



HAL
open science

Development and application of a generic method to assess species exploratory potential under climate change: focus on the exploration phase of anadromous fish

Félix Massiot Granier, Thibault Rougier, Patrick Lambert, Juliette Tison-Rosebery, Eric Rochard, Géraldine Lassalle

► To cite this version:

Félix Massiot Granier, Thibault Rougier, Patrick Lambert, Juliette Tison-Rosebery, Eric Rochard, et al.. Development and application of a generic method to assess species exploratory potential under climate change: focus on the exploration phase of anadromous fish. ICES Annual Conference, Sep 2016, Riga, Lithuania. pp.1, 2016. hal-02604921

HAL Id: hal-02604921

<https://hal.inrae.fr/hal-02604921>

Submitted on 16 May 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

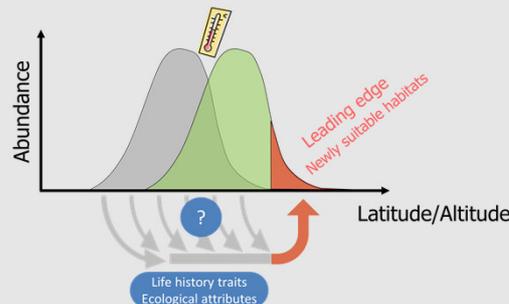
L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Félix Massiot-Granier, Thibaud Rougier, Patrick Lambert, Juliette Rosebery, Géraldine Lassalle

UR EABX, Aquatic Ecosystems and Global Changes Unit, 50 avenue de Verdun, 33612 Cestas-Gazinet, Cedex, France
E-mail: felix.massiot-granier@irstea.fr

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)
- ✓ Based 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, under 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 15 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, earliness of first maturity...)
- 3 Derive weights of each criteria from pairwise comparison matrices

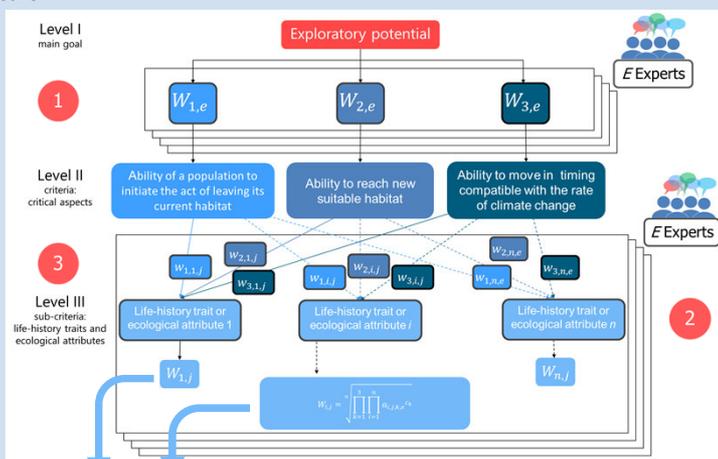
- 1 Equal importance
- 3 Slightly more important
- 5 More important
- 7 Strongly more important
- 9 Absolutely more important

	Life history trait 1	---	Life history trait n
Life history trait 1	1		$a_{1,n}$

Life history trait n	$a_{n,1}$		1

Data sources

- ✓ Behavioral, morphological and physiological traits databases coded into ordinal modalities
- ✓ 1st case study: diadromous fish species of the Northern Atlantic
Database regarding 20 diadromous fish species
 - ✓ TraitDiad (Iristea)
 - ✓ FishTraits (Frimpong and Angermeier, 2009)

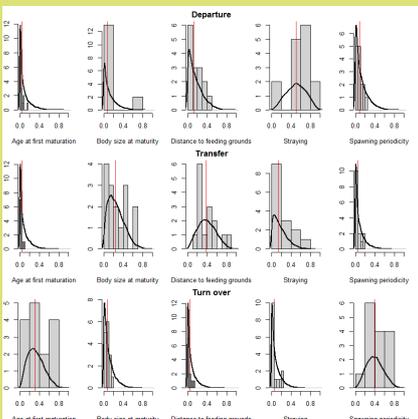
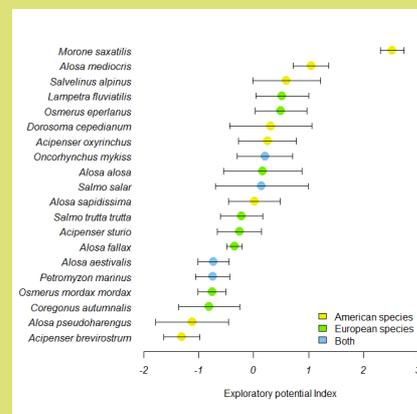


$$(W_{1,j}, \dots, W_{n,j}) \sim \text{Dirichlet}(W_1, \dots, W_n)$$

$$\text{Exploratory Potential Index} = \sum_{i=1}^n w_i \times \text{Trait}_i$$

Exploratory potential index

- ✓ **Consensus among the 15 experts** concerning the life traits impacting the phases of the exploration process
- ✓ **Two visions** among experts concerning the phases of the exploration process
 - ✓ Capital breeding strategy and income-breeding strategy (Jager et al., 2008)
 - ✓ Major importance of the departure phase (irruptive migration)
- ✓ An index globally consistent with the literature that allows to identify and "rate" **different dispersal strategies** and **support strong discrepancies** in the ability of anadromous fish of northern Atlantic to explore potential suitable habitat



Validation

- ✓ 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
- ✓ 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

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...)