Risk Factors for Fouling Biomass: Evidence from Small Vessels in Australia

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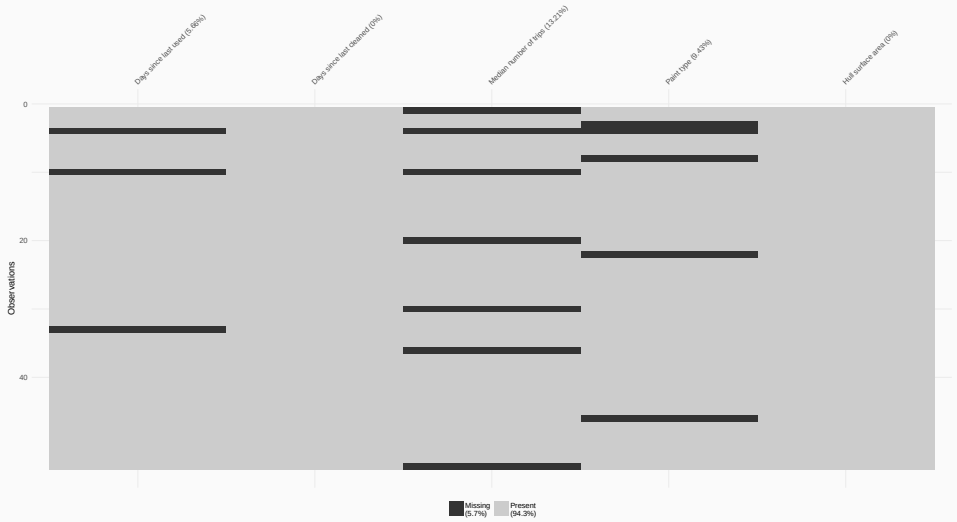
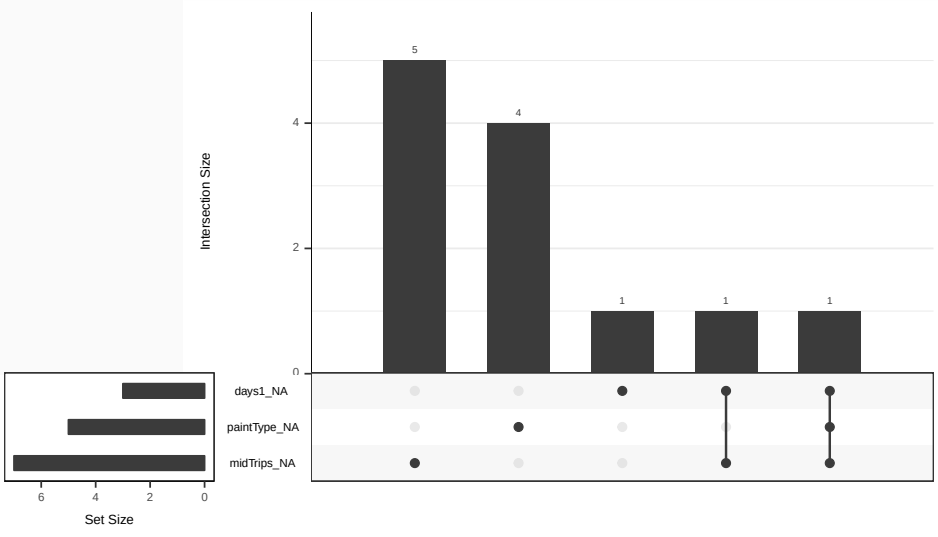
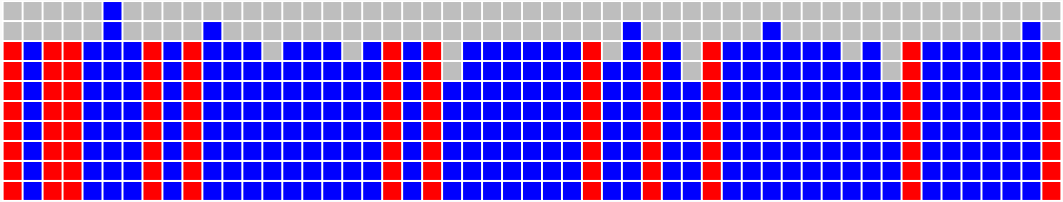
Missingness (Vessels)



