Variabilité inter-individuelle des capacités métaboliques, causes et conséquences pour l'écologie halieutique

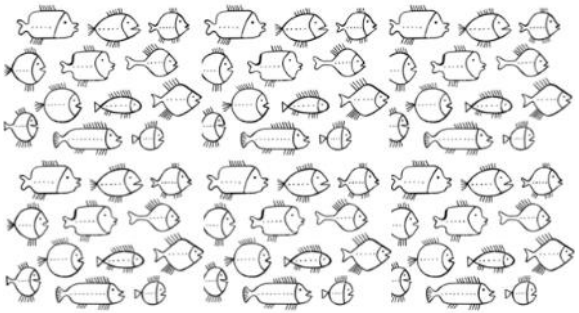
AGRO CAMPUS OUEST

DECOD
De la source à l'océan

B. Sadoul

Variabilité inter-individuelle

- Chaque individu d'une population est différent



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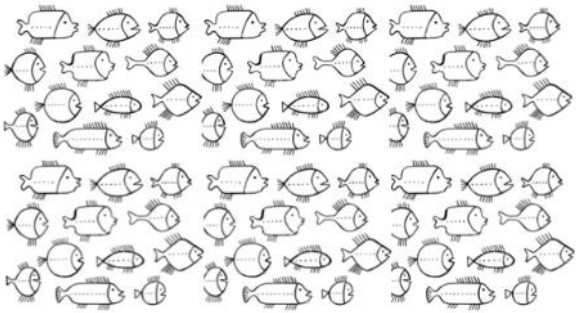

Par ex. tendance à prendre un risque

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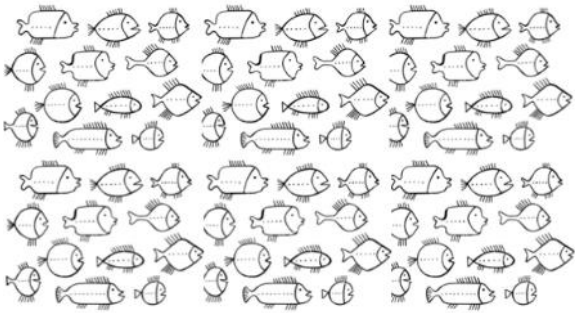

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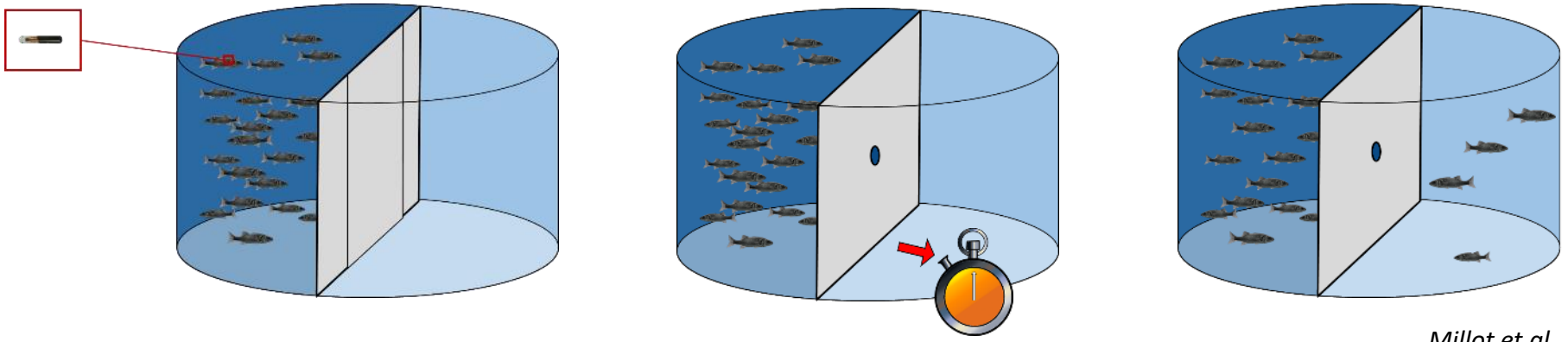


