

What is evolutionary ecology?

Virey [1]. The idea that species change as a result of a changing environment should not be news for an evolutionary ecologist, since this is the *raison d'être* for this field of biology. Thus, Lamarck was the

ECOLOGICAL THEATER

EVOLUTION



Evolutionary ecology. “Evolutionary biologists emphasize historical and lineage-dependent processes and hence often incorporate phylogenetic reconstructions and genetic models in their analyses. Ecologists, while cognizant of historical processes, tend to explain variation in terms of the contemporary effects of biotic and abiotic environmental factors. Evolutionary ecology spans these two disciplines and incorporates the full range of techniques and approaches from both.”

Fox, CW et al. 2001. [Evolutionary ecology: concepts and case studies](#).



✓ Eco-evolutionary dynamics

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Article

Figures & Data

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Abstract

Evolutionary ecologists and population biologists have recently considered that ecological and evolutionary changes are intimately linked and can occur on the same time-scale. Recent theoretical developments have shown how the feedback between ecological and evolutionary dynamics can be linked, and there are now empirical demonstrations showing that ecological change can lead to rapid evolutionary change. We also have evidence that microevolutionary change can leave an ecological signature. We are at a stage where the integration of ecology and evolution is a necessary step towards major advances in our understanding of the processes that shape and maintain biodiversity. This special feature about 'eco-evolutionary dynamics' brings together biologists from empirical and theoretical backgrounds to bridge the gap between ecology and evolution and provide a series of contributions aimed at quantifying the interactions between these fundamental processes.

Pelletier et al. (2009) [*Eco-Evolutionary dynamics*](#). Phil Trans Roy Soc Lond

Eco to Evo (Ecology affects evolution)

White-bodied peppered moth



Photo credit: Olaf Leillinger

Black-bodied peppered moth



Photo credit: Olaf Leillinger



Photo credit: Maarten Saane

Both colour variants on the same 'clean' tree

Eco to Evo

- How a species interacts with its environment, the species' **ecology**, determines its population dynamics
- If the trait of interest is heritable and the number of individuals with one trait variant is changing relative to another, **evolution** occurs

Evo to Eco

If the number of white-bodied variants decreases relative to black, and body color is heritable then evolution occurs. But also, if the number of white-bodied variants decreases, then any of the following ecological effects may occur:

1. Decrease in predators due to a reduced prey source
2. Release from intraspecific competition for other variants
3. Release from interspecific competition for other competitors

Evo to Eco

“At every moment natural selection is operating to change the genetic composition of populations in response to the momentary environment, but as that composition changes it forces a concomitant change in the environment itself. Thus organisms and environments are both causes and effects in a coevolutionary process.”

Lewontin, R. 2000. *The triple helix. Gene, organisms, and environment.* p126.

Evo to Eco

- Natural selection on traits that affects survival or reproduction will leave a population dynamical signature

Pelletier et al. (2009) [*Eco-Evolutionary dynamics*](#). Phil Trans Roy Soc Lond

- Number of clones (genetic composition) affects population dynamics

Yoshida et al. 2013. [*Rapid evolution drive ecological dynamics in a predator-prey system*](#). *Nature*.

