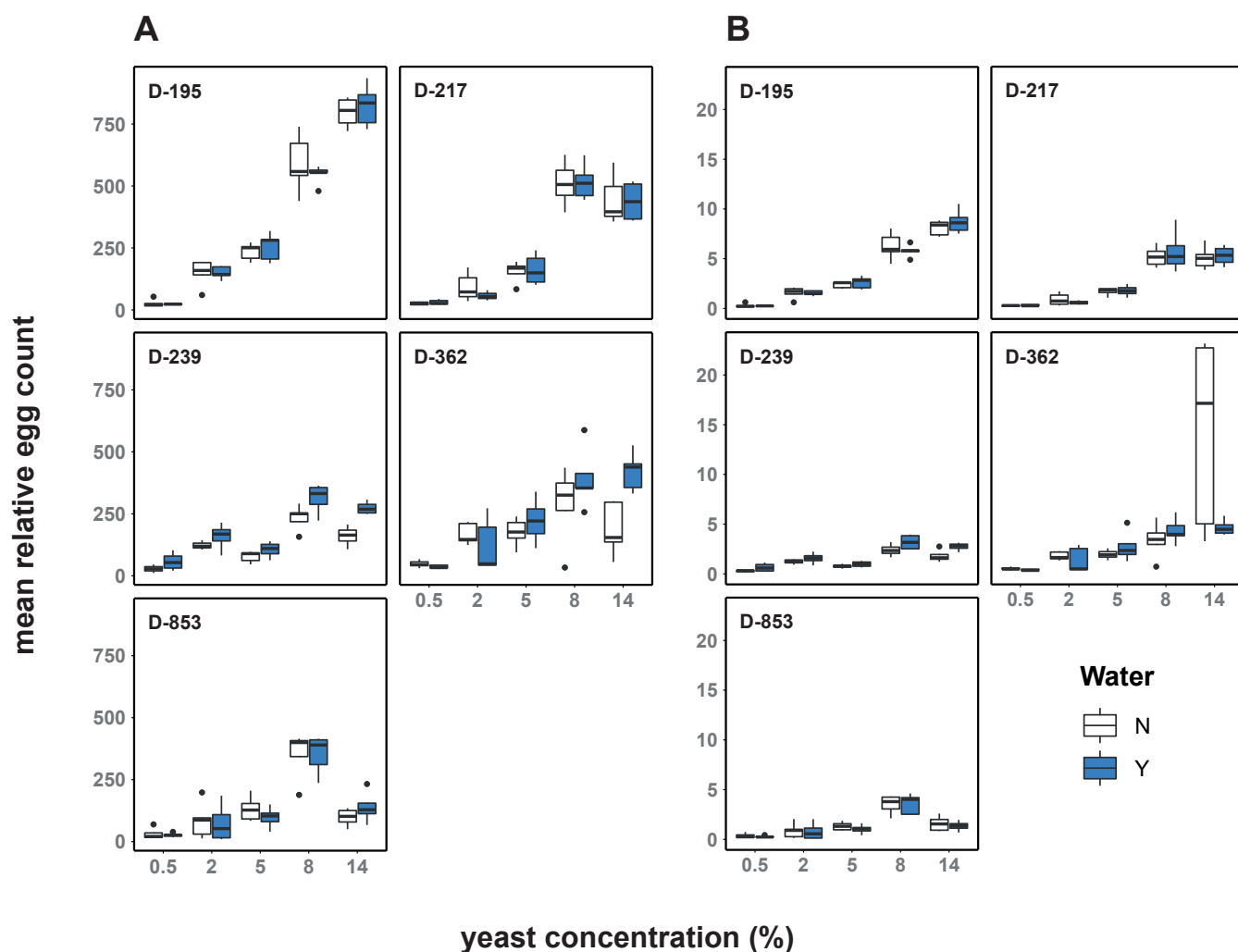
**Fig. S2. Fecundity analysis of panel under all conditions.** Fecundity has a positive relationship with dietary yeast concentration, except at the highest yeast concentration assayed (14%) for most genotypes. **A** - raw egg counts. **B** - mortality-corrected counts. Counts generated using QuantiFly software. Counts are relative, but directly comparable. Flies assayed at age 11-12 days, with boxplots aggregating totals (median, with the box depicting a quartile each way, and whiskers showing the range; outliers plotted as dots). Each cage was assayed on 1 scoring day at this age. Mortality corrected counts (**B**) generated by dividing raw counts, by N flies remaining in cage at the time of assaying. N = 25,519 females total; 4,800-5,282 per genotype. Note that DGRP-362 experienced significant mortality at this age under 14% yeast dietary