Millot et al., 2009

Timide — Téméraire

Variabilité inter-individuelle

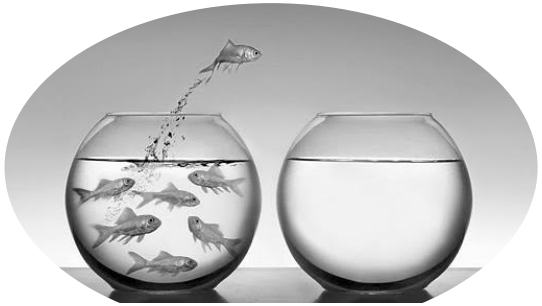
- Comportement répétable à travers les contextes et dans le temps
  = « personnalité »

Psychological Bulletin
2001, Vol. 127, No. 1, 45–86

0033-2909/01/$5.00 DOI: 10.1037//0033-2909.127.1.45

From Mice to Men: What Can We Learn About Personality From Animal Research?

Samuel D. Gosling
University of Texas at Austin



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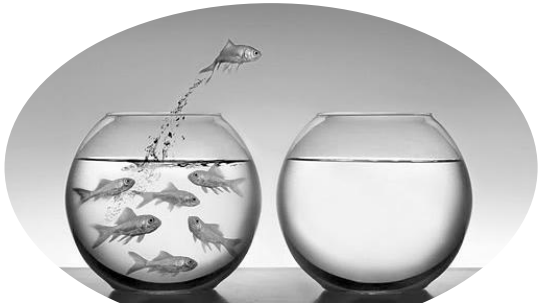

