Genetics and Evolutionary Ecology-based model for eel: GenEveel

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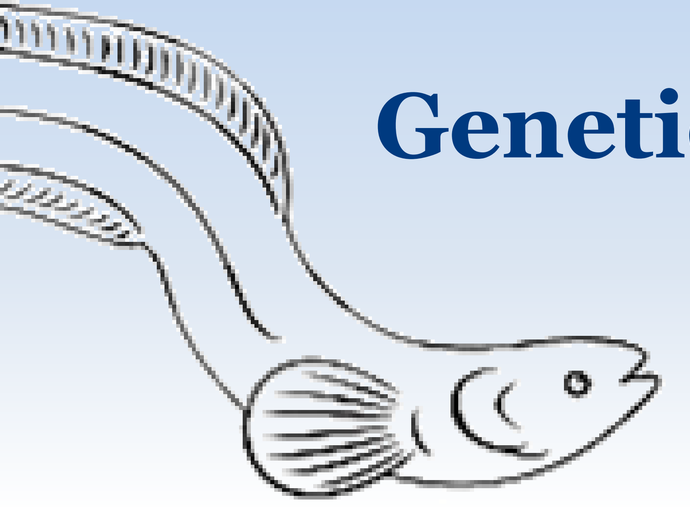

Genetics & Evolutionary Ecology-based model for Eel: GenEvEel

Consequences of adaptive plasticity and spatially variable selection in the European eel

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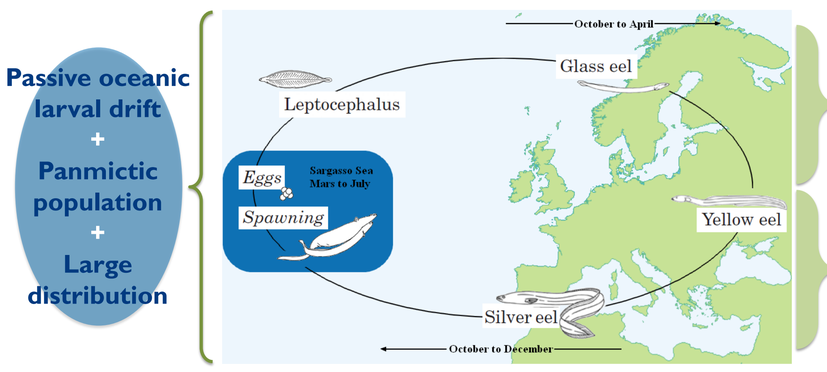
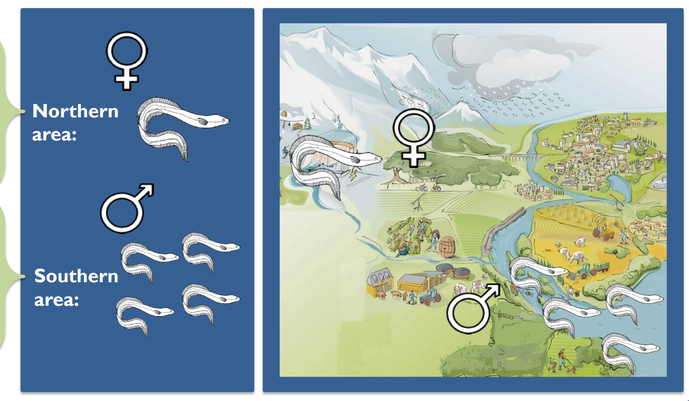
1. European eel: Features and distribution

- Features such as a complex life history (**A**), the controversy about genetic structure and an important interest for conservation make European eel (*Anguilla anguilla*) an interesting species to study!
- European eel displays a large phenotypic and tactical variability at different spatial scales (**B**).