treatment. This is the cause of the discrepancy in significance between raw, and age-adjusted fecundity counts. Note, egg-laying was not assessed throughout life and in natural circumstances lifespan of the fly is truncated by extrinsic factors, e.g. predation. We nonetheless, tentatively conclude that the enhanced mortality and reduced egg laying on very rich diets is caused by nutritional toxicity.
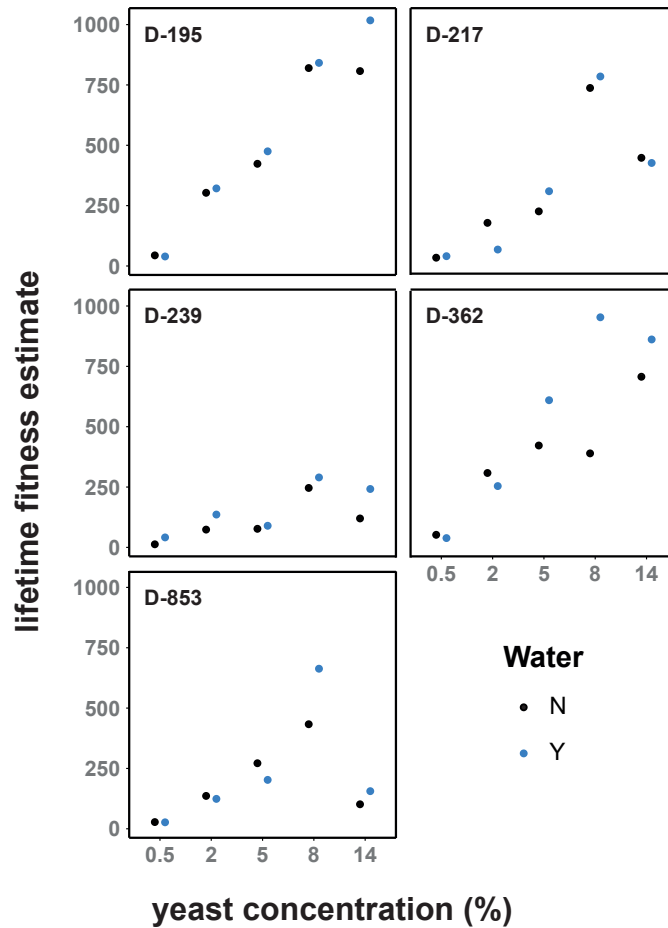
**Fig. S3. Lifetime reproductive fitness estimates of panel under all conditions.** Lifetime fitness has a positive relationship with dietary yeast concentration, except at the highest yeast concentration assayed (14%) for most genotypes. Mortality-adjusted egg counts from Fig. S2 were multiplied by the area under the relevant survival curve (restricted mean) to generate lifetime estimates. N = 25,519 females total; 4,800-5,282 per genotype.