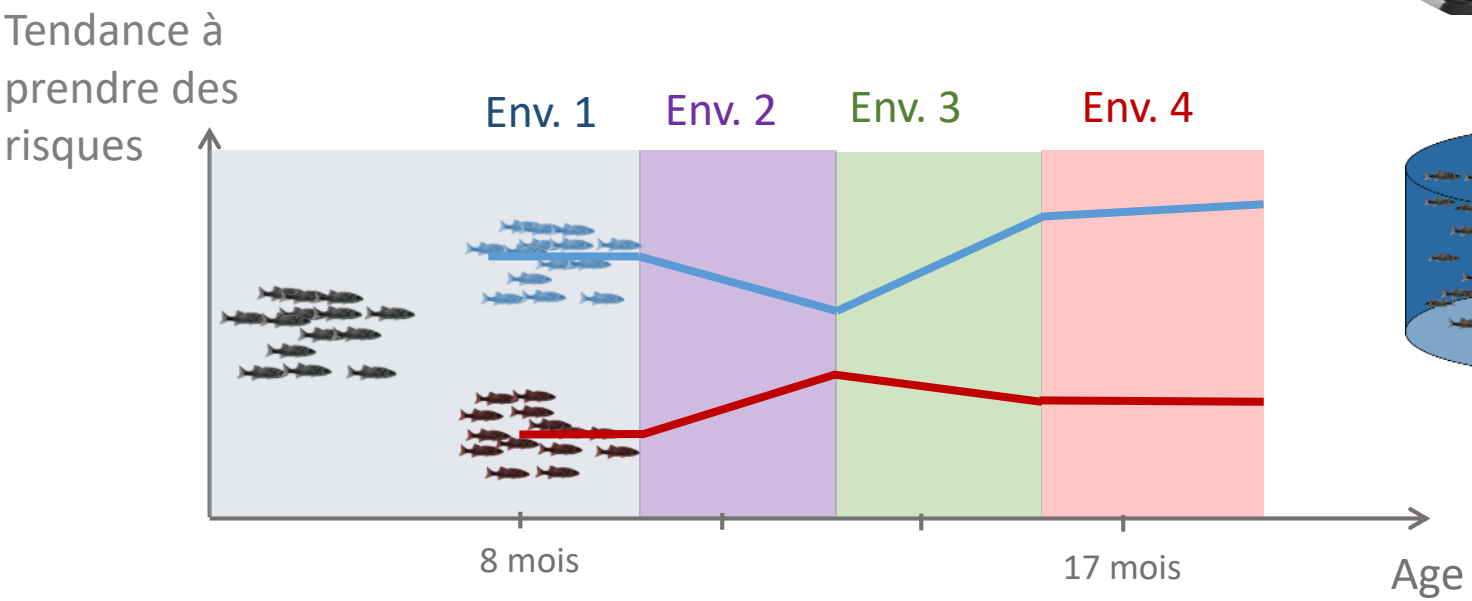

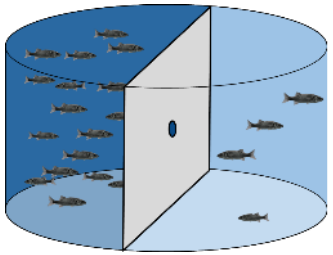

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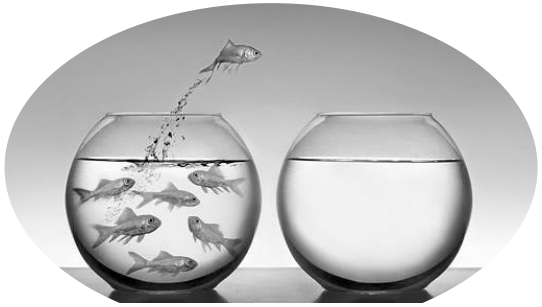

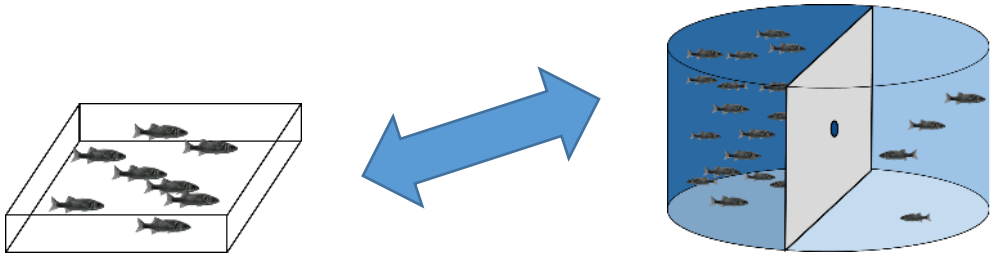

Activité de nage
+ Dispersion

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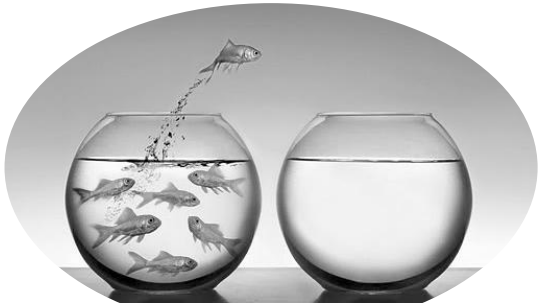

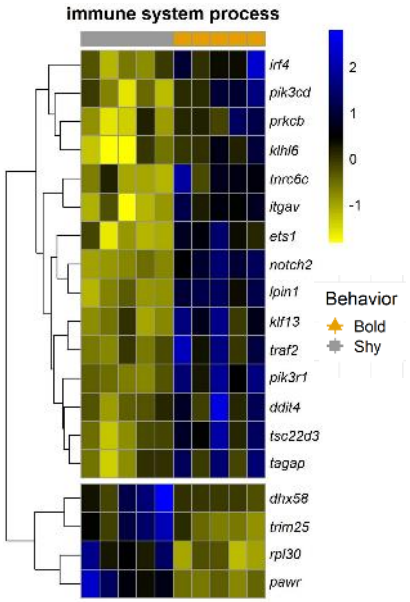

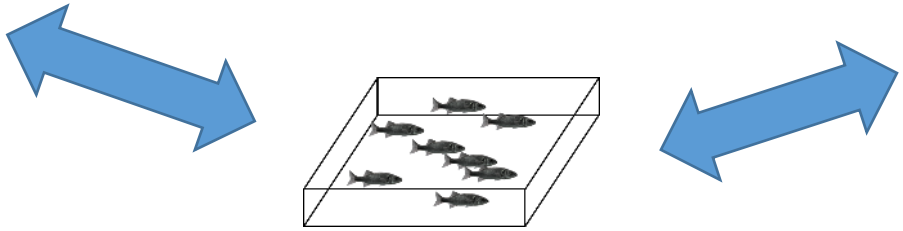

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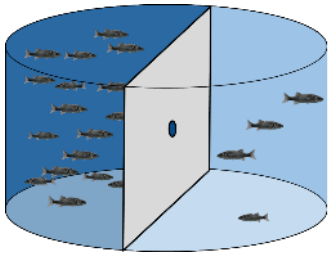

