Evaluating the adaptive network theory - A demo-genetic individual based model of Atlantic salmon metapopulation

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A demo-genetic individual based model of Atlantic salmon metapopulation

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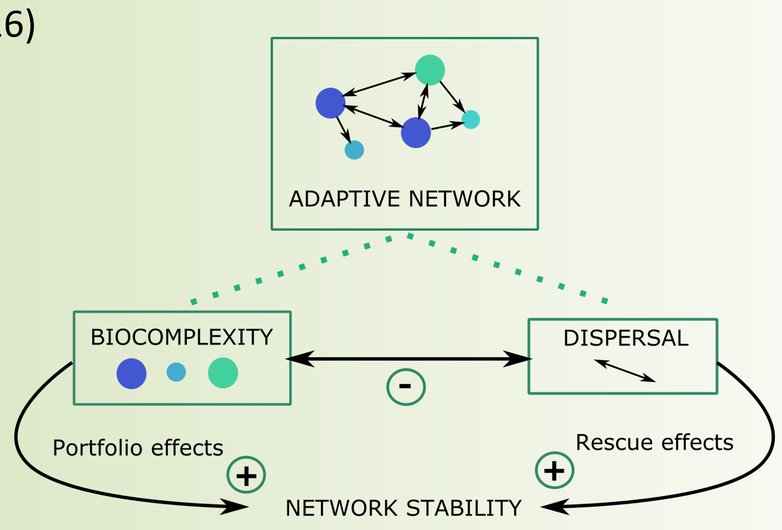
CONTEXT

- Drivers of species persistence and adaptation to environmental changes
- Metapopulation scale : **Adaptive network theory** (Webster *et al.* 2016)

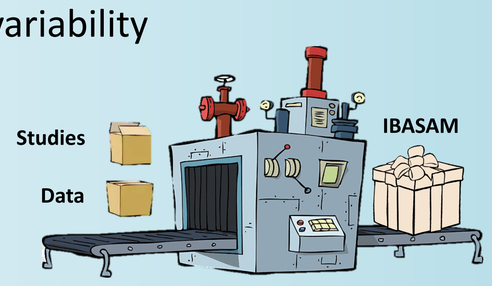


- Hypotheses rarely studied in a **unified framework**
- **Salmonids**: no strict philopatry (Schtickzelle & Quinn 2007), but dispersal is still considered as negligible

METHODS

A demo-genetic individual based model of Atlantic salmon populations...

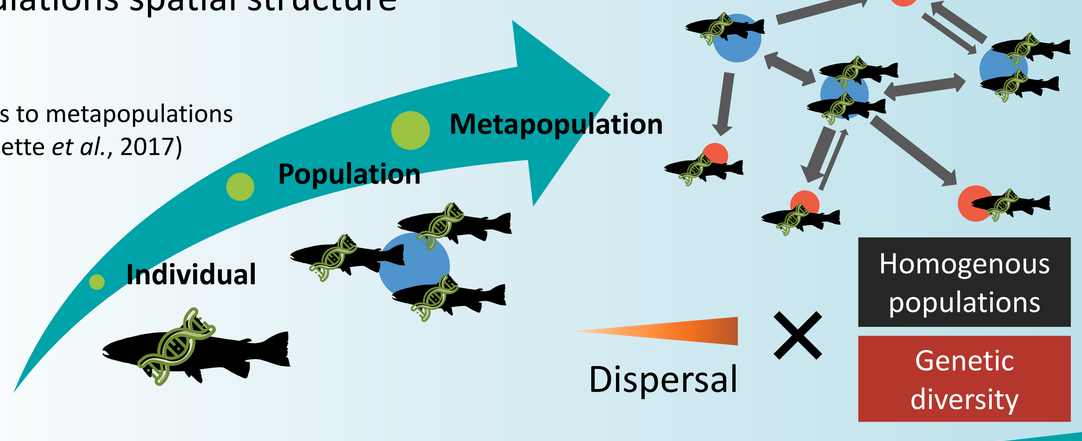
- IBM: a life cycle model including individual variability
- Explicit genetic transmission of traits
- Eco-evolutionary feedbacks



