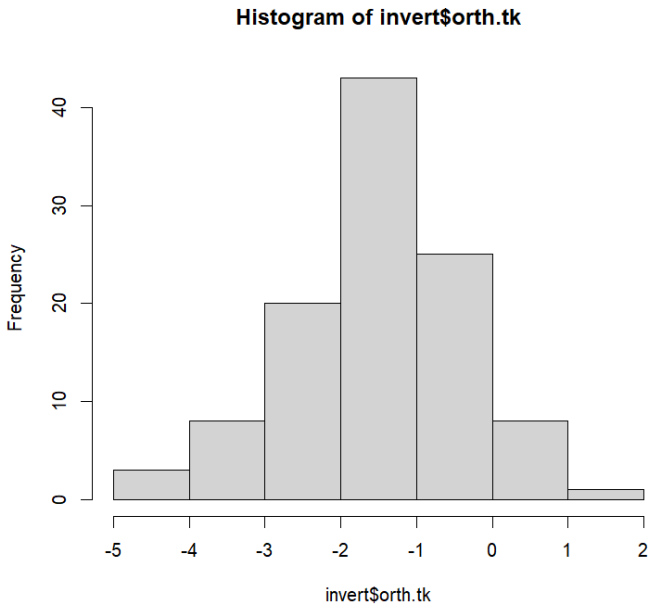
Appendix 6. Report on data transformations: Nestling condition of a grassland bird is not associated with food availability in restored grasslands.

Transformation mentioned herein were made according to Tukey's Ladder of Powers using Rcompanion (Mangiafico 2019). Specific transformations per response variable are described in manuscript.

Invertebrate and orthopteran biomass were not normal/right-skewed (Shapiro-Wilk p<0.01e-10) and transformations selected normalized the responses (total invert biomass Shapiro-Wilk W=0.986, p=0.307) or nearly so in the case of orthopteran biomass (Shapiro-Wilk W=0.973, p=0.028, though the data appear normally distributed – see Figure S1).

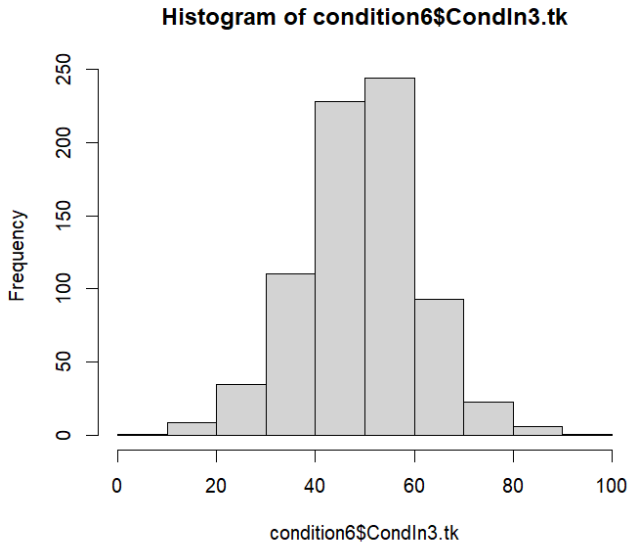
Figure A6.1. Frequency histogram of transformed (log) orthopteran biomass variable "orth.tk."



None of the per-nestling condition indices (mass-age residuals, mass-tarsus residuals, TRIG, SD tarsus at nest level) were normally distributed (all Shapiro-Wilk p<0.01e9). Transformations of nestling-level condition indices approached normality:

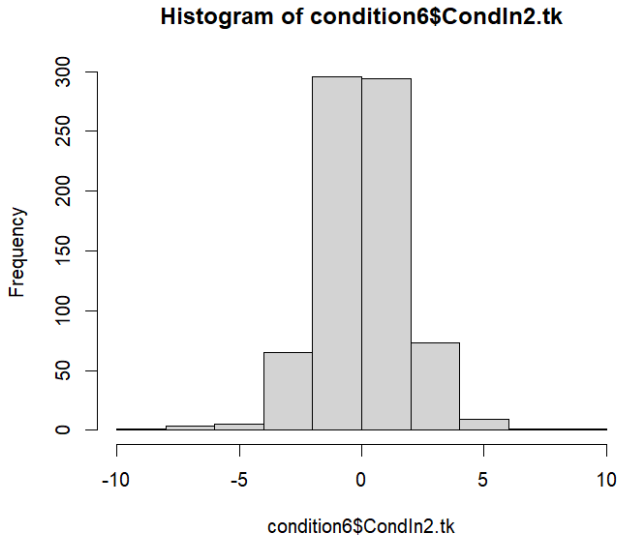
- Mass-age (day 6) residuals, Shapiro-Wilk p=0.01, but the histogram of this response appears sufficiently normally distributed (Figure S2).

Figure A6.2. Frequency histogram of transformed ($x^{1.5}$) mass-age (day 6) residuals ("CondIn3.tk") of Dickcissel nestlings.



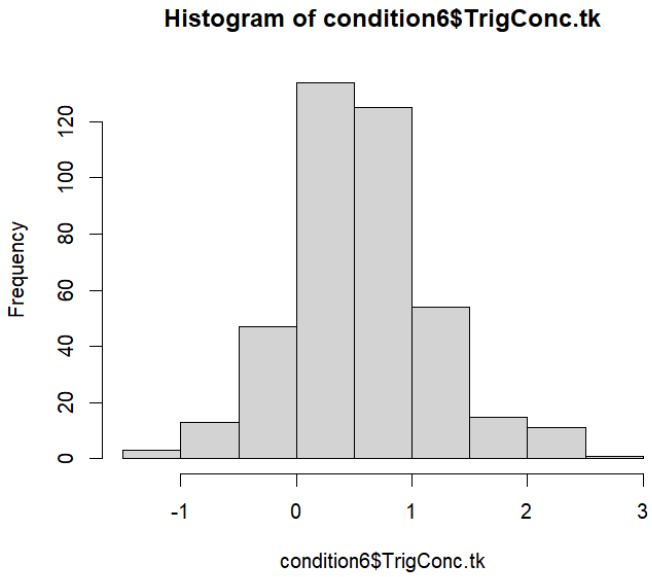
- Mass-tarsus residuals still not able to be improved toward normality by Rcompanion (x^1 selected as best transformation), but the histogram of this response has a convincing unimodal distribution (Figure S3).