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  = « syndrome comportementaux »

VOLUME 79, NO. 3 SEPTEMBER 2004

THE QUARTERLY REVIEW of BIOLOGY

BEHAVIORAL SYNDROMES: AN INTEGRATIVE OVERVIEW

ANDREW SIH
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Department of Biological Sciences, University of Kentucky
Lexington, Kentucky 40506 USA

ROBERT E. ZIEMBA
Department of Biology, Centre College
Danville, Kentucky 40422 USA

Variabilité inter-individuelle

- Corrélation entre comportements
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- Corrélation entre comportements et physiologie
  = « coping style »

PERGAMON

Neuroscience and Biobehavioral Reviews 23 (1999) 925–935

NEUROSCIENCE AND BIOBEHAVIORAL REVIEWS

www.elsevier.com/locate/neubiorev

Coping styles in animals: current status in behavior and stress-physiology

J.M. Koolhaas[a,*], S.M. Korte[b], S.F. De Boer[a], B.J. Van Der Vegt[a], C.G. Van Reenen[b], H. Hopster[b], I.C. De Jong[a,b], M.A.W. Ruis[b], H.J. Blokhuis[b]

[a]*Department of Animal Physiology, University of Groningen, P.O. Box 14, 9750 AA Haren, The Netherlands*
[b]*DLO-Institute for Animal Science and Health (ID-DLO), Department of Behavior, Stress Physiology and Management, P.O. Box 65, 8200 AB Lelystad, The Netherlands*

Received 1 May 1999

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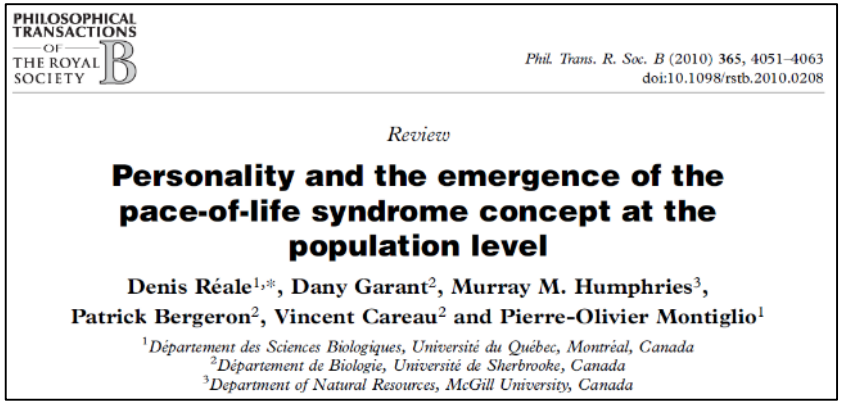

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B

Phil. Trans. R. Soc. B (2010) **365**, 4051–4063
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Review

Personality and the emergence of the pace-of-life syndrome concept at the population level

Denis Réale[1,*], Dany Garant[2], Murray M. Humphries[3], Patrick Bergeron[2], Vincent Careau[2] and Pierre-Olivier Montiglio[1]

[1]*Département des Sciences Biologiques, Université du Québec, Montréal, Canada*
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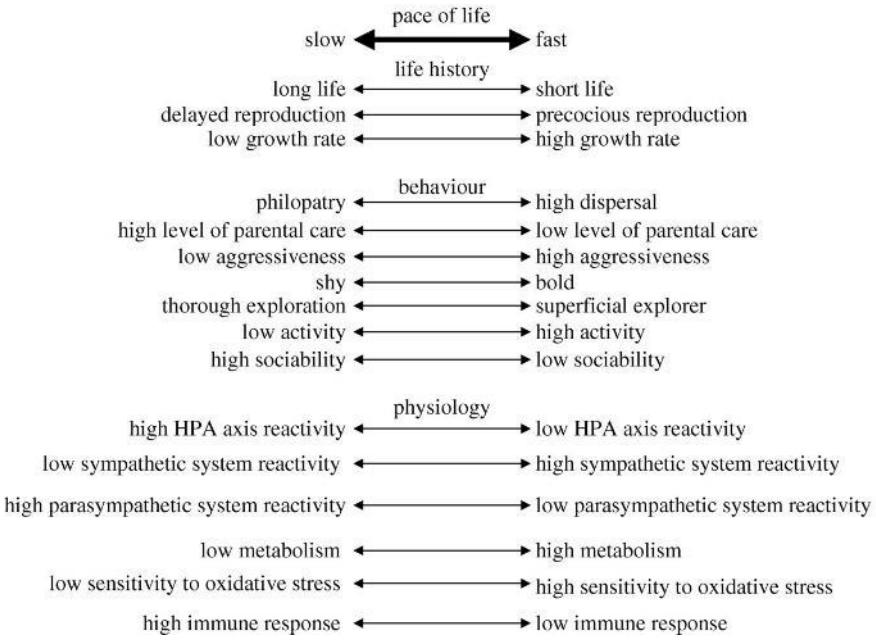

