Modeling PalEON biomass

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Outline

1. Data
   - Overview of the data
   - Models
2. Methodological details
   - Branching process details

Goal

- Produce a model of per-species biomass at time of settlement

Table of Contents

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Data

- Computed from settlement-era survey
- Working with composition, biomass, and stem density

Table of Contents

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Models

There are two divisions for modeling biomass data:

Model			Estimation method: Splines	GMRF	GLM
	One-stage	Zero-inflated gamma			
		Tweedie			
	Two-stage	Bernoulli-Gamma			

Two-stage models

- First stage: zero/non-zero
  - Logistic regression
  - $Z \sim \text{Bernoulli}(\gamma)$
  - $\text{logit}(\gamma) = f(x, y, p_k)$
- Second stage: distribution of positive biomass
  - $Y|Z = 1 \sim \text{Gamma}(\alpha, \beta)$
  - $\text{E}(Y|Z = 1) = \mu = \alpha\beta = f(x, y, p_k)$

Tweedie model

The Tweedie model is a Gamma-Poisson mixture.
How to visualize a Tweedie random variable:

- Draw $N \sim \text{Poisson}(\lambda)$
- Now make N iid draws: $V_\ell \sim \text{Gamma}(\alpha, \beta)$
- $Y = \sum_{\ell=1}^{N} V_\ell$

GLMs, Independent observations

GMRF

Splines

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