A generic method to assess species exploratory potential under climate change

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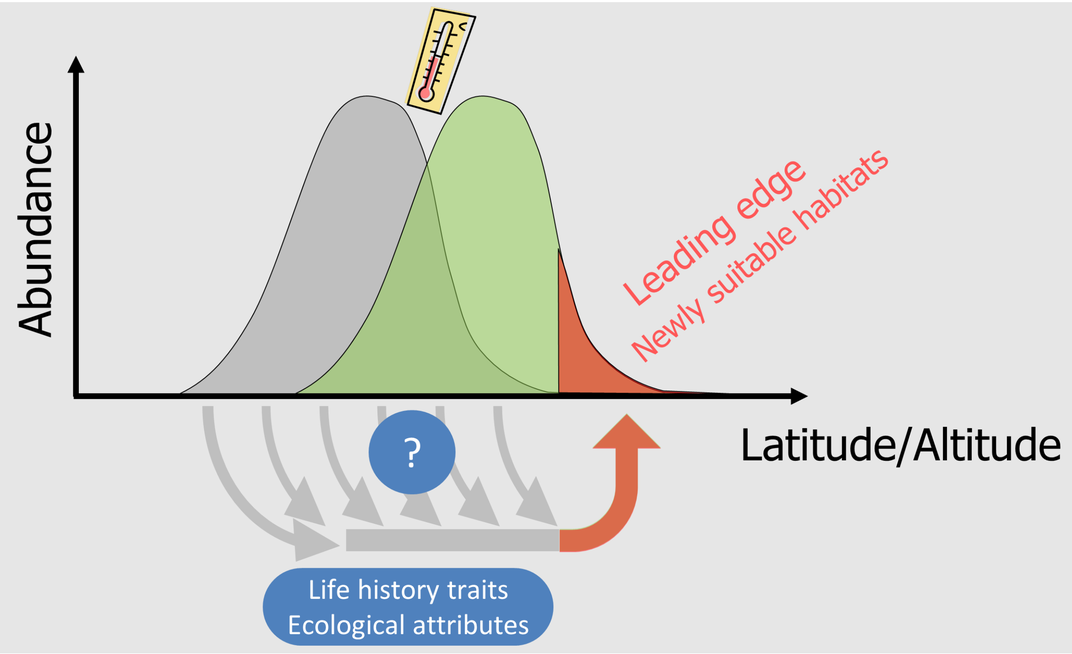
INTRODUCTION

- ✓ In response to climate change, some species have shifted their **latitudinal and elevational distributions** by exploiting **new suitable habitats** outside of their ranges *(Thomas and Lennon, 1999; Parmesan and Yohe, 2003; Cheung et al., 2015)*
- ✓ Various studies have demonstrated that species' traits can be important predictors of the type and intensity of responses to climate change *(Jiguet et al., 2007; Diamond et al., 2011; Chessman et al., 2013)*
- ✓ Build on these conclusions, how can be easily assessed the **exploratory potential** of **species** in order to provide insights for **biological conservation**?