... Connected through dispersal

- Dispersal kernel (distance and attractivity)
- Populations spatial structure

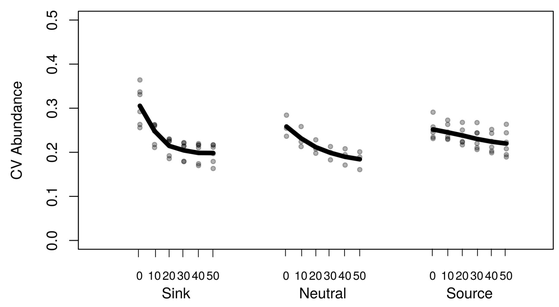
From genes to metapopulations (Baguette *et al.*, 2017)



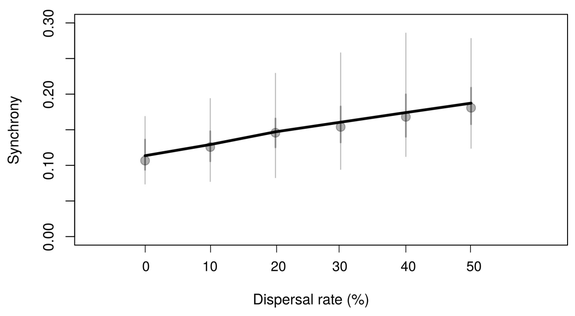
RESULTS

DISPERSAL EFFECTS

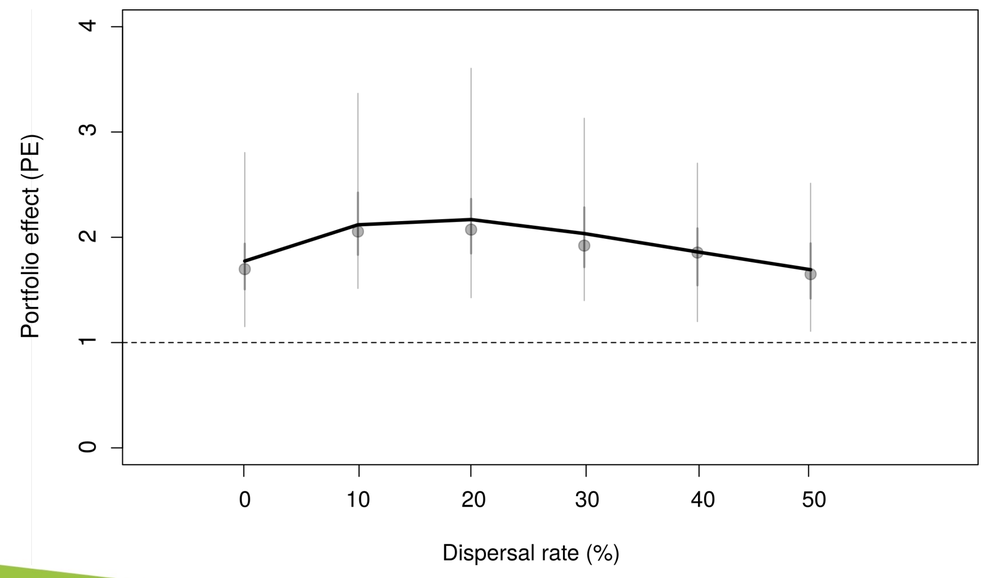
Demographic rescue of populations



Synchronization of populations dynamics

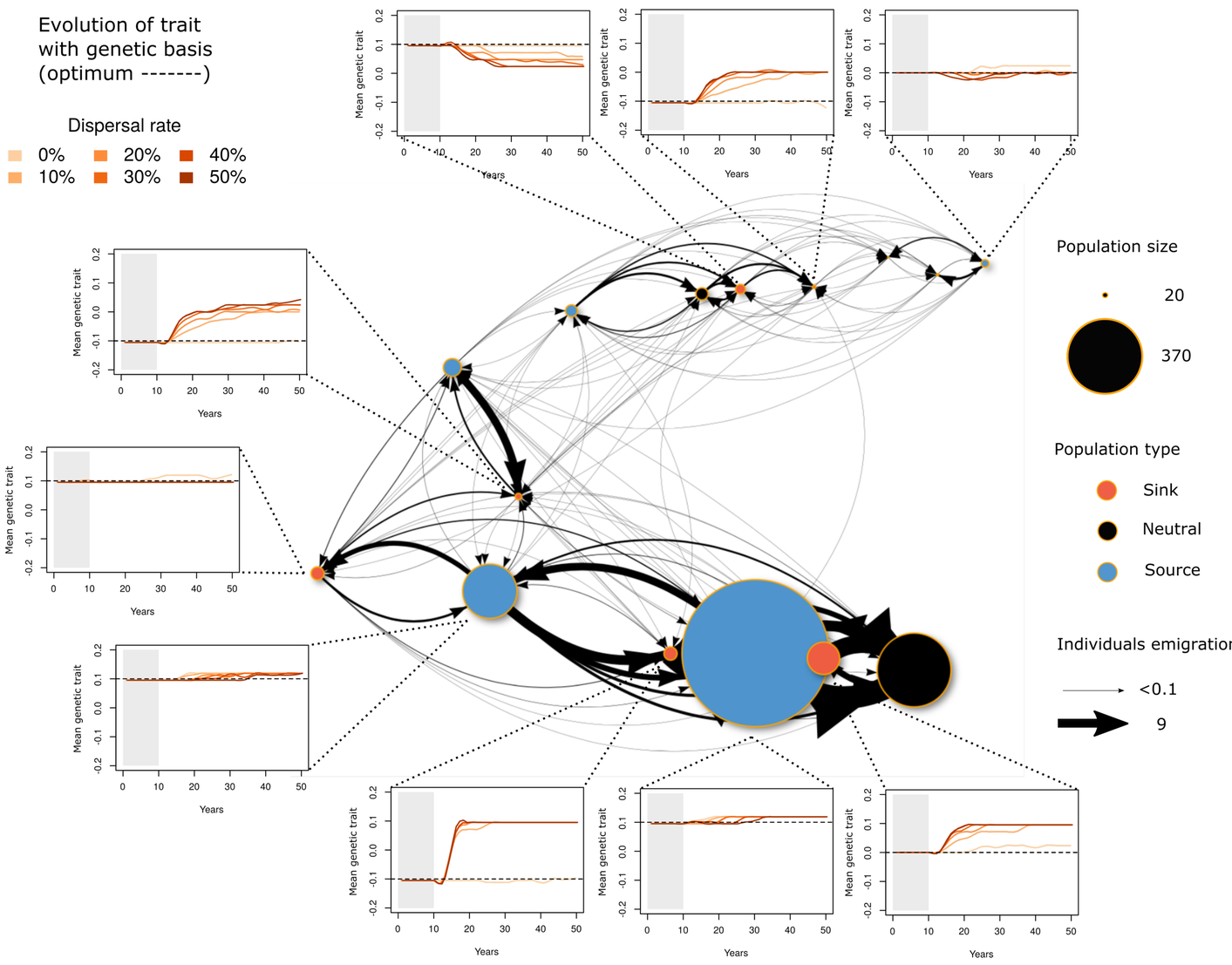


Non-linear relationship with network stability



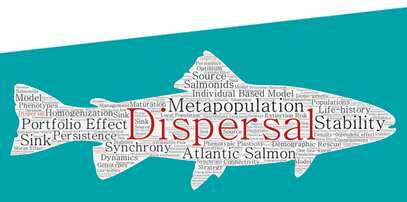
INTERPLAY DISPERSAL - BIOCOMPLEXITY

Homogenizing effect may lead to populations **maladaptation**...



... Depending on populations **spatial structure** (immigration rate and nearby populations genetic features)

DISCUSSION



Using a theoretical approach to evaluate the adaptive network theory in a single framework, we first showed **rescue effects** on populations with low rates of dispersal (Hill et al. 2002). However, our results also suggest that higher rates of dispersal might **synchronize** populations dynamics and reduce network stability (Yeakel et al. 2018). Taking advantage of the demo-genetic feature of our modeling approach, we highlighted the potential interplay between dispersal and between-populations genetic diversity, and especially **local adaptation impairment** through gene flow (Moore et al. 2013). However, these eco-evolutionary consequences might rely on our dispersal assumptions, populations trait optimum and **spatial structure**, as well as the environmental pressures they have to deal with. Altogether, we argue that focusing on a single population eco-evolutionary dynamic **without considering connectivity can be misleading**, especially for management decisions.