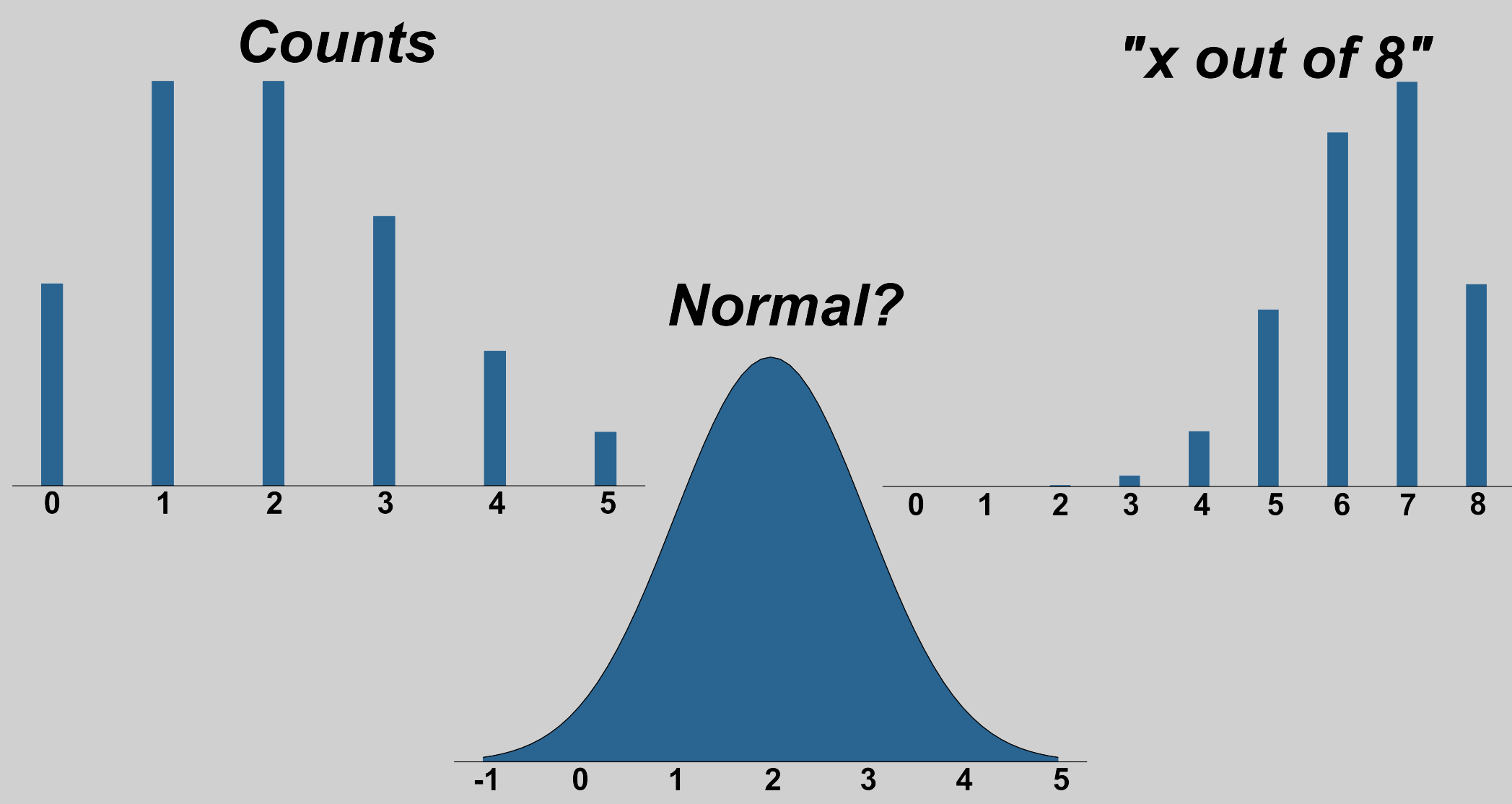


# Ecotoxicology is not normal.

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## Most eco(toxico)logical data is not normally distributed



- Usually analysed by
  - transforming data (e.g.  $\log(Ax + C)$ ,  $x^{0.5}$ ,  $\arcsine x^{0.25}$ ) for linear model [1]
  - non-parametric methods [2]
- Generalized Linear Models* (GLM) an alternative to direct model such data
- Can GLMs enhance inference in ecotoxicology?