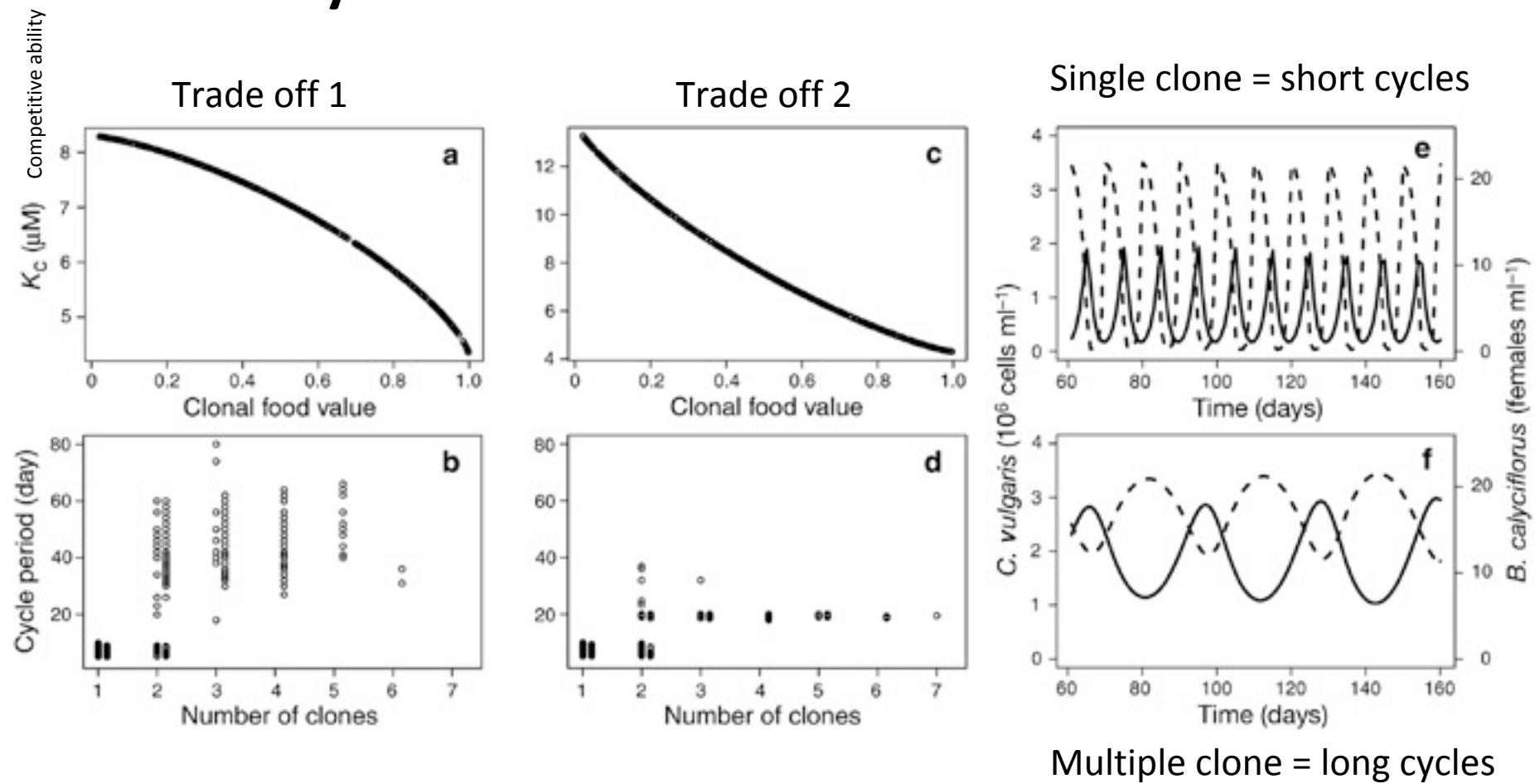
- Traits that affect dispersal will change the distribution of individuals

Pelletier et al. (2009) [*Eco-Evolutionary dynamics*](#). Phil Trans Roy Soc Lond

Yoshida et al. 2013. [Rapid evolution drive ecological dynamics in a predator-prey system](#). *Nature*.