**Fig. S4. Survival curves of panel in response to diet.** Dietary reaction norms vary in a genotype-specific manner. Survival curves are separated by genotype, and water-supplementation status. N = 25,519 females total; 4,800-5,282 per genotype.

## **Tables**

Table S1. Effect of diet and water supplementation on mortality across 5 DGRP lines (DGRP-195 is reference).
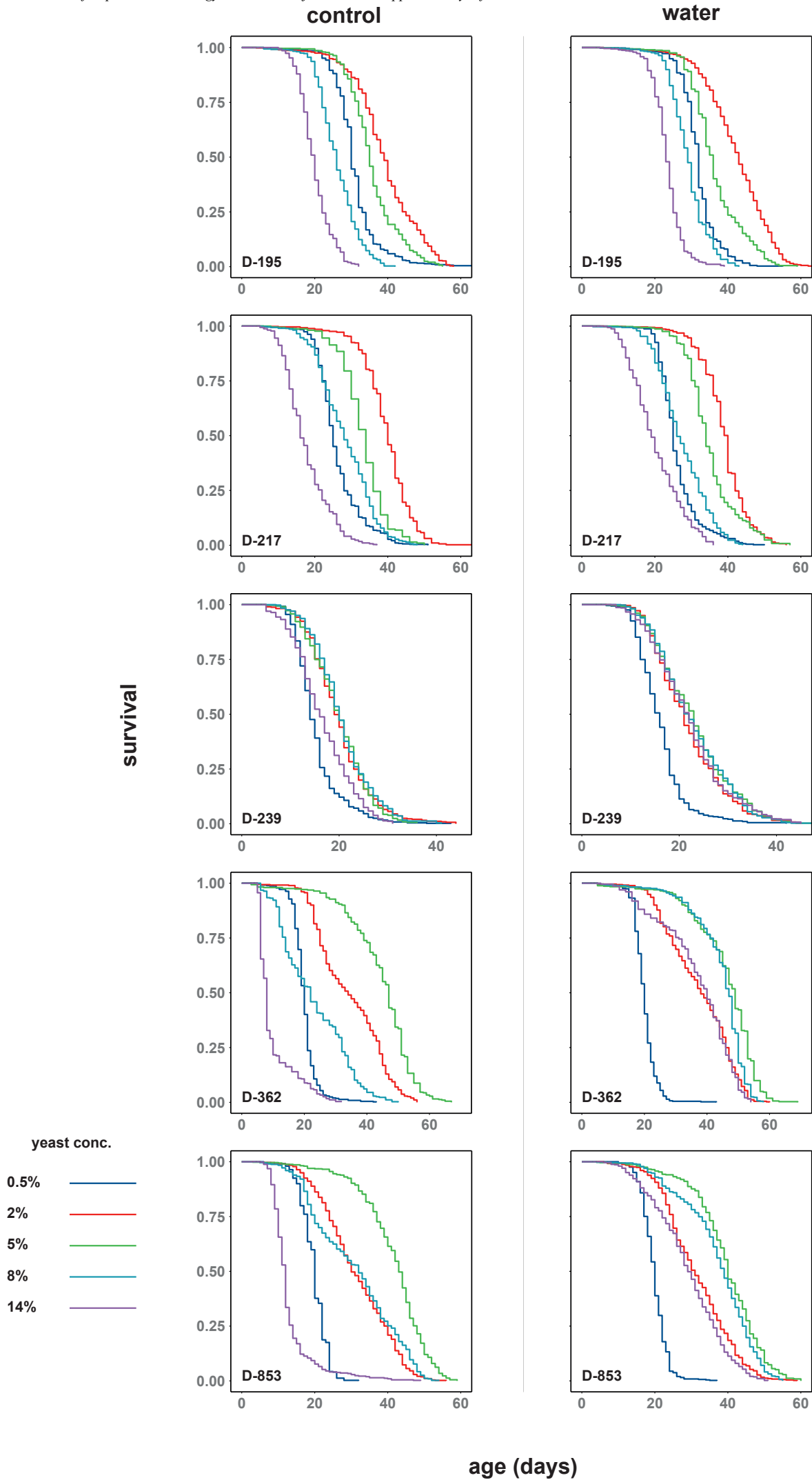
| coefficient | Full Model | | | |
|---|---|---|---|---|
| | estimate | exp | s.e. | p |
| water | -0.390 | 0.677 | 0.228 | 0.086 |
| 0.5% yeast | -0.796 | 0.451 | 0.228 | <0.001 |
| 2% yeast | -1.856 | 0.156 | 0.206 | <0.001 |
| 5% yeast | -1.296 | 0.274 | 0.225 | <0.001 |
| 14% yeast | 1.043 | 2.837 | 0.226 | <0.001 |
| 217 | -0.444 | 0.641 | 0.226 | 0.05 |
| 239 | 0.763 | 2.145 | 0.227 | 0.001 |
| 362 | 0.104 | 1.110 | 0.227 | 0.645 |
| 853 | -1.090 | 0.336 | 0.223 | <0.001 |
| 0.5% yeast * water | 0.470 | 1.601 | 0.322 | 0.144 |
| 2% yeast * water | 0.030 | 1.031 | 0.300 | 0.92 |
| 5% yeast * water | 0.277 | 1.319 | 0.322 | 0.39 |
| 14% yeast * water | -0.156 | 0.856 | 0.322 | 0.629 |
| 217 * 0.5% yeast | 1.195 | 3.302 | 0.320 | <0.001 |
| 217 * 2% yeast | 0.632 | 1.881 | 0.310 | 0.042 |
| 217 * 5% yeast | 0.786 | 2.195 | 0.321 | 0.014 |
| 217 * 14% yeast | 0.643 | 1.903 | 0.322 | 0.046 |
| 239 * 0.5% yeast | 1.793 | 6.008 | 0.321 | <0.001 |
| 239 * 2% yeast | 1.887 | 6.599 | 0.308 | <0.001 |
| 239 * 5% yeast | 1.429 | 4.174 | 0.321 | <0.001 |
| 239 * 14% yeast | -0.382 | 0.683 | 0.324 | 0.238 |
| 362 * 0.5% yeast | 1.754 | 5.775 | 0.319 | <0.001 |
