German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig
Deutscher Platz 5e, 04103 Leipzig, Germany

sDiv working group meeting summary

”sCaleWebs”

Food webs can be used to predict how changes in one species affect other species via feeding links. This project examines how environment, distance and species traits jointly determine the structure of food webs. To do so, we are using small aquatic food webs common throughout the Neotropics (tank bromeliads). We propose to integrate network, metacommunity and trait-based analyses of food webs to determine: (i) how and why does food web structure changes over space, (ii) which traits of species are most important in determining their trophic interactions, and (iii) if species traits determine shifts in food web structure over environmental gradients. We address these questions using the aquatic food webs in tank bromeliads across the entire range of this system, from Mexico to Argentina and through the Caribbean. The current database is comprised of 1762 tank bromeliads and their associated macrofauna at 22 locations distributed in 10 countries. We will combine this existing species, trait and environmental data with new site-specific interaction matrices to generate potential food webs. This project will shed light on the major processes determining food web structure, and thereby help us predict the effects of environmental and biotic change on complex ecological systems.

The focal areas of discussion of the first sCaleWebs working group were: i) to implement a theoretical framework to investigate empirically how environment (and environmental changes), distance and species traits jointly determine the structure of food webs, (ii) generate potential interaction networks from heterogeneous sources of information, and (iii) develop a workflow that combines multiple sources of information (gut content, feeding trials, literature, stable isotope) to set up potential ecological networks. Overall, our time was divided as follows: 50% brainstorming in subgroups, 30% large group exchange and task assignment, and 20% presentations.

Before the first meeting:

1. The participants representing different field sites populated a template provided by the PIs summarizing the data available (e.g. gut analyses, feeding trials, literature) regarding each cell in the interaction matrix for their field site.
2. The PIs circulated readings concerning uncertainty and criteria to establish trophic interactions (consumer-resource links), from heterogeneous sources: (i) gut contents, (ii) phylogenetic relationships, (iii) body size and defensive traits of resource, (iv) species co-occurrence, (v) chemical and isotopic signatures, (vi) feeding trials, and (vii) literature review.
3. Several PIs sent specimens from different field sites to Vancouver, Canada, where researchers developed gut content analyses and identifications of feeding items. Identifications were later checked and confirmed by other researchers.
4. A video-conference led by the PIs begun the discussion of how to synthesize heterogeneous information to generate interaction matrices, and ensured that participants arrive at the first meetings with the above preparatory tasks complete.

During the first meeting (10-14 December 2018):
The first meeting of sCaleWebs assembled a team of international scientists from a variety of countries, such as Argentina, Brazil, Canada, England, France, Germany and United States, which brought together a diversity of complementary backgrounds and expertise, including leaders in the fields of food web theory, complex ecological network, trait-based ecology and global change biology.

The main activities during the meeting were as follow:

1. Early in the week the PIs coordinated short presentations and plenary discussions about the general research approach, main aims, database available and potential statistical analyses.
2. Participants provided talks about their expertizing in uncertainty calculations in food webs (Mathias Pires) and the use and applications of *Cheddar* package in R language (Eoin O'Gorman).
3. Dr Andrew MacDonald provided a presentation to familiarize the participants with the digital tools to facilitate collaborations both in meetings and between meetings (e.g. version controlled code via Github, cloud-based editors, and a common repository of matrices), to ensure efficient and reproducible workflows.
4. Some participants presented open conferences to the iDiv students, researchers and professors about scientific topics related to the working group proposal. The speakers were: Diane Srivastava, Jana Petermann, Gustavo Romero, Regis Cereghino, Vinicius Farjalla, and Angélica González.
5. Division of the group into three subgroups: (a) a subgroup to develop the methodology for associating node- and network-level properties with functional traits and environmental gradients, (b) a subgroup to develop uncertainty in food web matrices, and (c) a subgroup to finalize the trophic interactions based on multiple information sources. These three groups collectively contributed to the workflow for assigning interactions to the species x species matrix for each site, as summarized in Figure 1 below.
6. Towards the end of the meeting, the group as a whole reviewed progress made by each subgroup, discussed methodological issues that have arisen, and assigned tasks for the period before the next working group. In addition, the group outlined future working plans and scientific output, including the submission of a "methods" paper to *Methods in Ecology and Evolution*, proposing the development of a workflow to set up interactions in food webs from varying sources of information – it is expected to be in advanced stage before the next meeting.

In summary, this was a very productive meeting thanks to the collaborative spirit of all the participants, together with the great logistic, financial support and facilities provided by sDiv. We believe that our working group is well positioned to tackle the proposed work. In addition, we believe that sCaleWebs will be an incubator for new ideas to advance the field of trait-based spatial food webs.