Figure A6.3. Frequency histogram of untransformed (x^1) mass-tarsus residuals ("CondIn2.tk") of Dickcissel nestlings.



- Plasma triglycerides (TRIG) did not significantly approximate normality (p=0.001) after the selected $x^{1.5}$ transformation, but again, the data visually appear to approximate a normal distribution (Figure S4).

Figure A6.4. Frequency histogram of transformed ($x^{1.5}$) plasma triglyceride levels ("TrigConc.tk") of Dickcissel nestlings.



Means of nestling condition indices across nestlings per nest, then per field, were not normally distributed, despite predictions of the central limit theorem (mean of means ~ normality). Shapiro-Wilk tests:

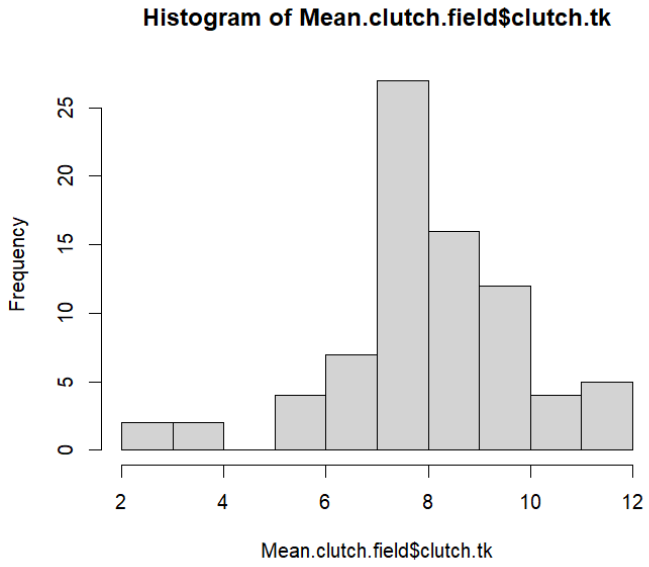
- Mass-age (day 6) residuals, p<0.0001 (right skewed)
- Mass-tarsus, p=0.02 (right skewed)
- SD tarsus, p<0.01e-5 (right skewed)
- TRIG, p<0.01e-5 (right skewed)

Transformations of field-level means of nestling condition indices made improvements toward normality (Shaprio-Wilk test p-values shown):

- Mass-age (day 6) residuals, transformed as $-1/x^{1.5}$, p=0.082 (normally distributed)
- Mass-tarsus residuals, p=0.02 (only slightly right skewed) (but Rcompanion selected x^1 as best—i.e., no—transformation)
- SD of tarsus length, transformed as $x^{0.5}$, p=0.002 (slightly right skewed)
- TRIG, transformed as $x^{0.5}$, p=0.352 (normally distributed)

Field-level means of clutch size and maximum brood size were also compared to field-level arthropod biomass. Mean clutch size was not normally distributed (Shapiro-Wilk p<0.01e-5) and neither was mean maximum brood size (p=0.02). The best transformation for mean clutch sizes ($x^{1.5}$) still did not statistically approximate a normal distribution (p=0.0002) but was unimodal (Figure S5). Transformed field level means ($x^{1.5}$) of maximum brood size were similarly not normally distributed (p=0.02), but being only slightly right skewed (Figure S6).

Figure A6.5. Frequency histogram of transformed ($x^{1.5}$) mean clutch size ("clutch.tk") per study field in Dickcissel nests.



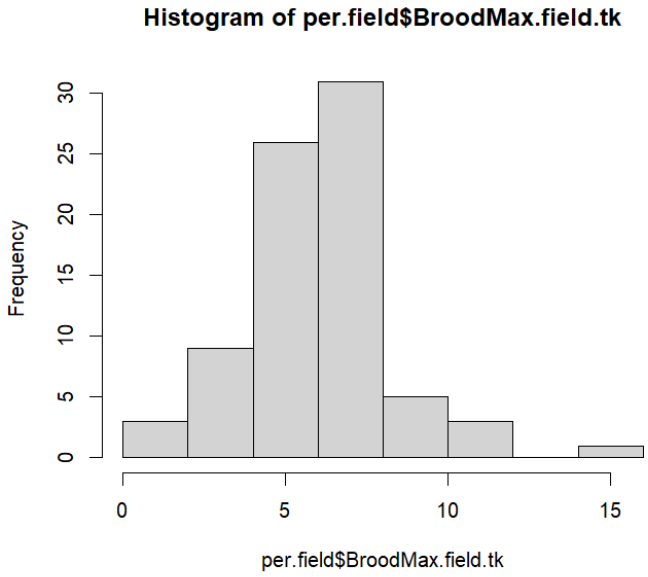


Figure A6.6. Frequency histogram of transformed ($x^{1.5}$) mean, maximum brood size ("clutch.tk") per field in Dickcissel nests. Brood size here includes Dickcissels and Brown-headed Cowbirds.

LITERATURE CITED

Mangiafico, S. 2019. Rcompanion: functions to support extension education program evaluation. R
package version 2.3.7. https://CRAN.R-project.org/package=rcompanion.