| 362 * 2% yeast | 0.262 | 1.300 | 0.311 | 0.399 |
| 362 * 5% yeast | -1.322 | 0.267 | 0.315 | <0.001 |
| 362 * 14% yeast | 1.880 | 6.551 | 0.316 | <0.001 |
| 853 * 0.5% yeast | 3.087 | 21.901 | 0.318 | <0.001 |
| 853 * 2% yeast | 2.029 | 7.604 | 0.307 | <0.001 |
| 853 * 5% yeast | 0.287 | 1.332 | 0.320 | 0.37 |
| 853 * 14% yeast | 2.100 | 8.168 | 0.320 | <0.001 |
| 217 * water | 0.551 | 1.736 | 0.322 | 0.087 |
| 239 * water | -0.101 | 0.904 | 0.322 | 0.754 |
| 362 * water | -2.015 | 0.133 | 0.319 | <0.001 |
| 853 * water | -0.101 | 0.904 | 0.323 | 0.753 |
| 217 * 0.5% yeast * water | -0.568 | 0.567 | 0.455 | 0.212 |
| 217 * 2% yeast * water | -0.114 | 0.893 | 0.441 | 0.797 |
| 217 * 5% yeast * water | -0.702 | 0.496 | 0.456 | 0.123 |
| 217 * 14% yeast * water | -0.448 | 0.639 | 0.456 | 0.327 |
| 239 * 0.5% yeast * water | -0.145 | 0.865 | 0.457 | 0.751 |
| 239 * 2% yeast * water | 0.126 | 1.134 | 0.440 | 0.775 |
| 239 * 5% yeast * water | -0.427 | 0.652 | 0.455 | 0.348 |
| 239 * 14% yeast * water | -0.383 | 0.682 | 0.457 | 0.402 |
| 362 * 0.5% yeast * water | 1.990 | 7.319 | 0.456 | <0.001 |
| 362 * 2% yeast * water | 2.068 | 7.912 | 0.439 | <0.001 |
| 362 * 5% yeast * water | 2.007 | 7.444 | 0.457 | <0.001 |
| 362 * 14% yeast * water | -1.942 | 0.143 | 0.451 | <0.001 |
| 853 * 0.5% yeast * water | -0.027 | 0.974 | 0.458 | 0.954 |
| 853 * 2% yeast * water | 0.351 | 1.420 | 0.441 | 0.427 |
| 853 * 5% yeast * water | 0.433 | 1.541 | 0.457 | 0.344 |
| 853 * 14% yeast * water | -2.056 | 0.128 | 0.455 | <0.001 |