A generic and collaborative approach

Exploratory potential index

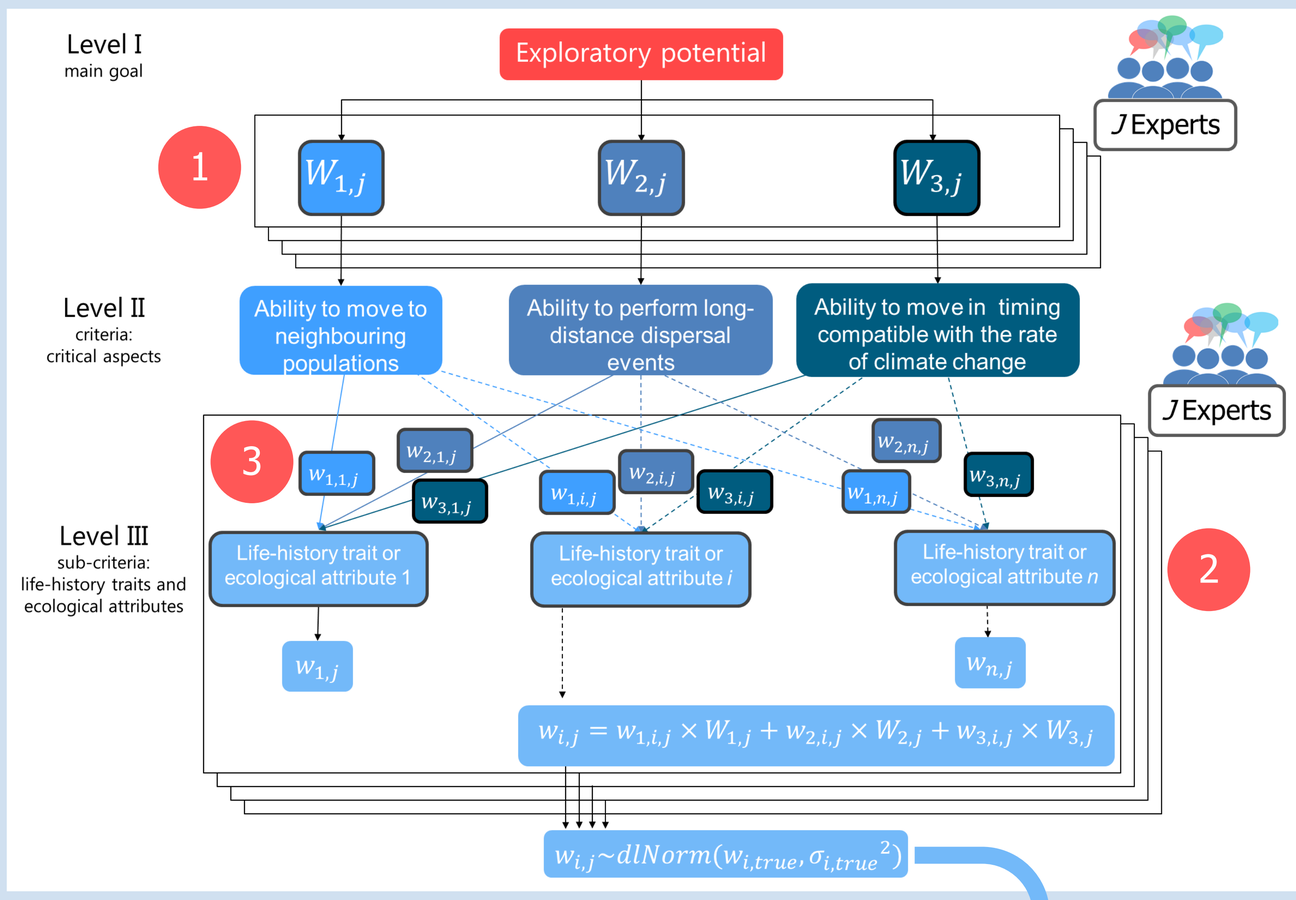
- ✓ Exploratory potential is there restricted to the capacity of species to **reach new suitable habitats**, beyond current ranges, apace with the rate of climate change
- ✓ Analytical Hierarchy Process *(Saaty, 1980, 2008)*
  - ✓ Breaks a **complex problem** down into **simplest issues to get relevant experts' opinions**
  - ✓ Combines **experts' opinions and observed data into a synthetic metric**

Work plan assigned to taxonomic group of experts

1. Determine the weight of the 3 main criteria (Level II) related to exploration ability using pairwise comparison matrices
2. Determine key life-history traits and ecological attributes (Sub-criteria in level III) relevant for each criterion (e.g. body size at maturity, number of reproduction events, homing, distance covered to access feeding grounds …)
3. Derive weights of each criteria from pairwise comparison matrices

1	**Equal importance**
3	**Slightly more important**
5	**More important**
7	**Strongly more important**
9	**Absolutely more important**

	Life history trait *1*	-------	**Life history trait *n***
Life history trait *1*	1		
⋮			
Life history trait *n*			1



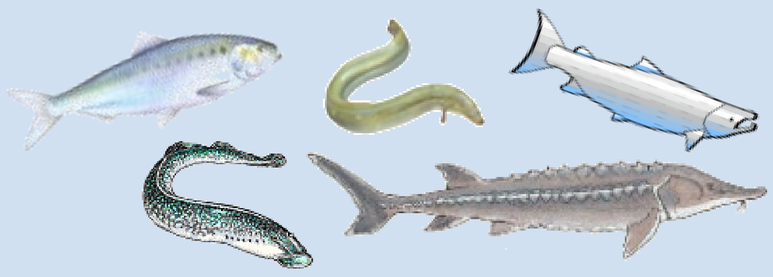
$$Exploratory\ Potential\ Index = \sum_{1}^{n} w_{i,true} \times Trait_i$$

Data sources

- ✓ Behavioral, morphological and physiological traits databases coded into ordinal modalities
- ✓ First case study: diadromous fish species of the Northern Atlantic

Database regarding 24 diadromous fish species

- ✓ TraitDiad (Irstea)
- ✓ FishTraits *(Frimpong and Angermeier, 2009)*



Validation and Perspectives

Validation

- ✓ Compare the species ranking obtained with the exploratory potential index to empirical data, e.g. the range of their (historical) distribution area

  Hypothesis: species with a large range that testified of a good post-glacial re-colonization should get a high value of exploratory potential index

- ✓ Compare the species ranking obtained with the exploratory potential index to mono-specific model simulations *(Lassalle et al., 2008; Rougier et al., 2014)*

  Hypothesis: species showing good repositioning capabilities in simulation model should get a high value of exploratory potential index

Perspectives

- ✓ Characterize geographic areas in terms of the exploratory potential of their fish assemblages
- ✓ Identify geographic areas hosting species with high or low (extreme) values of exploratory potential and thus of priority for biological conservation and management
- ✓ A generic tool that could be applied to other taxonomic groups of interest (e.g. micro-organisms, amphibians, birds…)

AFH, July 1-3 2015, Montpellier, France