Scientific report from short time work visit, SIZEMIC, Ref.No 3727

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Purpose of the visit

The purpose of the visit was to finalize several papers for projects started in the Sizemic working group "Body size and redundancy - an across ecosystem comparison".

Project description

Project 1:"How does the size structure of food webs affect their robustness against secondary extinctions?"

The aim of this project is to evaluate the role of the size structure for food web robustness aginst secondary extinctions: Which kind of food webs, in the context of network structure, dynamical properties and body size structures, are most resistant/vulnerable to secondary extinctions?

The size structure of food webs was measured according to the following relationships; a) body mass trophic level; b) abundance body mass; c) vulnerability/generality body mass d) predator-prey body-mass ratios; e) body-size distributions;

We generated model food webs by the niche model. The variance in size structure was generated by varying the mass/trophic level dependencies (size structure No. a)) around empirically measured values. To get rid of transient dynamics we simulated the food webs over a certain time and saved the food-web configurations. These stable webs were than analyzed for all size-structure parameters. Employing these stable food-webs, we performed species deletions by removing one species and simulate food web dynamics over time. This was replicated for each species in the food web.

Preliminary title

"The role of body size dependent characteristics for food web robustness"

Authors

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Project 2: "What is the effect of sequential deletions in dynamic food webs?"

The aim of this project is to measure how food web robustness is affected by different sequential deletions. We also evaluated how the size structure of the food webs modify effects of sequential deletions.

Sequential deletions were performed according to the following orderings; a) random; b) body size up; c) body size down; d) linkedness up; e) linkedness down; f) generality up; g) generality down; h) vulnerability up; i) vulnerability down; j) basal species deletions; k) (trophic uniqueness)

Here we used the same set of niche food webs produced for Project 1 and performed sequential deletions on these food webs. Sequential deletions means

that species are ordered according to the traits defined above and species deletions are done in that sequence until a certain percent of the original food web remains (25-50 percent). The deletion sequence was updated during the simulation and the deletions were made in a deterministic rather than a probabilistic manner.

Preliminary title

"Extinctions based on species specific traits determine food web vulnerability"

Authors

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The work carried out during the visit

All the simulations were done prior to the work visit. During the visit we performed statistics on the data (exploratory and descriptive) and analysed the results. The overall statistics addressed how the number of secondary extinctions depends on the initial size-structure (and other) parameters at the time of the primary extinction. We had discussions about the results and started to write up the papers. In the end of the visit we had one draft of each paper. We now work via email contact to finalize the manuscripts and the timeframe is set to have the manuscripts ready for publication in the end of December 2010.

Main results obtained

I will here shortly describe the main results from the project 1 since that is the project I am responsible for. We performed a stepwise multiple regression including 30 selectet variables in the start model. In the final model we ended up with eleven parameters having a significant effect on the average number of secondary

extinctions and thereby food web robustness. We classified the parameters as having weak or strong effect on food web robustness against species removals. The hill exponent (a parameter in the functional response) had the overall strongest effect indicating first the importance of the functional reponse used and second the importance of including population dynmaics in these kinds of analyses. Also the bodymass abundance relationship had a strong effect on food web robustness. However, also of interest is that several parameters one would assume to be important, like food web connectance, was not.

In project 2 we found significant difference between the different sequential deletions.

Future collaboration with host institution

Finalizing the manuscripts from Project 1 and 2. We also started a third project comparing outcomes of sequential deletions (the same as in project 2) in toplogical versus dynmaical models. Additionally we have plans of a review paper on secondary extinctions in food webs.

Projected publications

The goal is to have three papers from the work done during this work visit (and earlier) and publish them in high ranked journals. At this point we have drafts on two of the manuscripts written and in progress.