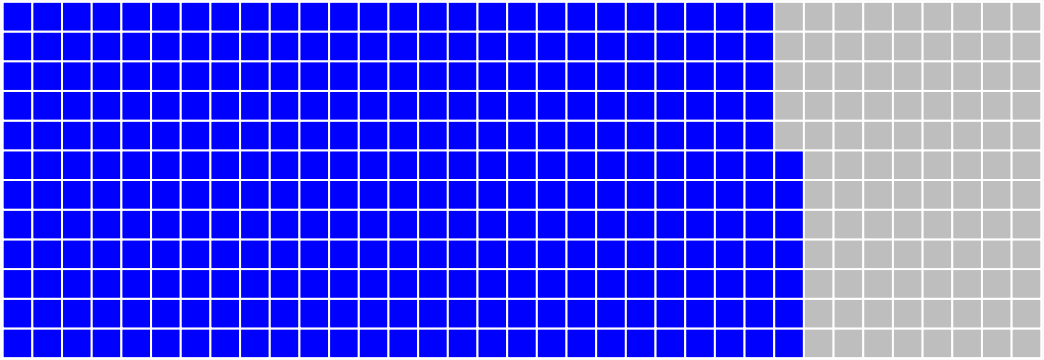
Missingness (Vessels)



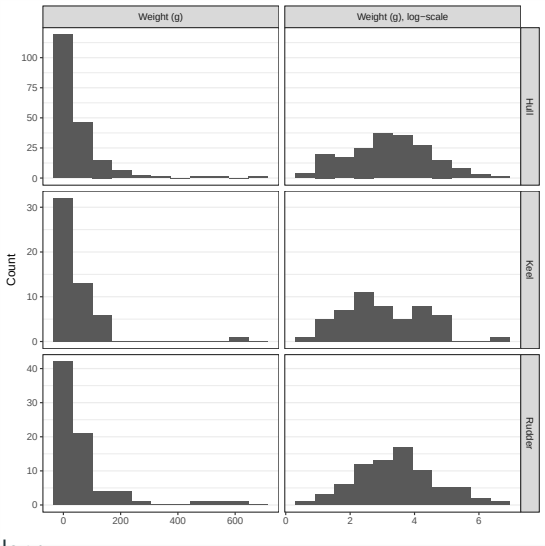
Missingness (Samples)



Censoring



Distribution



How to Model?

1. Set the samples below LOD to the 'middle' value
2. Remove those samples completely
3. Calculate the mean wet weight biomass (for the outcome)
4. Remove any observations with missing covariates
5. Finally, a simple regression model

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Or not!

Model Algorithm

- Repeat the following a 'sufficient' number of times:
  - Summarise wet weight biomass by median (within vessel)
  - Impute (via chained equations) missing vessel data
  - Fit a censored regression (using Stan/HMC)

$$L(\theta) = \prod_{i=1}^{n} f_Y(y_i; \theta, x)^{I(y_i > c)} F_Y(c; \theta, x)^{I(y_i \leq c)}$$

- Collate chains and summarise.