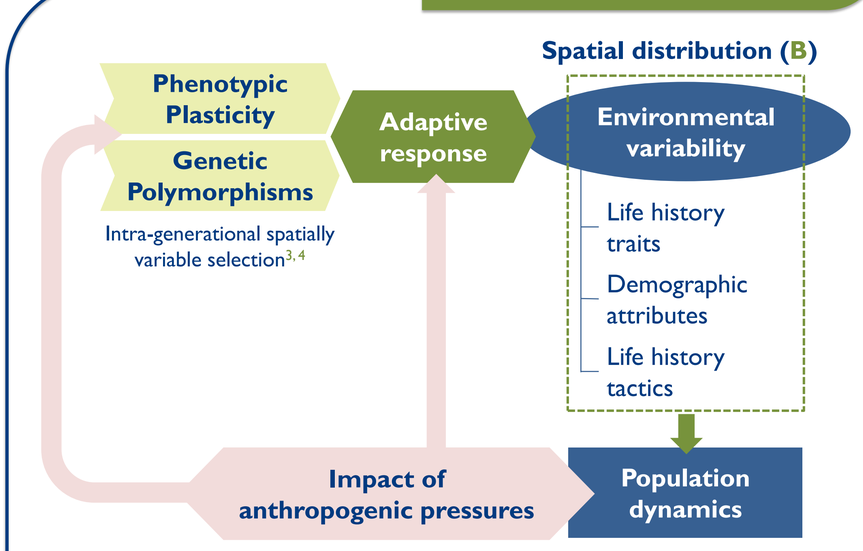
A. The life cycle of the European eel



B. Spatial patterns of life history traits and tactics at different spatial scales



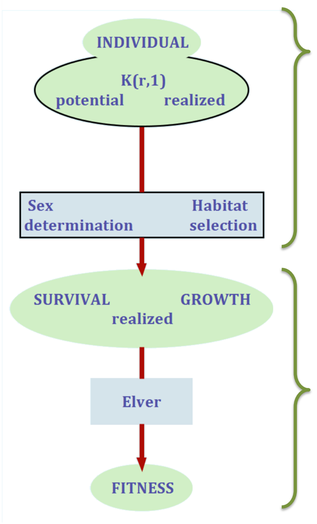
2. Purpose

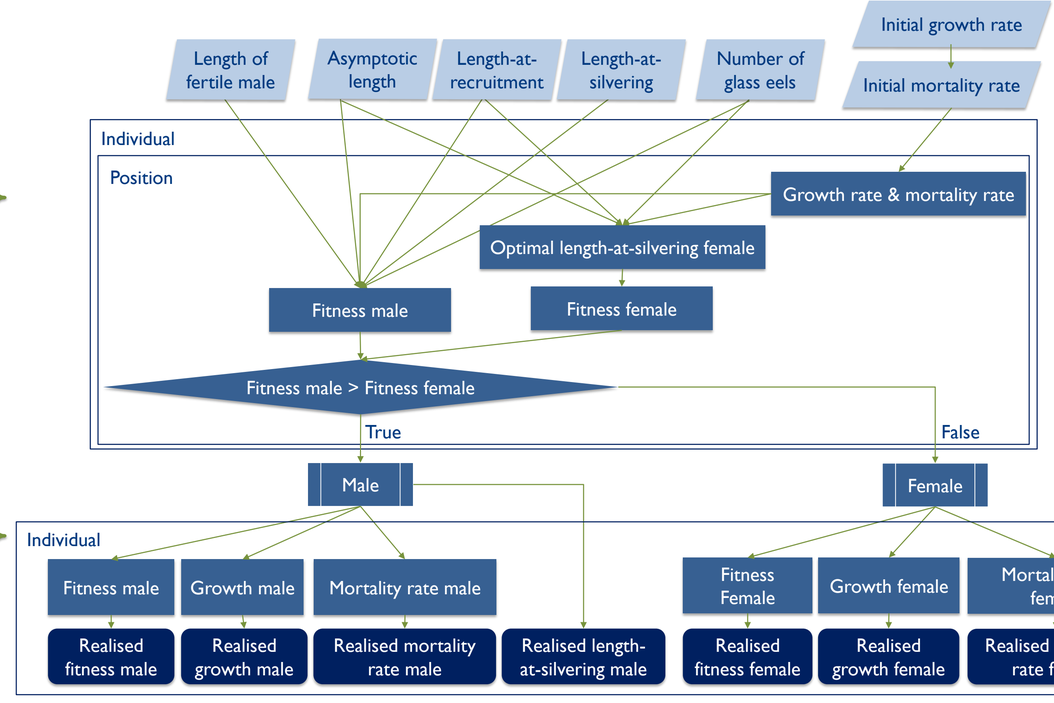


- Are phenotypic plasticity and genetic polymorphisms adaptive responses to variable environment?
- How these adaptive responses affect the impact of anthropogenic pressures on population dynamics?

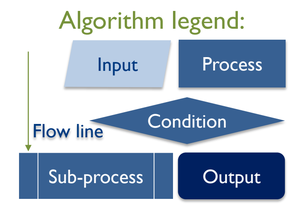
3. Building the optimality model GenEvEel 1.0.