Table S2. Effect of diet and water supplementation on mortality within DGRP-195.

| coefficient | Estimates from individual model | | | | Effect of water, compared to no water | | |
|---|---|---|---|---|---|---|---|
| | estimate | exp | s.e. | p | estimate | exp | p |
| water supplementation | -0.481 | 0.618 | 0.113 | <0.001 | | | |
| 0.5% yeast | -0.954 | 0.385 | 0.112 | <0.001 | | | |
| 2% yeast | -2.139 | 0.118 | 0.103 | <0.001 | | | |
| 5% yeast | -1.620 | 0.198 | 0.112 | <0.001 | | | |
| 14% yeast | 1.612 | 5.012 | 0.112 | <0.001 | | | |
| 0.5% yeast * water | 0.475 | 1.608 | 0.158 | 0.003 | -0.006 | 0.994 | 0.971 |
| 2% yeast * water | 0.156 | 1.169 | 0.147 | 0.289 | -0.324 | 0.723 | 0.028 |
| 5% yeast * water | 0.369 | 1.446 | 0.160 | 0.021 | -0.112 | 0.894 | 0.483 |
| 14% yeast * water | -0.301 | 0.740 | 0.159 | 0.059 | -0.781 | 0.458 | <0.001 |

Table S3. Effect of diet and water supplementation on mortality within DGRP-217.

| coefficient | Estimates from individual model | | | | Effect of water, compared to no water | | |
|---|---|---|---|---|---|---|---|
| | estimate | exp | s.e. | p | estimate | exp | p |
| water supplementation | 0.190 | 1.209 | 0.213 | 0.373 | | | |
| 0.5% yeast | 0.454 | 1.574 | 0.211 | 0.032 | | | |
| 2% yeast | -1.395 | 0.248 | 0.208 | <0.001 | | | |
| 5% yeast | -0.549 | 0.578 | 0.212 | 0.01 | | | |
| 14% yeast | 1.905 | 6.716 | 0.200 | <0.001 | | | |
| 0.5% yeast * water | -0.108 | 0.898 | 0.306 | 0.724 | 0.082 | 1.08 | 0.789 |
| 2% yeast * water | -0.105 | 0.901 | 0.306 | 0.732 | 0.085 | 1.08 | 0.781 |
| 5% yeast * water | -0.470 | 0.625 | 0.300 | 0.117 | -0.280 | 0.75 | 0.350 |
| 14% yeast * water | -0.668 | 0.513 | 0.306 | 0.029 | -0.479 | 0.62 | 0.118 |

Table S4. Effect of diet and water supplementation on mortality within DGRP-239.

| coefficient | Estimates from individual model | | | | Effect of water, compared to no water | | |
|---|---|---|---|---|---|---|---|
| | estimate | exp | s.e. | p | estimate | exp | p |
| water supplementation | -0.343 | 0.710 | 0.105 | 0.001 | | | |
| 0.5% yeast | 0.946 | 2.575 | 0.104 | <0.001 | | | |
| 2% yeast | 0.070 | 1.072 | 0.104 | 0.502 | | | |
| 5% yeast | 0.094 | 1.098 | 0.103 | 0.363 | | | |
| 14% yeast | 0.572 | 1.771 | 0.103 | <0.001 | | | |
| 0.5% yeast * water | 0.173 | 1.188 | 0.148 | 0.243 | -0.170 | 0.843 | 0.249 |
| 2% yeast * water | 0.079 | 1.082 | 0.148 | 0.593 | -0.264 | 0.768 | 0.075 |
| 5% yeast * water | -0.108 | 0.898 | 0.147 | 0.464 | -0.451 | 0.637 | 0.002 |
| 14% yeast * water | -0.476 | 0.621 | 0.147 | 0.001 | -0.819 | 0.441 | <0.001 |

Table S5. Effect of diet and water supplementation on mortality within DGRP-362.

