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Briefing paper

Trophic positioning of meiofauna revealed by stable isotopes and food web analyses

Jenny M. Schmid-Araya, Peter E. Schmid, Steven P. Todd, Genoveva Esteban, Ecology, Volume 97, Issue 11, 2016.

This study examines seasonal food webs of the invertebrates inhabiting the streambed of the chalk River Lambourn. A food web is a representation of who eats who in a given place that leads scientists to follow the flow of energy from one set of organisms to another.

This research uses gut content analyses of macro (> 0.5mm), meiofauna (<0.5mm) and also stable isotope analyses of meiofauna to assess seasonal food webs of a chalk stream. The gut content analysis is a dietary snapshot but it also informs on the diversity of diet composition that is difficult to assess from the stable isotopes alone. Stable isotope analysis is a technique based on carbon-13 and nitrogen-15 signatures that can determine the feeding links of an organism as it reflects its assimilated diet (you are what you eat!).

Outline of research

This research aimed to evaluate whether ignoring small sized organisms, basal species (algae, leaf material, invertebrate eggs, etc.) and seasonal variability had an effect on food web properties. These properties are used by scientists to estimate, for example, how many species are in the web, how they are linked, what is the ratio of predators, how many steps are in the food web, etc.

Using stable isotopes, the study also assessed for the small sized organism (<0.5mm), their seasonal energy sources (based on carbon-13 signatures) and estimated the trophic position or how high they are within the food web (based on nitrogen signatures).

Key findings and impact

- The first analysis included 4 seasonal webs and a summary web constructed from the gut content analysis. 16 food web properties were estimated and 6 other food webs were constructed to test whether eliminating or grouping species into coarse categories had an effect on estimating food web properties.

Read the full paper here: http://onlinelibrary.wiley.com/doi/10.1002/ecy.1553/full

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- The second analysis included 4 seasonal webs based on stable isotopes. All organisms caught during a season were processed for carbon-13 and nitrogen-15 signatures following a specialized procedure (the reduced column technique).
- In total, 177 different consumers and food resources were identified on the River Lambourn, including 49 diatom species, 12 other basal resources, 112 invertebrates and 1 fish.
- The seasonal analysis showed a distinct difference in trophic similarity. The web size doubled from 77 species in winter to 133 species in summer, showing that more basal and top consumers inhabited the streambed in winter. During the summer, there was an even distribution of links.
- Aggregating species into coarse categories resulted in strong negative impact on estimating the size of a web, the number of links in the web, how many links each species has and the ratios of predators to prey.
- In the food webs, more than 1/3 of all invertebrates belonged to the meiofauna category and based on gut content analysis they were positioned as both top and intermediate consumers. The results of the stable isotopes (based on nitrogen-15 signatures) confirmed the position of small-sized organisms.

Conclusion

This research shows that meiofauna or small-sized organisms (< 0.5mm) are important in river food webs as: they are up to 1/3 of the total species and, depending on season, up to 44% of the top consumers can be small-sized organisms. The paper also stresses the importance of temporal variations in food and consumer species for understanding a food web structure.

The meiofauna being positioned high in the river web questions the assumption that only larger organisms are at the top of the food web. The study demonstrates that ignoring the small-sized organisms and seasonal changes could lead to wrong interpretations and conclusions.

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