

Table S8. Proportion of major trait loadings for dominant functional traits along survival fitness pathways leading to lower (orange) or higher (blue) fitness for scale-eater phenotypes in Fig. 6.

Figure S1. Log-transformed lower jaw length versus log-transformed standard length for *a*) allopatric Cyprinodontidae species (black) and *b*) hybrid populations (one color per treatment) used in this study.

Figure S2. Histograms depicting the phenotypic variance of hybrid populations in high- (gray bars) and low-frequency (orange/blue) treatments in lake 1 (first row) and lake 2 (second row) on the first and second discriminant axes (LD1 and LD2 from Fig. 3).

Figure S3. Morphometric landmarks indicating the 28 linear distances, 3 angles (25-27), and standard length (SL) for *a*) lateral, *b*) close-up of the craniofacial region, *c*) dorsal view, and *d*) close-up of the injected coded wire tag in the dorsal musculature including injection site (note different hybrid image used here for clarity).

Figure S4. Growth rate fitness landscapes for *a*) high-frequency and *b*) low-frequency treatments in lake 1 (Crescent Pond).

Figure S5. Residual survival probability relative to the density of similar hybrid phenotypes in high- (first column) and low-frequency (second column) field enclosures.

Figure S6. Residual growth rate relative to the density of similar hybrid phenotypes in high- (first column) and low-frequency (second column) field enclosures.

Figure S7. Joint survival (first column) and growth (second column) fitness landscapes estimated across treatments and lake environments using generalized additive modeling.

Figure S8. Simulated 1%, 10%, and 20% effect sizes in the upper region (top fifth) of the survival fitness landscapes for both low-frequency field enclosures.