| coefficient | Estimates from individual model | | | | Effect of water, compared to no water | | |
|---|---|---|---|---|---|---|---|
| | estimate | exp | s.e. | p | estimate | exp | p |
| water supplementation | -2.330 | 0.097 | 0.363 | <0.001 | | | |
| 0.5% yeast | 0.763 | 2.144 | 0.356 | 0.032 | | | |
| 2% yeast | -1.520 | 0.219 | 0.383 | <0.001 | | | |
| 5% yeast | -2.638 | 0.072 | 0.351 | <0.001 | | | |
| 14% yeast | 2.393 | 10.950 | 0.339 | <0.001 | | | |
| 0.5% yeast * water | 2.358 | 10.571 | 0.545 | <0.001 | 0.028 | 1.029 | 0.958 |
| 2% yeast * water | 2.016 | 7.509 | 0.482 | <0.001 | -0.314 | 0.731 | 0.515 |
| 5% yeast * water | 2.213 | 9.145 | 0.597 | <0.001 | -0.116 | 0.890 | 0.845 |
| 14% yeast * water | -1.564 | 0.209 | 0.549 | 0.004 | -3.894 | 0.020 | <0.001 |

Table S6. Effect of diet and water supplementation on mortality within DGRP-853.

| coefficient | Estimates from individual model | | | | Effect of water, compared to no water | | |
|---|---|---|---|---|---|---|---|
| | estimate | exp | s.e. | p | estimate | exp | p |
| water supplementation | -0.473 | 0.623 | 0.259 | 0.067 | | | |
| 0.5% yeast | 1.987 | 7.293 | 0.239 | <0.001 | | | |
| 2% yeast | 0.150 | 1.162 | 0.254 | 0.554 | | | |
| 5% yeast | -0.967 | 0.380 | 0.248 | <0.001 | | | |
| 14% yeast | 2.955 | 19.204 | 0.223 | <0.001 | | | |
| 0.5% yeast * water | 0.436 | 1.547 | 0.399 | 0.274 | -0.037 | 0.964 | 0.926 |
| 2% yeast * water | 0.379 | 1.461 | 0.365 | 0.299 | -0.094 | 0.910 | 0.797 |
| 5% yeast * water | 0.680 | 1.973 | 0.373 | 0.068 | 0.206 | 1.229 | 0.58 |
| 14% yeast * water | -2.083 | 0.125 | 0.339 | <0.001 | -2.556 | 0.078 | <0.001 |

Table S7. Effect of diet on mortality across 5 water-supplemented DGRP lines (DGRP-195 is reference).

| coefficient | Full Model | | | |
|---|---|---|---|---|
| | estimate | exp | s.e. | p |
| 0.5% yeast | -0.345 | 0.709 | 0.228 | 0.131 |
| 2% yeast | -1.921 | 0.146 | 0.202 | <0.001 |
| 5% yeast | -1.060 | 0.347 | 0.224 | <0.001 |
| 14% yeast | 0.930 | 2.535 | 0.225 | <0.001 |
| 217 | 0.107 | 1.113 | 0.228 | 0.638 |
| 239 | 0.683 | 1.980 | 0.228 | 0.003 |
| 362 | -1.991 | 0.137 | 0.218 | <0.001 |
| 853 | -1.242 | 0.289 | 0.221 | <0.001 |
| 217 * 0.5% yeast | 0.658 | 1.931 | 0.320 | 0.04 |
| 217 * 2% yeast | 0.567 | 1.764 | 0.311 | 0.068 |
| 217 * 5% yeast | 0.096 | 1.101 | 0.321 | 0.764 |
| 217 * 14% yeast | 0.206 | 1.229 | 0.324 | 0.524 |
| 239 * 0.5% yeast | 1.771 | 5.877 | 0.318 | <0.001 |
| 239 * 2% yeast | 2.119 | 8.326 | 0.305 | <0.001 |
| 239 * 5% yeast | 1.042 | 2.834 | 0.321 | 0.001 |
| 239 * 14% yeast | -0.799 | 0.450 | 0.322 | 0.013 |
| 362 * 0.5% yeast | 3.937 | 51.246 | 0.315 | <0.001 |
| 362 * 2% yeast | 2.434 | 11.404 | 0.307 | <0.001 |
| 362 * 5% yeast | 0.691 | 1.995 | 0.318 | 0.03 |
| 362 * 14% yeast | -0.071 | 0.932 | 0.323 | 0.826 |
| 853 * 0.5% yeast | 3.228 | 25.234 | 0.312 | <0.001 |
| 853 * 2% yeast | 2.482 | 11.960 | 0.303 | <0.001 |
| 853 * 5% yeast | 0.739 | 2.094 | 0.322 | 0.022 |
| 853 * 14% yeast | 0.033 | 1.033 | 0.319 | 0.918 |

