CIESM Congress Session : Food web modelling

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Moderator's Synthesis

Food webs represent who eats whom in a ecosystem. They are complex entities composed by hundreds of species and myriads of individuals interacting in many ways from competitive and antagonistic to mutualistic and cooperative interactions. In the last decade, there has been a large progress in understanding how food webs may be responding to human disturbances and environmental fluctuations. Yet, there are many emerging gaps and opportunities to improve our understanding of food webs and the biodiversity they sustain. In this meeting we discussed mostly three gaps that if explored further may produce a more accurate theory of food webs: 1) The inference gap, 2) The biogeography gap and 3) The interdependent networks gap. The inference gap concerns methods to compare outputs from a variety of models to data to infer the mechanisms predicting best the empirical data. This is currently a fast moving field with many new techniques coming from physics and computer science that are making the model-data comparison possible even for slow and complex models like the ones used in food webs. Our discussion in this area focused in how to compare simple and complex models and how this comparison enters in the well-known tractability-computational cost trade-off with the final aim to produce more accurate predictions under a variety of realistic scenarios like global warming and increasing the variance of environmental variables.

The biogeography gap is another emerging synthesis in food webs. There are many unknown questions in this gap. For example, how do the contacts between species from different biogeographic regions alter the stability properties of local food webs? Do dispersal dynamics synchronize population dynamics of resources and consumers? And does synchronization stabilize species fluctuations? Food webs are difficult to sample because there are many interacting species and factors driving their dynamics. This is a real challenge for the many existing biodiversity programs monitoring large ecosystems. Understanding the biogeography of food webs would require "high-resolution and spatially extended" sensor networks to monitor several variables at small and large spatial scales. This need connects to our last discussed gap -- the interdependent networks gap. Many species have several preys and predators but they are also composed by many occupied patches extended in space. This posits new challenges because understanding the biogeography of food webs is also coupling the dynamics of local networks to spatially extended networks. Are these two networks coupled? If so, which are the consequences for understanding the formation, evolution and dynamics of complex food webs?

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