

Sensitivity study of the Icelandic Atlantis model

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Introduction

- Sensitivity analysis of an ecosystem model can give insight into what parameters contribute to uncertainty in the output.
- It can also be helpful in understanding behaviour and functioning of the system.
- Sensitivity study of recruitment and growth parameters in the Icelandic Atlantis model was carried out.
- The Atlantis model
 - Oceanographic, biology and fisheries model
 - 52 functional groups and 10 age classes
 - 52 spatial boxes and 7 layers

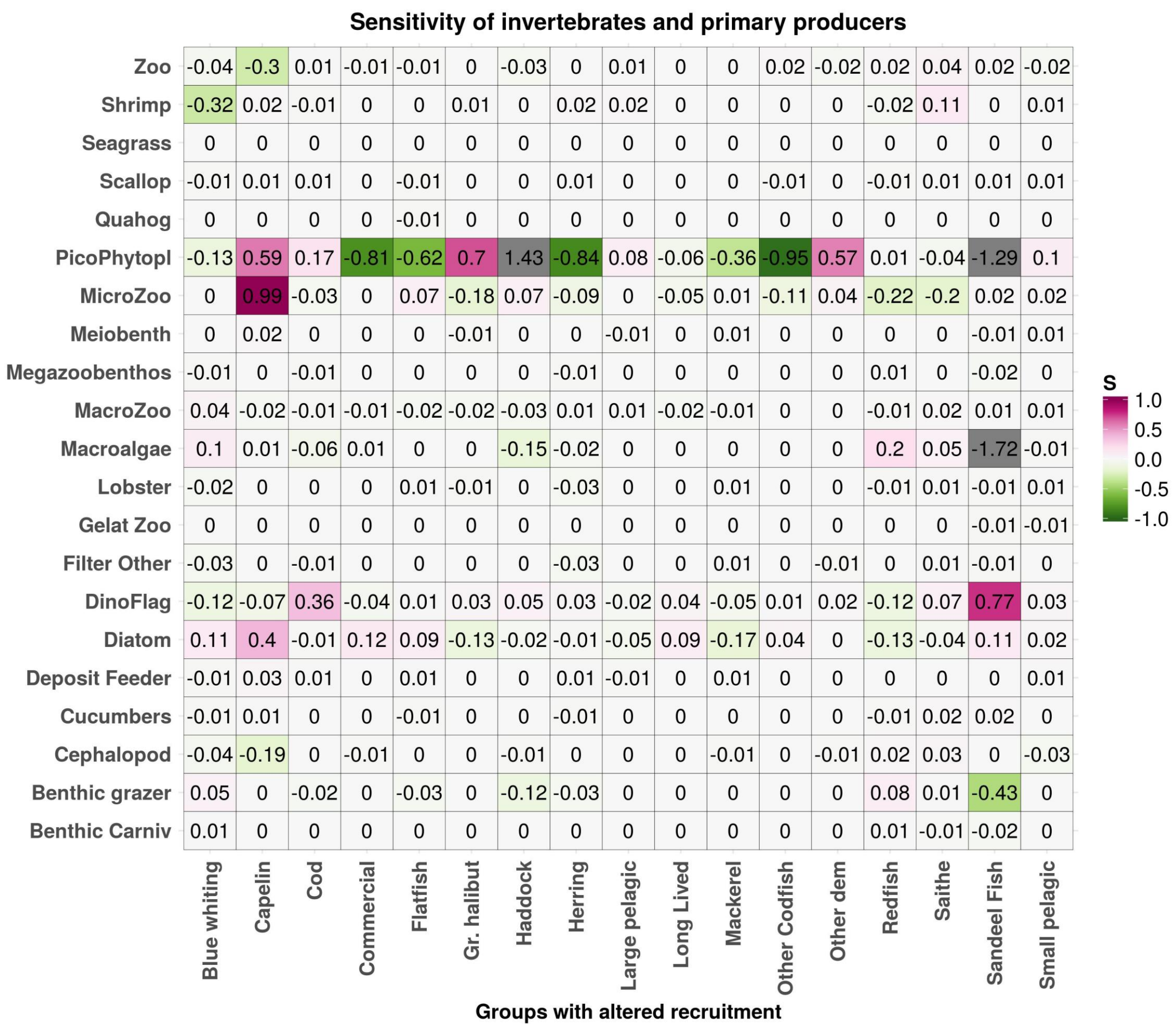
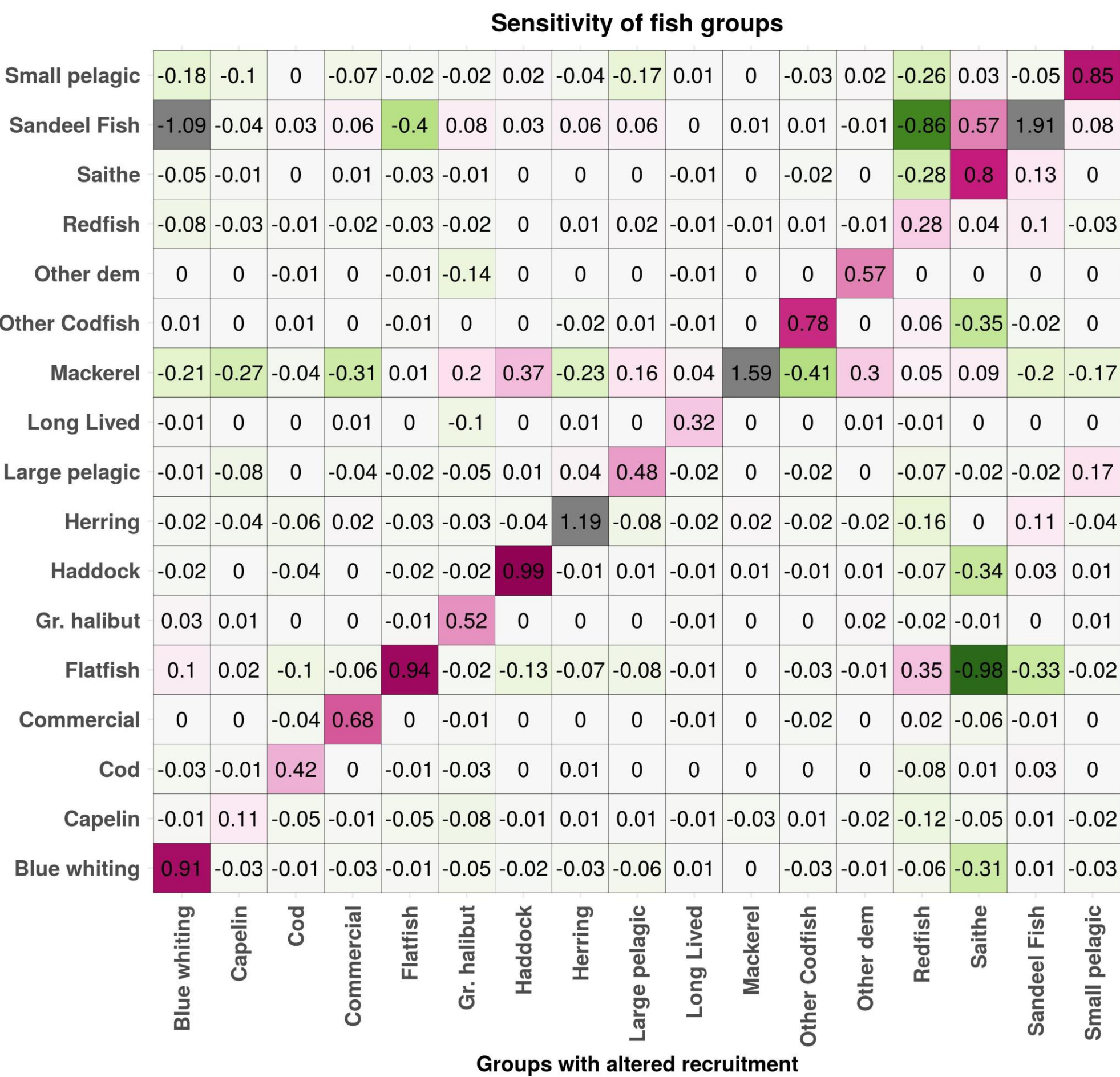
Methods

- Maximum recruitment (α) in the Beverton-Holt function was altered by $\pm 20\%$
$$Rec = \frac{\alpha * SSB}{\beta + SSB}$$
- The maximum growth rate (mum) in Holling II was altered by $\pm 20\%$ for zooplankton.
$$Cons = \frac{C \cdot B}{1 + \frac{C}{mum} [B \cdot E]}$$
- Growth rate for phytoplankton altered by $\pm 20\%$.
- Interactions between ZL, PS and PL studied.