Table S8. Effect of diet on mortality within water-supplemented DGRP-195.

| coefficient | Estimates from individual model | | | |
|---|---|---|---|---|
| | estimate | exp | s.e. | p |
| 0.5% yeast | -0.512 | 0.599 | 0.098 | <0.001 |
| 2% yeast | -2.124 | 0.120 | 0.100 | <0.001 |
| 5% yeast | -1.322 | 0.267 | 0.102 | <0.001 |
| 14% yeast | 1.410 | 4.095 | 0.100 | <0.001 |

Table S9. Effect of diet on mortality within water-supplemented DGRP-217.

|  | Estimates from individual model | | | |
|---|---|---|---|---|
| coefficient | estimate | exp | s.e. | p |
| 0.5% yeast | 0.357 | 1.429 | 0.214 | 0.095 |
| 2% yeast | -1.487 | 0.226 | 0.215 | <0.001 |
| 5% yeast | -1.011 | 0.364 | 0.216 | <0.001 |
| 14% yeast | 1.260 | 3.527 | 0.215 | <0.001 |

Table S10. Effect of diet on mortality within water-supplemented DGRP-239.

|  | Estimates from individual model | | | |
|---|---|---|---|---|
| coefficient | estimate | exp | s.e. | p |
| 0.5% yeast | 1.114 | 3.046 | 0.119 | <0.001 |
| 2% yeast | 0.150 | 1.162 | 0.118 | 0.204 |
| 5% yeast | -0.012 | 0.988 | 0.117 | 0.919 |
| 14% yeast | 0.096 | 1.101 | 0.118 | 0.413 |

Table S11. Effect of diet on mortality within water-supplemented DGRP-362.

|  | Estimates from individual model | | | |
|---|---|---|---|---|
| coefficient | estimate | exp | s.e. | p |
| 0.5% yeast | 3.631 | 37.764 | 0.386 | <0.001 |
| 2% yeast | 0.518 | 1.678 | 0.379 | 0.172 |
| 5% yeast | -0.487 | 0.614 | 0.380 | 0.2 |
| 14% yeast | 0.920 | 2.509 | 0.379 | 0.015 |

Table S12. Effect of diet on mortality within water-supplemented DGRP-853.

|  | Estimates from individual model | | | |
|---|---|---|---|---|
| coefficient | estimate | exp | s.e. | p |
| 0.5% yeast | 2.811 | 16.623 | 0.222 | <0.001 |
| 2% yeast | 0.564 | 1.759 | 0.216 | 0.009 |
| 5% yeast | -0.284 | 0.753 | 0.216 | 0.19 |
| 14% yeast | 0.923 | 2.518 | 0.216 | <0.001 |

Table S13. Effect of diet and water supplementation on fecundity across 5 DGRP lines, derived from linear model estimates oflog-transformed raw fecundity counts (DGRP-195 is reference). Counts generated using QuantiFly software. Counts are relative, but directly comparable.