## Methods: Simulation study

- Simulated count and binomial data
- One-factorial design
- Benchmarks:
  - Power
  - Type I error
- Variates:
  - Number of replicates
  - Abundance
  - Effect size
  - Methods
- Endpoints:
  - Global Treatment effect
  - LOEC

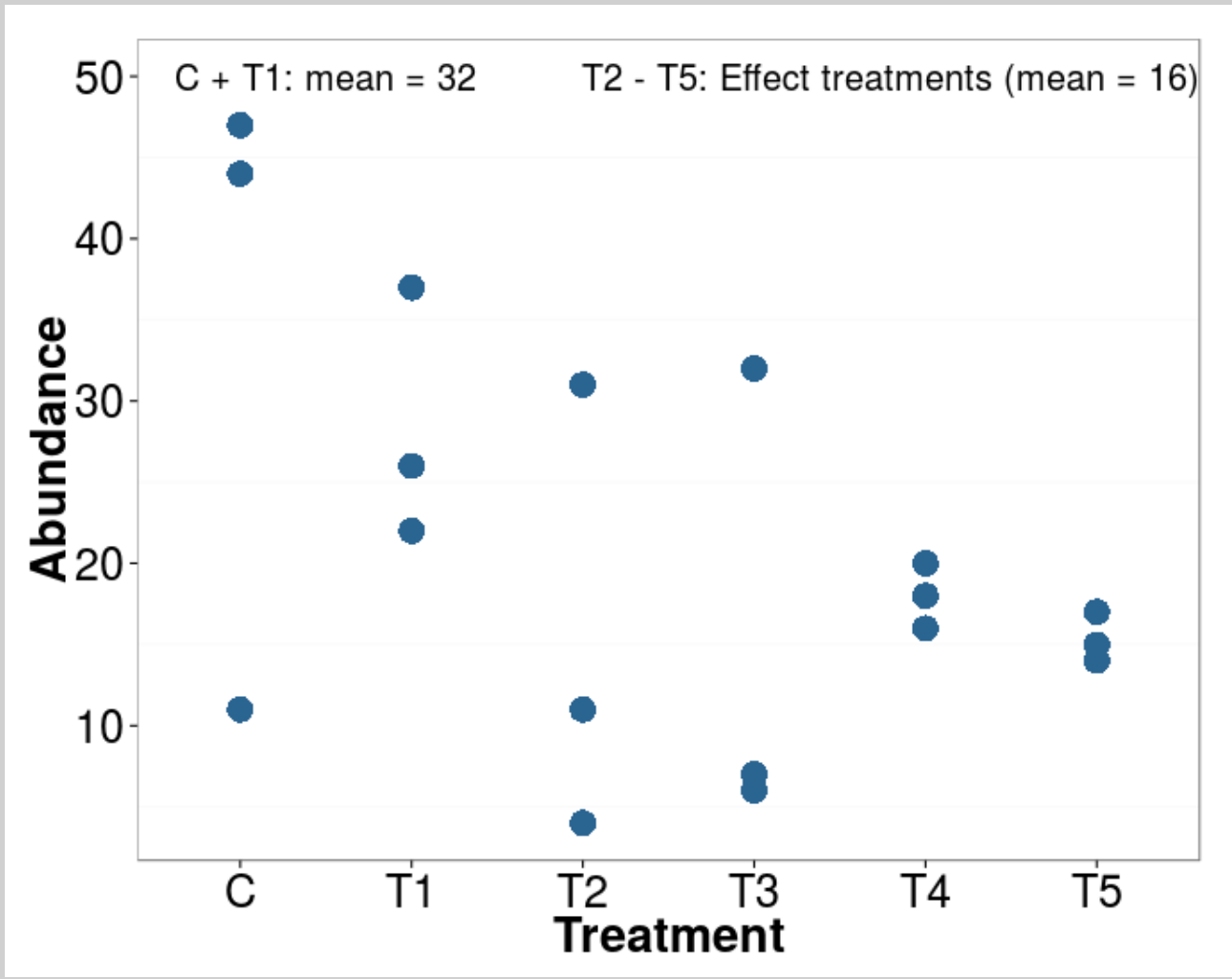


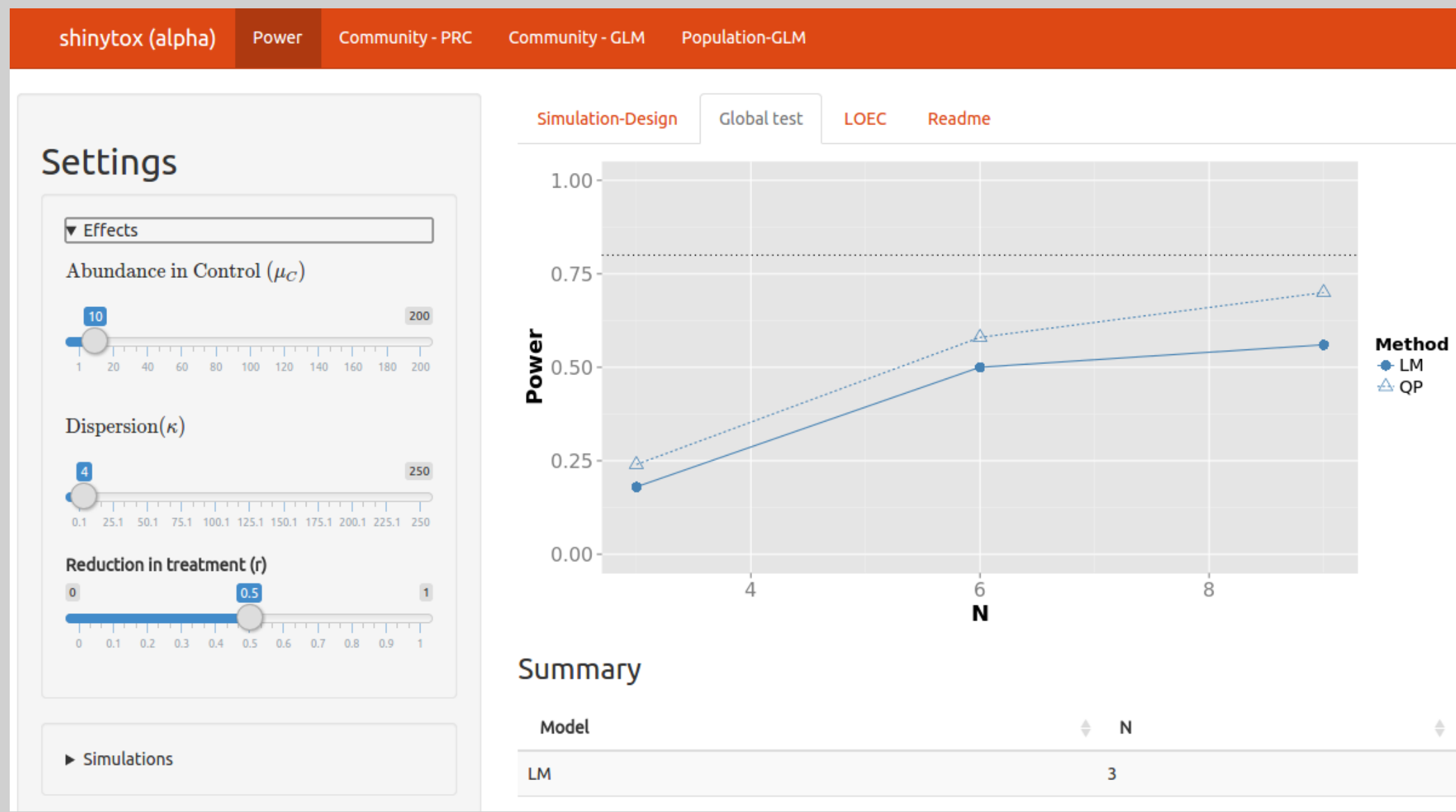
Figure 1 : A realised simulation.  $N = 3$ , mean = 32, effectsize = 50%

## Results: Type I errors

## Results: Power

## Power estimation app

- For "a priori" power calculations
- web based, easy to use, for one factorial designs
- Currently hostet at <http://52.28.43.83/shinypower/>



## Conclusions

- Low power at common experimental designs (NOEC!?)
- Change your model, not your data!
- Negative binomial GLM not recommended (but see bootstrap).

## References

- [1] Michael C Newman. *Quantitative ecotoxicology*. Taylor & Francis, Boca Raton, FL, 2012.
- [2] M. Wang and M. Riffel. Making the right conclusions based on wrong results and small sample sizes: interpretation of statistical tests in ecotoxicology. *Ecotoxicology and Environmental Safety*, 74(4):684–92, 2011.

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