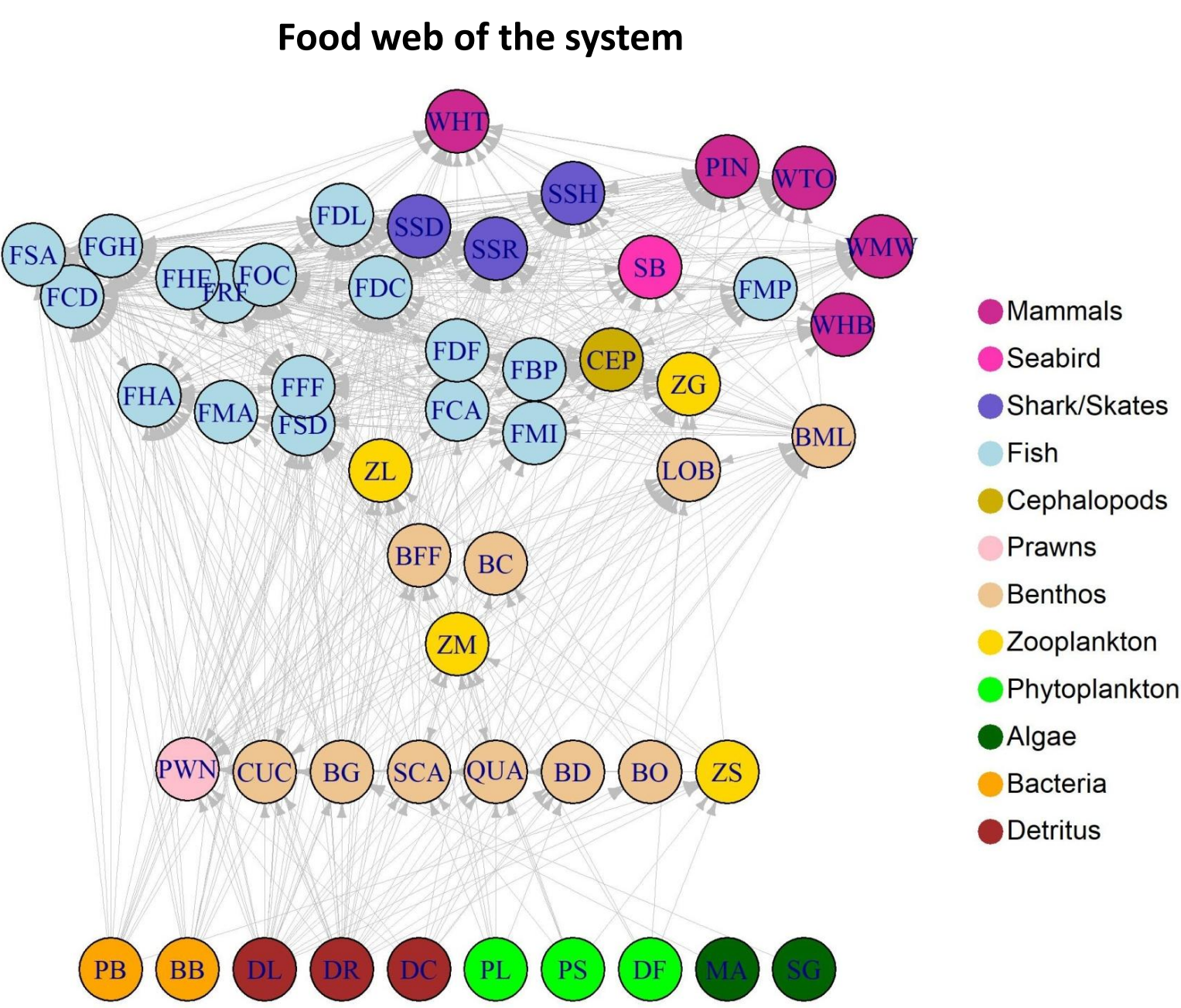
Measure of sensitivity

- Average biomass over the whole simulated period (65 years) used to measure sensitivity.
- Sensitivity of recruitment parameters measured with:
$$S_{ij} = \frac{V_i(1.2\alpha_j) - V_i(0.8\alpha_j)}{0.4V_i(\alpha_j)}$$
- Sensitivity of growth parameters and their interactions measured with percentage change in biomass.