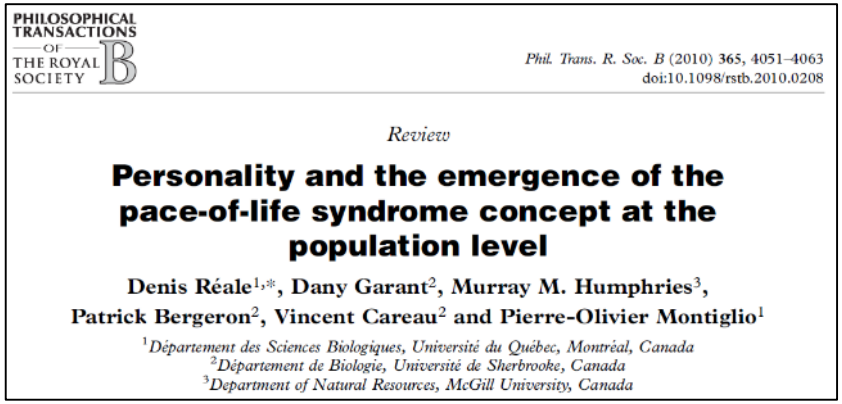

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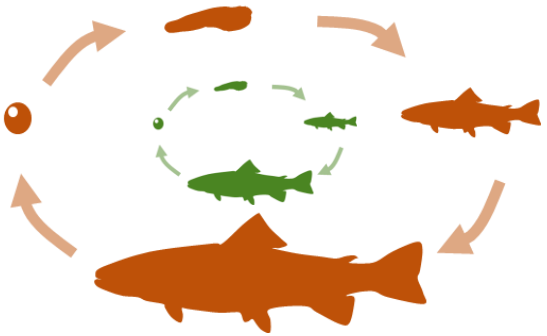

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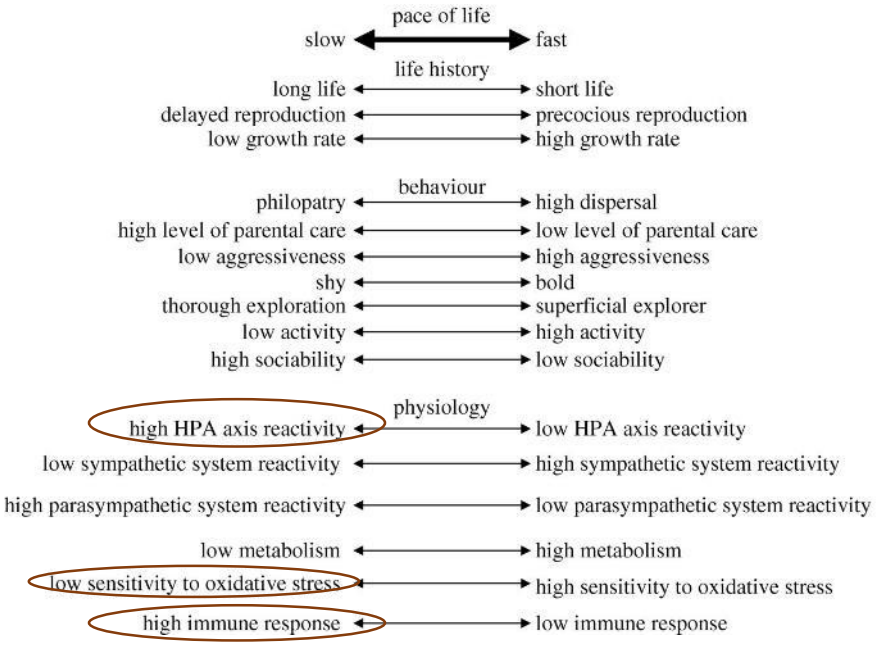