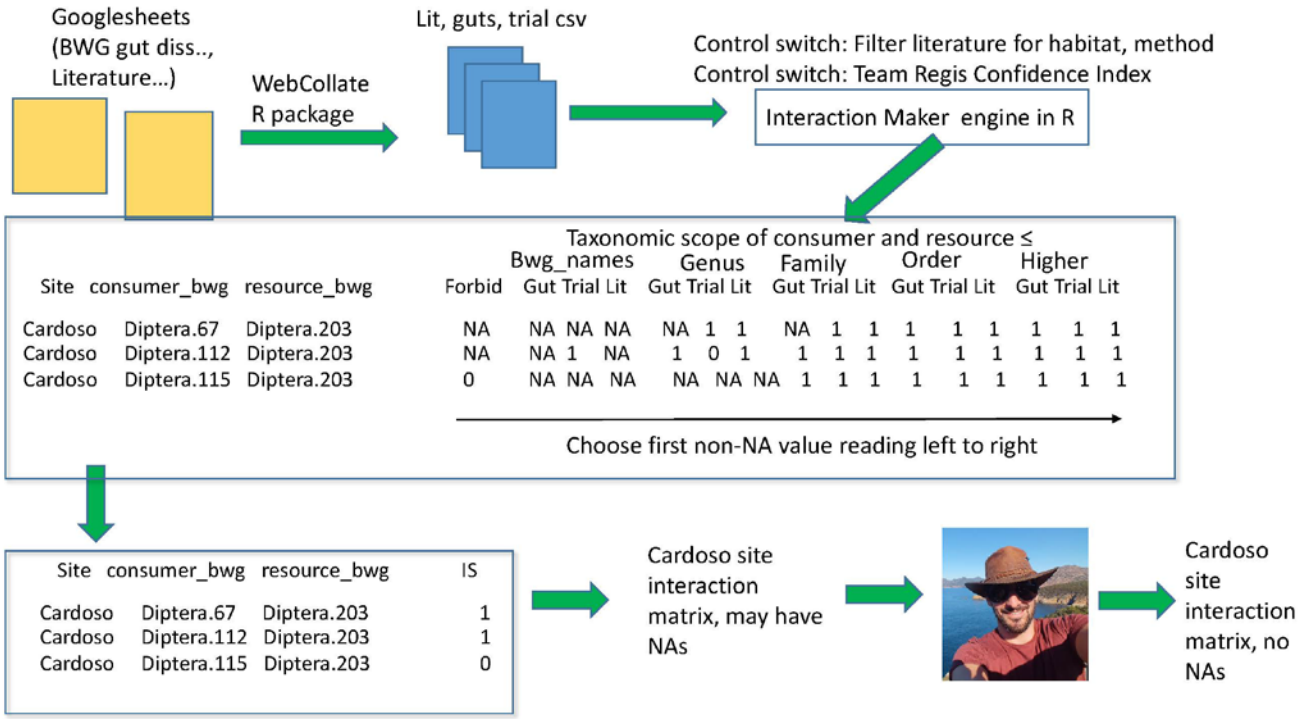

Figure 1

Participant list (first working group meeting)

Participant	Name / institution	Expertise important for the working group	Professional status
PI	Gustavo Q Romero	influence of biotic and environmental changes on community and food web structure, and on ecosystem functioning; ecosystem linkages	Associate professor
PI	Diane S Srivastava	food web ecology; metacommunity ecology; effects of biodiversity on ecosystem functioning; food web responses to climate change	Full professor, Director
iDiv member	Ulrich Bose	biodiversity, spatial and food-web theory; distributions of body sizes and predator-prey body-size ratios across food webs and ecosystem types	Professor
PhD student	Juliana Leal	importance of autochthonous and allochthonous organic matters to aquatic food webs. Stable isotope and fatty acids analysis	PhD student
Participant	Olivier Dézerald	community ecology, food webs, functional ecology, freshwater and terrestrial invertebrates, tank bromeliads, metacommunity, population dynamics	Postdoc
Participant	Regis Céréghino	Functional traits, Community ecology, Functional Ecology, Food webs, Biological interactions, Invertebrate biodiversity, taxonomy and biology	Full professor
Participant	Jana Petermann	Community ecology, Multitrophic interactions, Food webs, Metacommunity ecology, Microecosystems, Community assembly	Associate professor
Participant	Angélica González	community and ecosystem ecology. Research program focused on the structure and dynamics of ancient and modern food webs in a changing world	Assistant professor
Participant	Vinicius Farjalla	Aquatic ecologist. Use tank bromeliads as model systems to test ecological predictions. Expertise in community and ecosystem ecology	Associate professor
Participant	Ignacio Barberis	Community ecology; Bromeliad ecology; Food webs; Tank bromeliad ecosystems	Adjunct professor
Participant	Andrew MacDonald	community ecologist and data scientist. Developed many of the tools our group uses to interact with the data. Skills in ecological modelling	Postdoc
Participant	Nicholas Marino	R programming, statistics; community and ecosystem ecology, ecological interactions modified by changes in environmental conditions	Postdoc