| coefficient | Full Model | | | Compared to 8% | |
|---|---|---|---|---|---|
| | estimate | s.e. | p | estimate | p |
| intercept | 2.731 | 0.067 | <0.001 | | |
| water | 0.039 | 0.027 | 0.15 | | |
| 0.5% yeast | -1.374 | 0.092 | <0.001 | | |
| 2% yeast | -0.595 | 0.092 | <0.001 | | |
| 5% yeast | -0.367 | 0.092 | <0.001 | | |
| 14% yeast | 0.157 | 0.092 | 0.09 | 2.888 | <0.001 |
| 217 | -0.044 | 0.092 | 0.634 | | |
| 239 | -0.331 | 0.095 | 0.001 | | |
| 362 | -0.294 | 0.092 | 0.002 | | |
| 853 | -0.221 | 0.095 | 0.021 | | |
| 217 * 0.5% yeast | 0.113 | 0.130 | 0.387 | | |
| 217 * 2% yeast | -0.268 | 0.134 | 0.048 | | |
| 217 * 5% yeast | -0.164 | 0.132 | 0.216 | | |
| 217 * 14% yeast | -0.224 | 0.132 | 0.092 | -0.110 | 0.404 |
| 239 * 0.5% yeast | 0.509 | 0.139 | <0.001 | | |
| 239 * 2% yeast | 0.310 | 0.139 | 0.027 | | |
| 239 * 5% yeast | -0.119 | 0.134 | 0.373 | | |
| 239 * 14% yeast | -0.262 | 0.136 | 0.056 | -0.436 | 0.001 |
| 362 * 0.5% yeast | 0.524 | 0.130 | <0.001 | | |
| 362 * 2% yeast | 0.212 | 0.130 | 0.106 | | |
| 362 * 5% yeast | 0.180 | 0.130 | 0.168 | | |
| 362 * 14% yeast | -0.202 | 0.130 | 0.122 | -0.339 | 0.009 |
| 853 * 0.5% yeast | 0.249 | 0.134 | 0.065 | | |
| 853 * 2% yeast | -0.233 | 0.132 | 0.079 | | |
| 853 * 5% yeast | -0.137 | 0.132 | 0.3 | | |
| 853 * 14% yeast | -0.657 | 0.134 | <0.001 | -0.721 | <0.001 |

Table S14. Effect of diet and water supplementation on fecundity across 5 DGRP lines, derived from linear model estimates oflog-transformed mortality-adjusted fecundity counts (DGRP-195 is reference). Counts generated using QuantiFly software. Counts are relative, but directly comparable.

| coefficient | Full Model | | | Compared to 8% | |
|---|---|---|---|---|---|
| | estimate | s.e. | p | estimate | p |
| intercept | 0.776 | 0.067 | <0.001 | | |
| water | -0.004 | 0.027 | 0.873 | | |
| 0.5% yeast | -1.379 | 0.093 | <0.001 | | |
| 2% yeast | -0.602 | 0.093 | <0.001 | | |
| 5% yeast | -0.384 | 0.093 | <0.001 | | |
| 14% yeast | 0.148 | 0.093 | 0.114 | 0.925 | <0.001 |
| 217 | -0.050 | 0.093 | 0.594 | | |
| 239 | -0.350 | 0.096 | <0.001 | | |
| 362 | -0.239 | 0.093 | 0.011 | | |
| 853 | -0.241 | 0.096 | 0.013 | | |
| 217 * 0.5% yeast | 0.101 | 0.132 | 0.444 | | |
| 217 * 2% yeast | -0.301 | 0.136 | 0.028 | | |
| 217 * 5% yeast | -0.113 | 0.134 | 0.398 | | |
| 217 * 14% yeast | -0.165 | 0.134 | 0.218 | -0.067 | 0.617 |
| 239 * 0.5% yeast | 0.542 | 0.141 | <0.001 | | |
| 239 * 2% yeast | 0.311 | 0.141 | 0.028 | | |
| 239 * 5% yeast | -0.120 | 0.136 | 0.378 | | |
| 239 * 14% yeast | -0.237 | 0.138 | 0.087 | -0.439 | 0.001 |
| 362 * 0.5% yeast | 0.485 | 0.132 | <0.001 | | |
| 362 * 2% yeast | 0.177 | 0.132 | 0.182 | | |
| 362 * 5% yeast | 0.186 | 0.132 | 0.16 | | |
| 362 * 14% yeast | 0.166 | 0.132 | 0.209 | 0.075 | 0.568 |
| 853 * 0.5% yeast | 0.284 | 0.136 | 0.038 | | |
| 853 * 2% yeast | -0.227 | 0.134 | 0.091 | | |
| 853 * 5% yeast | -0.111 | 0.134 | 0.406 | | |
| 853 * 14% yeast | -0.550 | 0.136 | <0.001 | -0.643 | <0.001 |