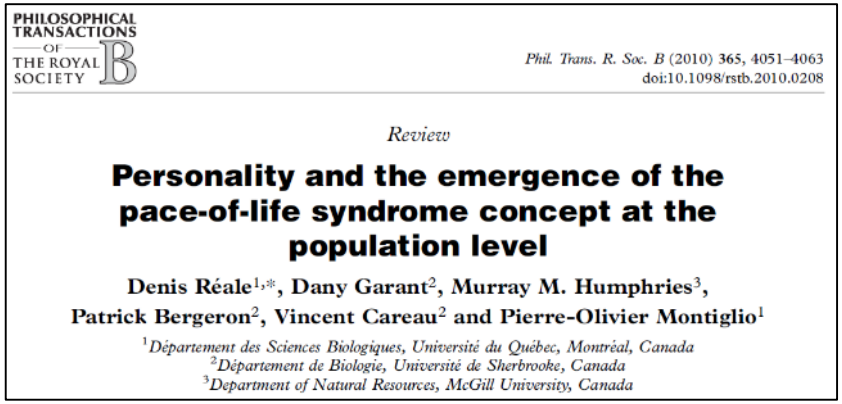
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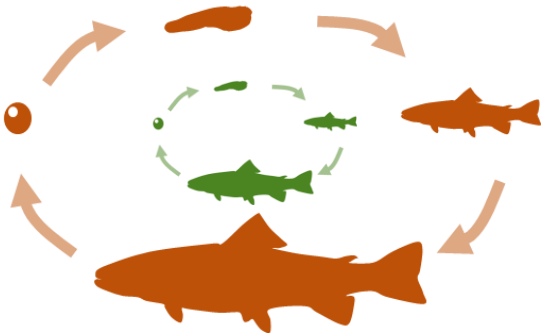

Lien avec la physiologie de l'adaptation

Sources de cette variabilité

- Comment conserver dans la population des différences entre individus sont stables dans le temps et les contextes?

composante génétique forte + des fitness différentes en fonction de l'environnement + des environnements variés

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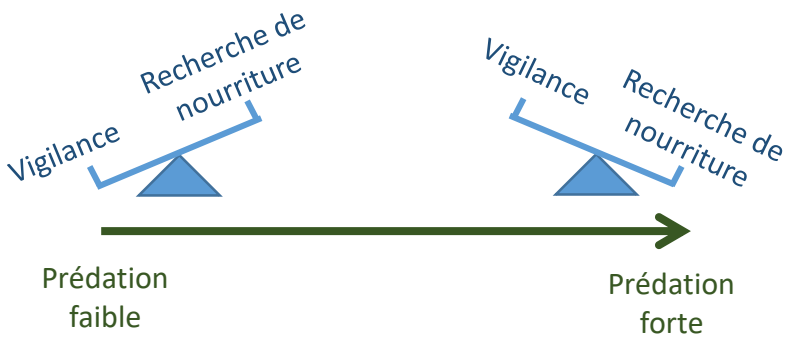