Model Formulation

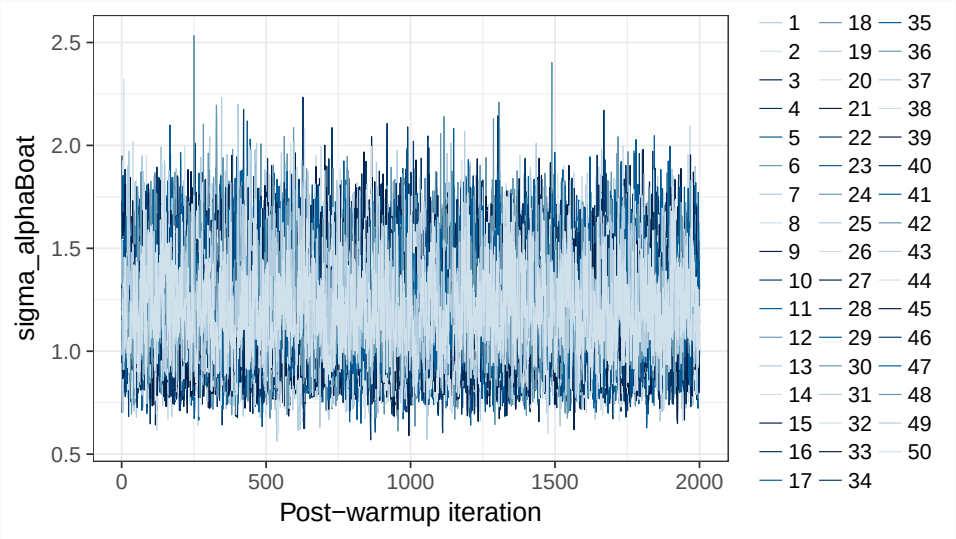
$$Y_i \sim t_\nu(\mu_i, \sigma)$$

$$\mu_i = \mu + \gamma_{j[i]} + \beta_{l[i]}$$

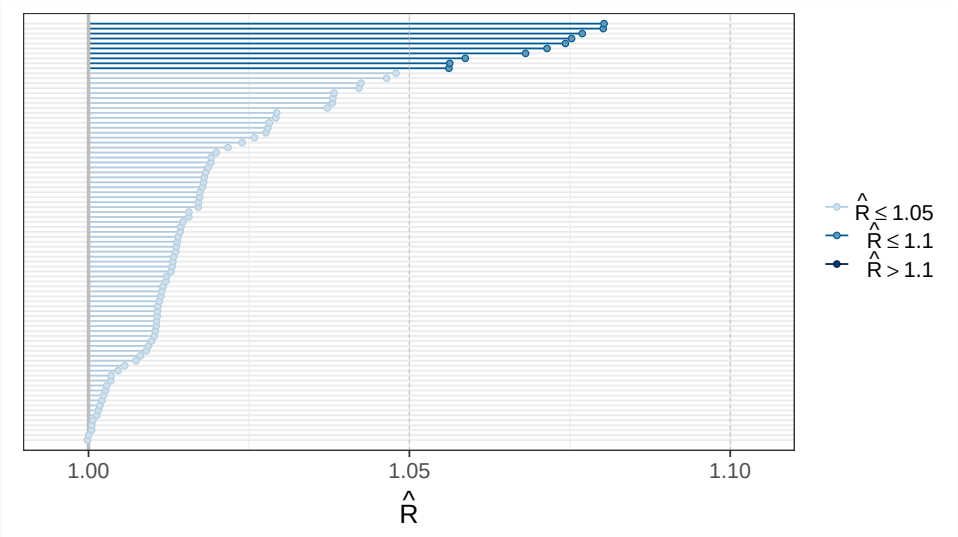
$$\gamma_j^* = \alpha_j + \beta_{d1} \cdot \text{days1}_j + \beta_{d2} \cdot \text{days2}_j + \beta_m \cdot \text{midTrips}_j + \beta_h \cdot \text{hullSA}_j + \beta_{p[j]} + \beta_{t[j]} +$$

$$(\text{M1}) + \beta_{dt[j]} \cdot \text{days1}_j + \beta_{mt[j]} \cdot \text{midTrips}_j + \beta_{mp[j]} \cdot \text{midTrips}_j$$

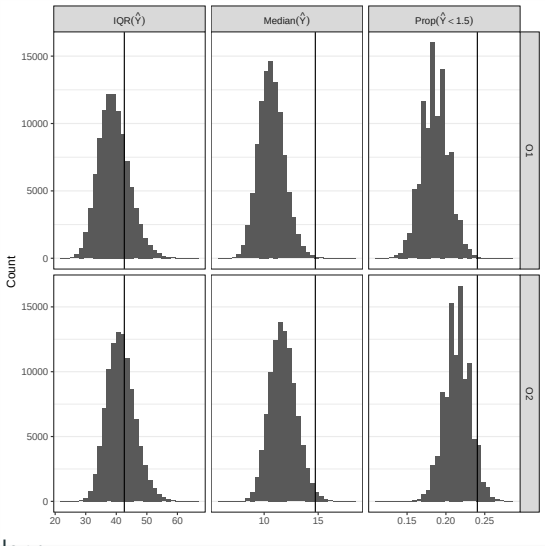
Diagnostics



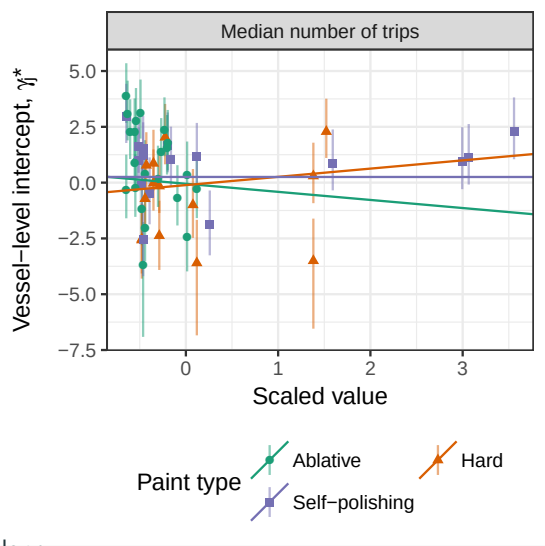
Diagnostics



Posterior Predictive Checks



Graphical Summary



Concluding Remarks

- Relationships are largely consistent with prior expectations
- Limited vessels meant limited precision to estimate vessel-level effects
- 'Simple' models inappropriate
- Mixture model could be a possibility (but again, limited data)