Figure S1. Energetic costs of the breeding migration scale superlinearly with structural mass in wild sockeye salmon.

A) Total energy content of female individuals of *Onchorhynchus tshawytscha* at the beginning of the breeding travel \( (E_{bt} = 14.57 \times \text{Structural mass} + 4.0085, \text{R-squared} = 0.845, \text{blue}) \) and at arrival in the spawning grounds \( (E_{at} = 6.3057 \times \text{Structural mass} + 9.5457, \text{R-squared} = 0.514, \text{red}) \) from Bowerman et al (2017) (data courteously provided by T. Bowerman). Structural mass was calculated from fork length \( L_f \) data \( \text{Structural mass} = dw \times (L_f \times sc)^3 \), where \( dw=1 \text{ g cm}^{-3} \) is the density of the organism and \( sc=0.2 \) is the shape coefficient for this species (Pecquerie et al. 2011).

B) Mass-specific energy expenditure calculated from the regression lines in A as the difference between the total energy content at the beginning of the breeding travel and at arrival in spawning grounds, divided by the structural mass \( \text{Energy spent during the breeding migration} = 8.26 - 5.54 \times (\text{structural mass})^{\frac{1}{3}} \).
Figure S2. Fitness components as a function of age when costs of the breeding migration are high, and under conditions of high (red lines) and low (blue lines) food abundance in the ocean. The maturation threshold is A) 25 cm and B) 30 cm. Structural (solid line) and reversible mass (dashed lines) are shown in the top panels, cumulative fecundity in the middle panels, and expected reproductive output in the bottom panels. Individuals start their life in the freshwater habitat (background yellow region), later they smolt and migrate to the ocean (background blue region). After reaching maturity, individuals migrate yearly back to the freshwater habitat to breed (background grey lines). Costs of migration $C$ are 3, and feeding level in the ocean $f_s = 0.6$ when low and $f_s = 0.8$ when high. Other parameter values as in table 1.
Figure S3. Lifetime reproductive output (color scale) as a function of the costs of the breeding migration and the feeding level in the ocean when the costs of the breeding migration scale sublinearly (left) and superlinearly (right) with structural mass. Other parameter values as in table 1.
Figure S4. Population biomass dynamics when costs of the breeding migration are low (black line) and high (grey line), and the costs of the breeding migration scale A) sublinearly ($\gamma = 0.8$) and B) superlinearly ($\gamma = 1.2$) with the structural mass. Feeding level in the ocean $f_s$ is initially 0.8 times the amount of food ad libitum (time 0 to 20 years) and drops to 0.5 after year 20 (dashed line). Costs of the breeding migration C are 10 (when low) and 15 (when high) in A, and 0.1 and 0.5 in B. Other parameter values as in table 1.
Figure S5. Observed energy density and body length of Sacramento River Chinook Salmon before (blue circles) and after the habitat switch (red crosses) (Kruskal-Wallis test $p<0.001$). Modified from Fig. 5 in Martin et al. (2017).
Figure S6. Effect of step-up food change on fecundity per unit of biomass in six species. To allow comparison between species the mean fecundity of control individuals (constant high food) is normalized to 1 and the fecundity of individuals that experience a change in food is a fraction of 1. The errorbars represent the standard deviation. See supplementary material; table S1.