

# 8. How To Reject A Paper That Uses SEM

## 8. Is SEM Necessary?

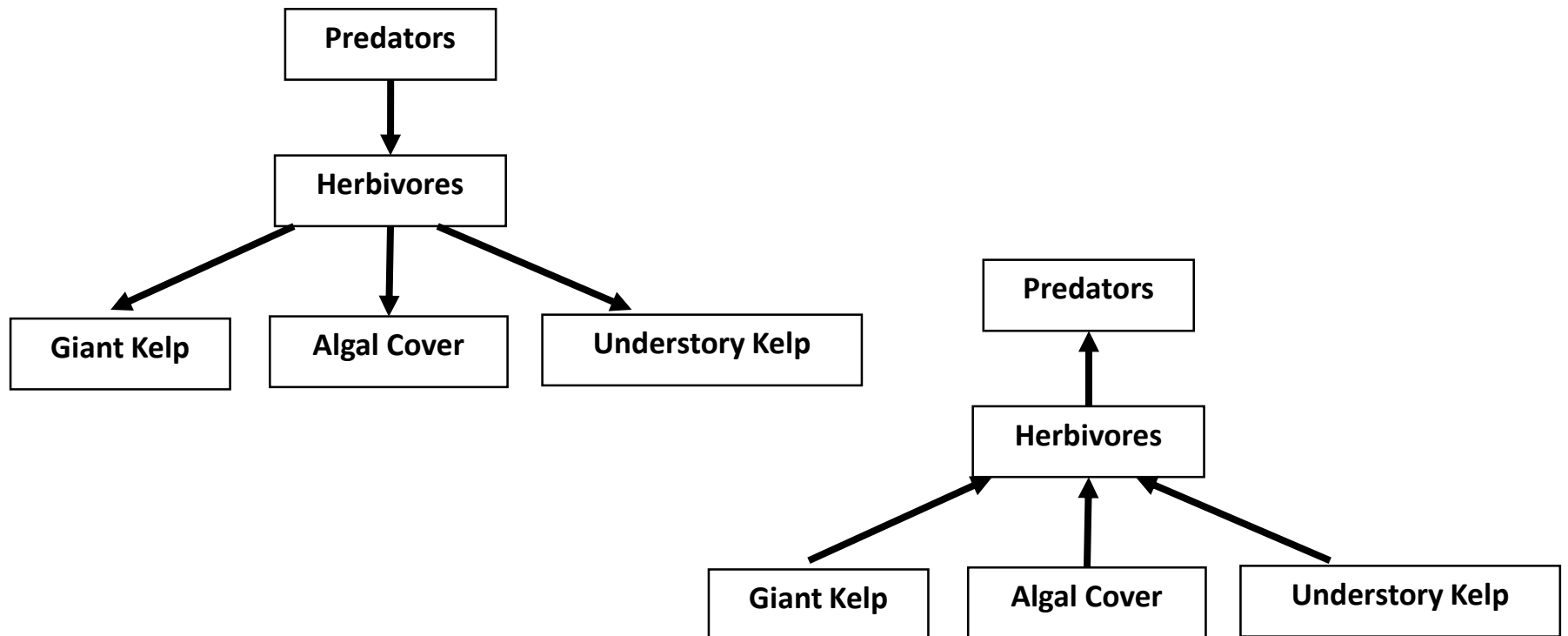
- Is SEM necessary to accomplish the goals of the paper?
- Does the question benefit from a network approach?
- Was the study/experiment designed to accommodate SEM?
  - Replication (power)
  - Identification

