

Human impacts on food webs – are there patterns across ecosystems?

An integration of species and size based approaches

Leader

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Participants

(key: **terrestrial**; **marine**; **fresh water**):

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(We expect that there will be some turn-over in participants, depending on where people go after their PhD)

Research goals

1. Review methodologies used for measuring food web responses to human disturbance and their ecological relevance in different ecosystem domains (marine, freshwater, terrestrial).
2. Through meta-analysis investigate whether there are general responses within and across marine, freshwater and terrestrial systems.
3. Cross-fertilisation: Apply different methodologies to existing data sets and ongoing projects.

Rationale for the research

Human activities such as exploitation, pollution and habitat modification are currently causing one of the greatest mass extinctions in the earth’s history. There has been a longstanding focus on measuring how our actions are causing changes to ecological communities in terms of species diversity and composition. However, ecologists are increasingly looking to quantify impacts on networks of feeding interactions within communities, which may best reflect the consequences for ecological functions and services. Numerous individual studies have investigated particular human impacts and their effects on ecological food webs. However there have been no integrative studies investigating whether the effects within and across ecosystem types are similar or system-specific. A major hurdle to overcome for such a study is the great variety of methodologies and food web characteristics used to document impacts. The reasons behind this variety include different

motivations for research, different traditions in different fields (ecosystem domains), data availability and dominance of different forms of human impact in different ecosystem domains (either real or in terms of research focus).

Integrating methods across domains

Although there are biases in domains there is also clearly a degree of overlap. Size spectra measures, food chain length and network topology all reflect the trophic structure of communities and are widely applied. But does the same approach have the same meaning in different systems? E.g. trophic structure in marine systems is generally considered to be largely sized-based: big things eat small things. Drawing a food web with species as nodes may not reflect the real trophic structure because the species, especially fish, change in size (and therefore diet) by several orders of magnitude during development. Changes in the slope (or shape) of the size spectrum in these systems reflect changes in the trophic structure. In other systems, especially terrestrial ones, but also perhaps diverse marine systems such as coral reefs, the trophic organisation is far less size-based and a species-based food web analysis will be more likely to give information on the effects on trophic organisation of the food web. The ecological meaning of a change in size spectrum is therefore not necessarily the same in different ecosystems and the same can be said for species-based food web topology. Current biases in methodology do therefore to some extent make biological sense. The question is whether they tell us in effect the same story. To answer this question we need to understand clearly what aspects of the size spectrum mean for the trophic organisation and what the equivalent aspects of species-based food web topology are. Different approaches may therefore be equivalent (ie measure the same thing) when we compare across domains (e.g marine size spectrum vs terrestrial food web topology) while they may be complimentary (ie measure different things) when both are applied to the same system. A review of available literature but also a re-analysis of data-sets, could thus test to what degree these approaches reflect actual ecological differences.

We will start the project with a thorough review of methodologies and their interpretations across systems. Based on this we will carry out a meta-analysis to study whether three types of human disturbance (exploitation, pollution, habitat modification) generate similar responses across ecosystems. The composition of this working group is well balanced across the domains and provides a unique opportunity for working towards a reconciliation of the different approaches. The review and meta-analysis will undoubtedly throw up many questions and ideas with regard to existing datasets and ongoing projects of group members. The third aspect of the project will therefore aim to foster cross-fertilisation by encouraging the application of different methodologies to datasets through collaboration of group members. This can for example take the form of a PhD student taking their data to another lab to collaborate on novel analysis, or small groups of people getting together to analyse data. In principle these projects should be proposed by early career researchers and they will be assessed by the senior members of the group.

Anticipated outputs

Publications

- Review of methodologies across ecological domains and their ecological meaning in different systems
- Meta-analysis of human impact across ecological domains
- (re-) Analyses of existing datasets applying different methodologies.

Organisation

The group is divided into 3 sub groups based on the three ecosystem domains which will gather material for the review and the data for the meta analysis. The work in each of the three sub groups is coordinated by a PhD student: Katie Longo (marine), Sanne de Visser (terrestrial) and Bláithín Ní

Ainín (fresh water). Currently there are 8 group members eligible for early career exchange visits (PhD students and post docs < 5 yrs). We anticipate (and will encourage) that more students and post docs will join and apply for funding from the group where this benefits our goals.

Timetable

April - July 2008: Initial literature search to be assessed on 7 July.

July – Autumn 2008: Write review and start work on meta-analysis.

Autumn 2008: 3 day meeting of coordinators (in Silwood Park, UK?) to finish review and assess progress on meta-analysis.

Spring 2009: Meta-analysis to be finished before SIZEMIC meeting in Sweden.

2008-2010: Collaborative work among group members.

Spring 2010: Presentation of output from various collaborative projects at main SIZEMIC meeting.