- Applying pattern-oriented modelling approach[1], spatial patterns of model output are compared with those observed in real river catchment:
  - ✓ Higher density downstream than upstream[2].
  - ✓ Male-biased sex ratio downstream and female-biased sex ratio upstream[2].
  - ✓ Faster growth rates in downstream than those from upstream[3,4].
  - ✓ Higher length-at-silvering upstream than downstream[2].
- Flowchart outlining the work-flow for using GenEvEel 1.0.:





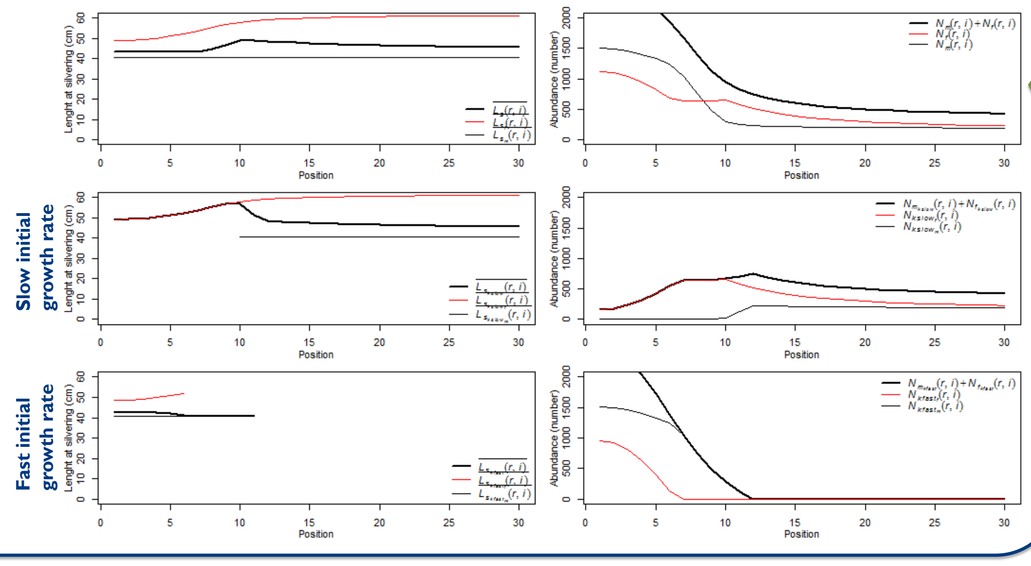
- The algorithm proceeds in two steps:
  - I. For each individual, potential fitness is calculated to determine its sex and select its growth habitat in the river catchment. Fitness-maximizing is the basis of these decisions.
  - II. Realised life-history traits are then calculated as a combination of genetic differences in growth, fitness maximization and density-dependence an individual experiences.



4. First results

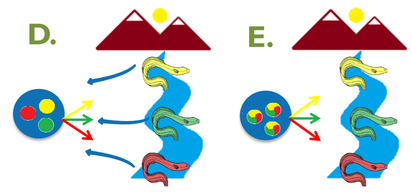
- The model mimics the four spatial patterns (**C**):
  - ✓ There are more individuals in downstream than upstream section of river.
  - ✓ Males are more concentrated in downstream section of river while females are concentrated in upstream section of river.
  - ✓ Individuals in downstream tend to grow fast and mature early (lower length-at-silvering). Individuals in upstream grow slowly and mature older (higher length-at-silvering).
  - ✓ Silver eels are smaller downstream than upstream.

C. Length-at-silvering and abundance by sex (red line, females; black line, males) and all initial growth rates



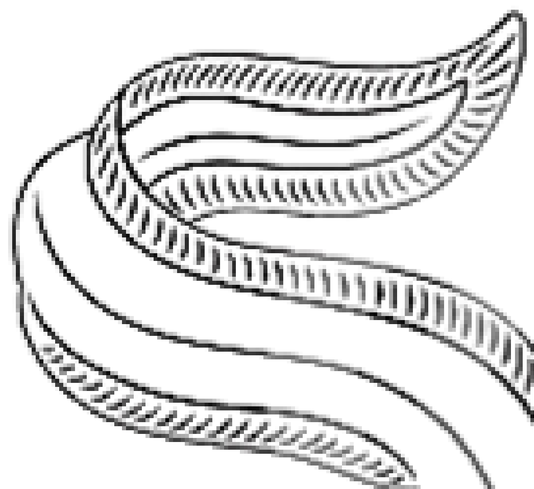
These results suggest that…

Intra-generational spatially variable selection (D) and **phenotypic plasticity (E)** could be two complementary **adaptive mechanisms** that explain different **spatial patterns** in terms of **length-at-silvering**, **sex-ratio** and **habitat use.**



5. Perspectives

- A second version of GenEvEel will be developed to assess the impacts of anthropogenic pressures (habitat fragmentation, pollution or fishing) in terms of spawning biomass and population's demographic attributes.
- Finally, the model will be calibrated and validated on a real study case, such as the Garonne-Dordogne catchment.
- Hopefully, this model could be used as decision-support system to help management of this resource.



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