# Overview

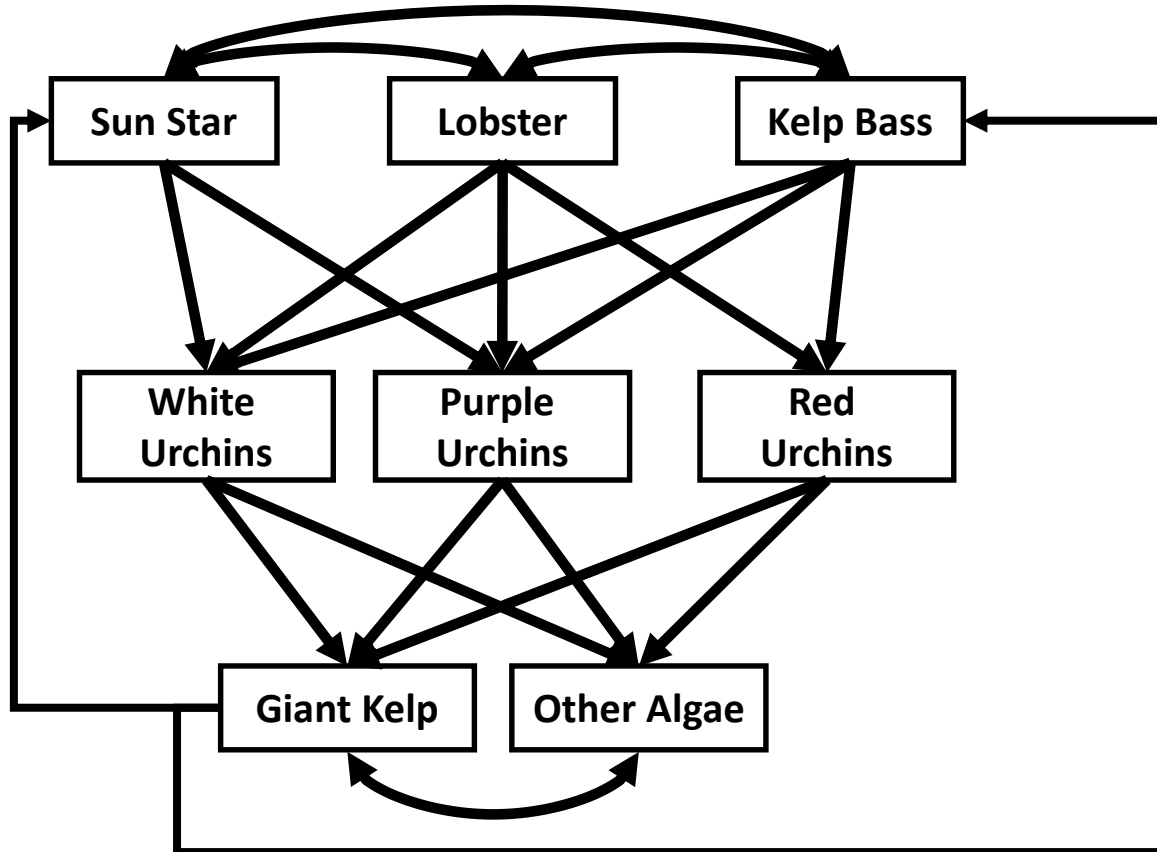
1. Model specification
2. Checking fit & assumptions
3. Interpretation

# 8.1 Specification.

- Justification using a meta-model (rooted in theory)
- Did the authors consider alternate hypotheses?



# 8.1 Specification. Parsimony



What will we learn from this model?

How is it being a multivariate model useful?