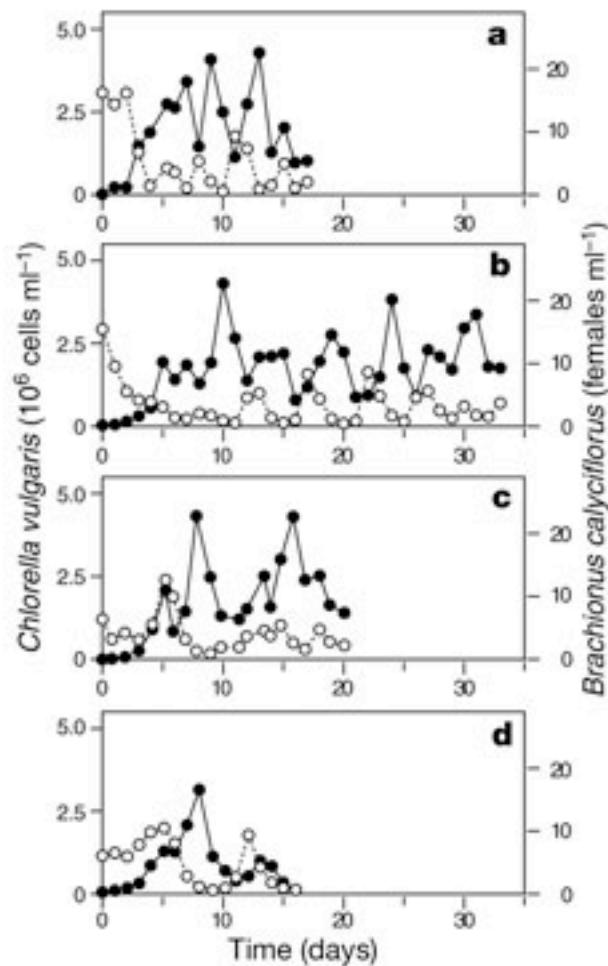


Theory

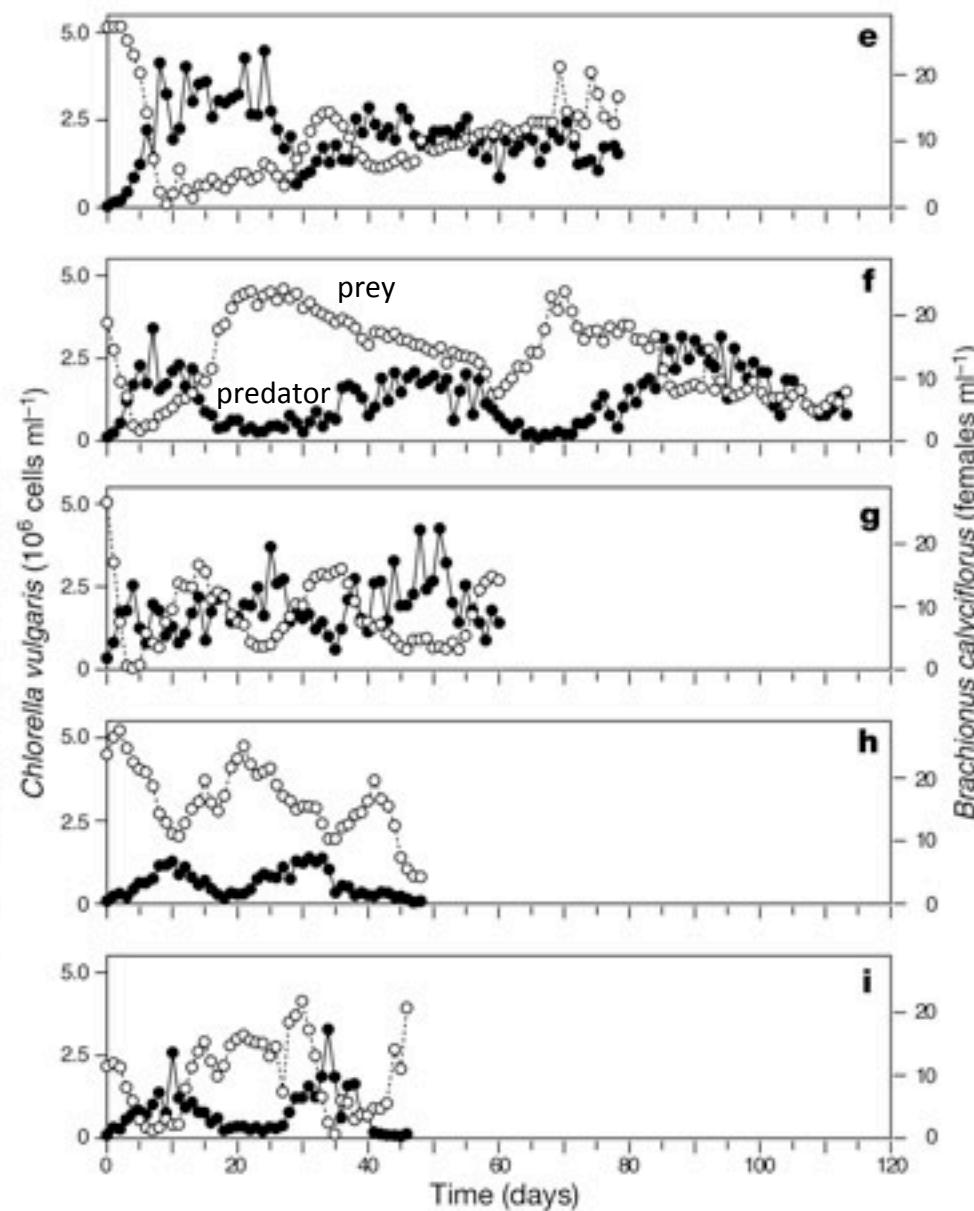


Experiment

Single clone = short cycles



Multiple clones = long cycles



Summary

- What are eco-evolutionary dynamics
- Explain/give an example of how ecology affects evolution
- Explain/give an example of how evolution affects ecology