Sensitivity of recruitment parameters

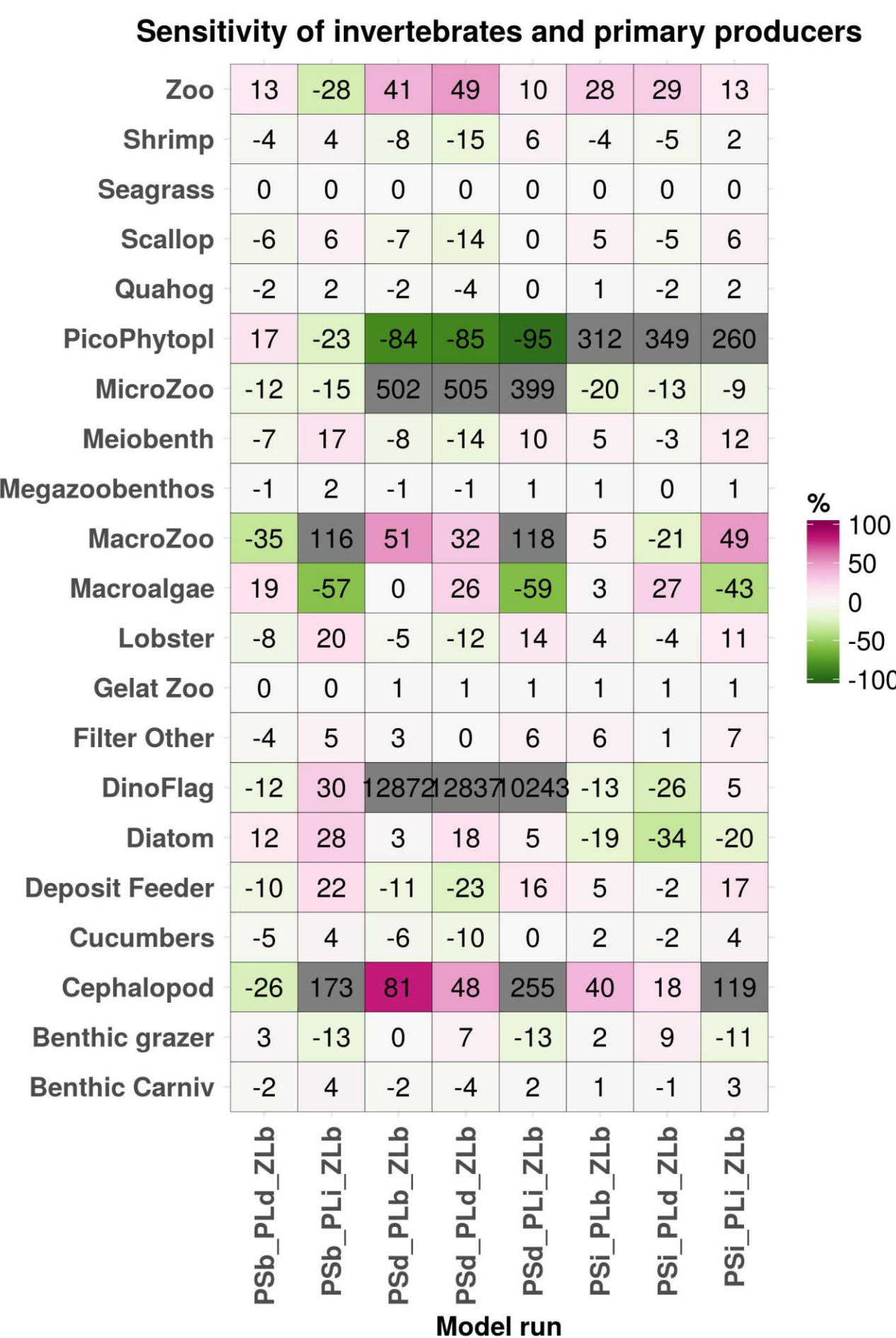
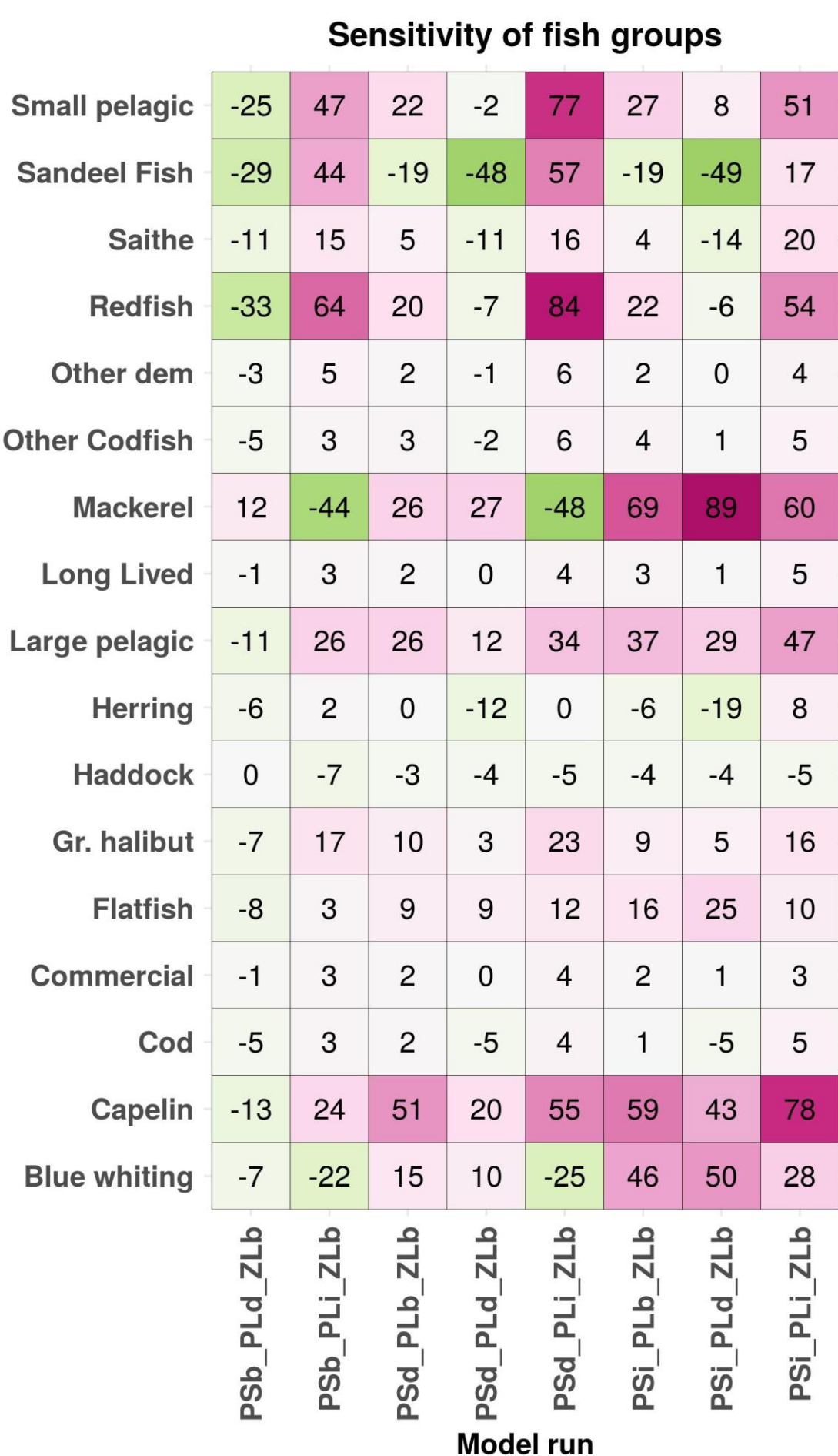


Sensitivity of growth parameters



Description of code for model runs

ZL = Large zooplankton
PL = Diatoms
PS = Pico-phytoplankton
b = growth parameter as in the base run
d = growth parameter decreased
i = growth parameter increased
Example:
PSd_PLi_ZLb = Model run where growth parameter decreased for pico-phytoplankton, increased for diatoms and unchanged for large zooplankton.



Results

- Altering the growth parameter of ZL did not have much effect (not shown).
- Fish groups feeding on zooplankton were sensitive to changes in phytoplankton growth rate.
- Increasing the growth rate of PL had positive effects on all fish groups except mackerel and blue whiting.
- Decreasing the growth rate of PS had positive effects on dino-flagellates that otherwise became extinct.
- The sensitivity study shows the functioning of the system and will be helpful for further work with the Atlantis model.



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