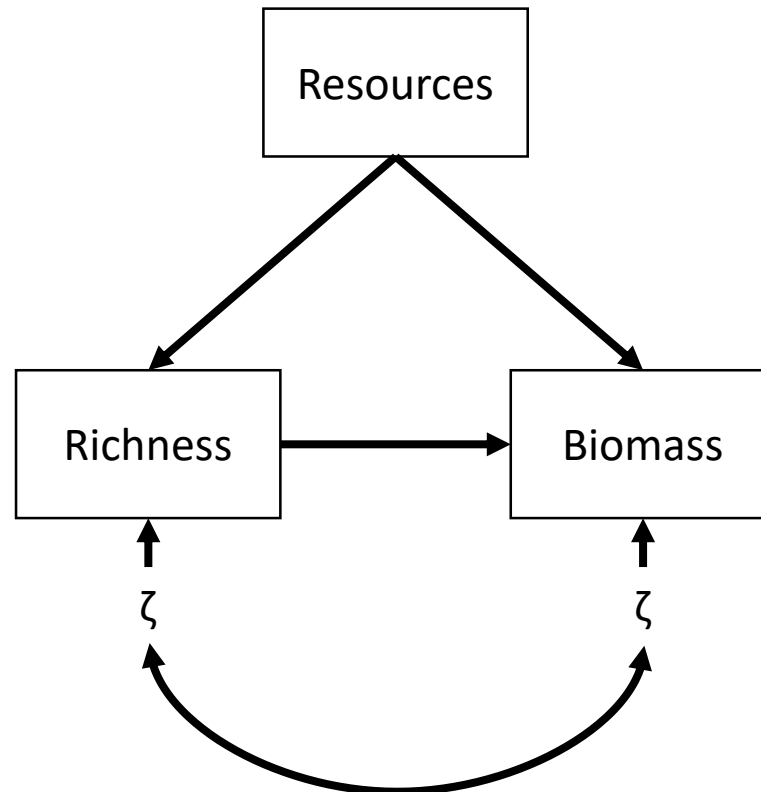
Would a simpler model better represent processes we can detect given our data?

Will including all of these paths lead to excessive parameter uncertainty?

Can we even estimate the overall fit of the model?\*

## 8.1 Specification. Correlated errors

- Are relationships directional or correlated errors?
- Everything is correlated! Choose wisely...



## 8.2 Assumptions. Linearity

- Did the authors check for linearity?
  - Reviewed MS where conceptual figures showed curvilinear relationships, yet the authors fit linear models...

## 8.2 Assumptions. Normality

- Did the authors check for multivariate normality?  
(easier said than done)
  - If variables are non-normal, did they transform or fit to a different distribution?
- Did the authors explore residuals from the model output? (Q-Q plots)
- Did they screen for outliers?



## 8.2 Assumptions. Independence

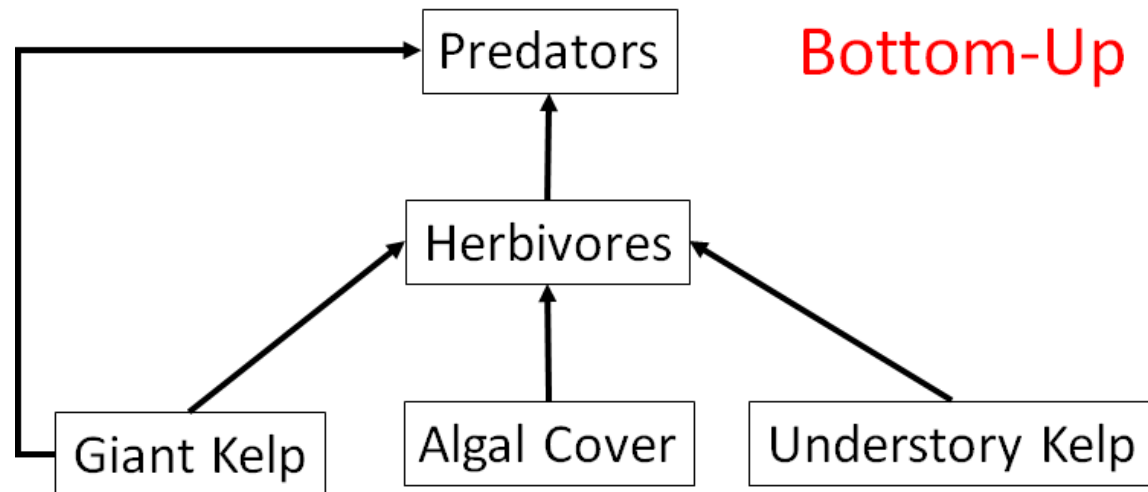
- Did the authors assume data points are independent?
  - Should they be?
- If not, did they correctly test for and address the non-independence?
  - Mixed models
  - Correlation structures
- Is there evidence their estimates could be biased by collinearity?
  - Study design (time, space)
  - Sampling
  - Centering

## 8.2 Assumptions. Model fit

- Did the authors assess model fit?
  - Do they provide a global fit statistic?
  - *Did they interpret it correctly??* ( $P > 0.05$  is GOOD!)
- Did the authors look at the fits of the individual models?
  - $R^2$
  - Fitted vs. residuals

## 8.3 Interpretation. Remember biology

- Are estimates biologically relevant?
  - $P < 0.001$  but  $\beta = 1 \times 10^{-18}$
- Do the paths reconcile with the hypothesis & study system?



What if you fit this model, and all paths were significant. You have good model fit. Variables were even well predicted, but...

**ALL OF THE PATH COEFFICIENTS WERE NEGATIVE**

## 8.3 Reproducibility

- Did the authors include data or a script so that their analysis is reproducible?
  - Requirement at most journals now
  - Meta-data, meta-data, META-DATA!!

# 9. Parting Thoughts

## 9. Think Critically!

- SEM is a tool, it is up to the user to employ it thoughtfully
- Don't rely on the statistics as much as what you know about biology and ecology
  - If the answer doesn't make sense, assume the model or test is wrong!

# 9. Report Bugs

- Software is imperfect
  - Bugs are constantly found and squashed



# 9. Report Bugs

- Contact the package author
  - `help("piecewiseSEM")`

piecewiseSEM-package {piecewiseSEM}

R Documentation

## Piecewise Structural Equation Modeling

### Description

Implements piecewise structural equation modeling in R, complete with goodness-of-fit tests and retrieval of model coefficients. Compared with traditional variance-covariance based SEM, piecewise SEM allows for fitting of models to different distributions and/or incorporates hierarchical/nested random structures.

Supported model classes include: `lm`, `glm`, `glm.nb`, `gls`, `pgls`, `lme`, `glmmPQL`, and `merModLmerTest`.

### Details

Package: piecewiseSEM

Type: Package

Version: 1.0.4

Date: 2016-02-09

Depends: R (3.2.X), ggm, lavaan

Suggests: MASS, lmerTest, nlme

License: MIT

The primary functions in the package are [sem.fit](#) which performs goodness-of-fit tests, and [sem.coefs](#) which returns path coefficients (standardized, if specified) and standard errors.

### Author(s)

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# 9. Report Bugs

GitHub

## Open a bug on GitHub

[Sign up](#) [Sign in](#)

jslefcbe / **piecewiseSEM** Watch 3 Star 11 Fork 5

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[Labels](#) [Milestones](#) [New issue](#)

11 Open ✓ 33 Closed Author ▾ Labels ▾ Milestones ▾ Assignee ▾ Sort ▾

- Dealing with transformed vars when standardize = "scale" in sem.coefs**  
#45 opened 7 days ago by jslefcbe 0
- Interactions & main effects in basis set**  
#44 opened 9 days ago by jslefcbe 2
- get.model.control fails in lme4 1.1-11**  
#43 opened 9 days ago by jslefcbe 0
- Including corr.errors with sem.coefs gives an error**  
#41 opened 21 days ago by jebyrnes 1
- sem.coeff does not standardize coefficients when offsets are included in the models**  
#40 opened 22 days ago by srgriffin108 2
- `get.random.formula` does not like uncorrelated intercepts**  
#39 opened 28 days ago by jslefcbe 0
- sem.model.fits reports marginal AIC**  
#32 opened on Dec 3, 2015 by jslefcbe 0
- What to do with standardized interactions?**  
#31 opened on Oct 19, 2015 by jslefcbe 2
- Entering interactions where orders are switched in subsequent models generates inconsistent basis set**  
#30 opened on Aug 25, 2015 by jslefcbe 0