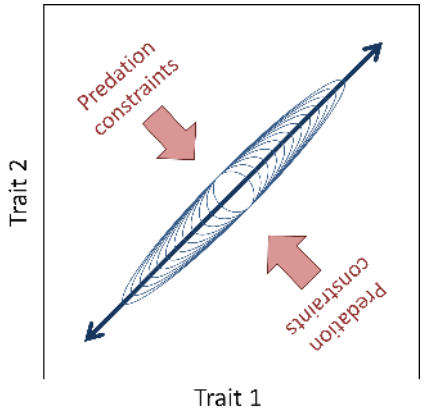

Impacts de l'Homme

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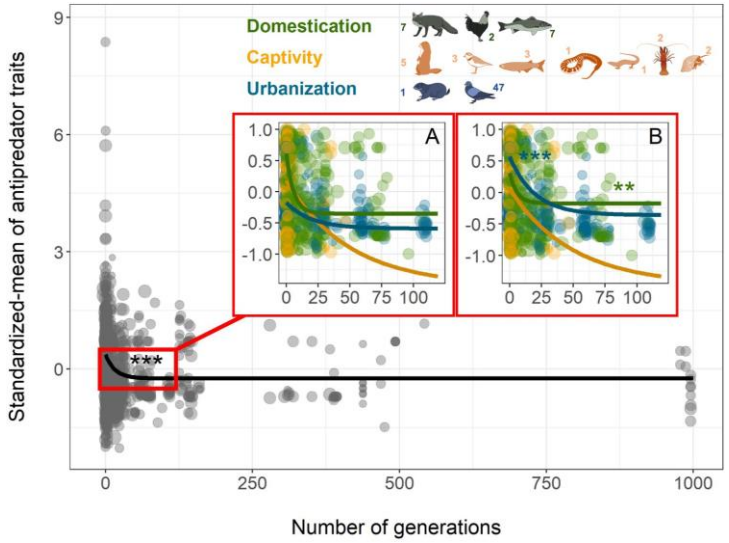

Sadoul et al. 2020

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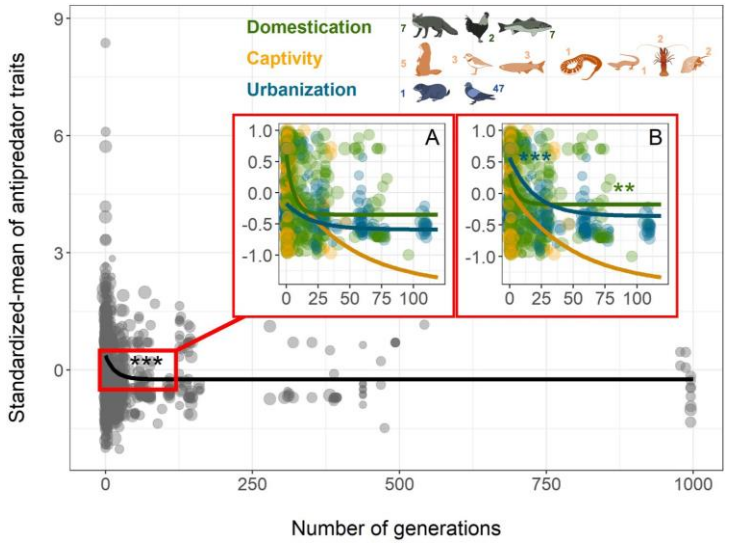

Sadoul et al. 2020


frontiers in Conservation Science

HYPOTHESIS AND THEORY
published: 16 December 2020
doi: 10.3389/fcosc.2020.611919

A World for Reactive Phenotypes

Benjamin Geffroy[1], Sébastien Alfonso[2]*, Bastien Sadoul[3]* and Daniel T. Blumstein[4]**

[1] MARBEC, Univ. Montpellier, Ifremer, IRD, CNRS, Palavas-Les-Flots, France, [2] COISPA Tecnologia & Ricerca, Stazione Sperimentale per lo Studio delle Risorse del Mare, Bari, Italy, [3] ESE, Ecology and Ecosystem Health, Institut Agro, INRAE, Rennes, France, [4] Department of Ecology and Evolutionary Biology, University of California, Los Angeles, Los Angeles, CA, United States


PLOS BIOLOGY

ESSAY

Human protection drives the emergence of a new coping style in animals

Bastien Sadoul[1], Daniel T. Blumstein[2], Sébastien Alfonso[3], Benjamin Geffroy[4]*

1 ESE, Ecology and Ecosystem Health, Institut Agro, INRAE, Rennes, France, 2 Department of Ecology and Evolutionary Biology, University of California, Los Angeles, California, United States of America, 3 COISPA Tecnologia & Ricerca, Stazione Sperimentale per lo Studio delle Risorse del Mare, Bari, Italy, 4 MARBEC, Univ. Montpellier, Ifremer, IRD, CNRS, Palavas-Les-Flots, France

Conséquences pour l'écologie halieutique

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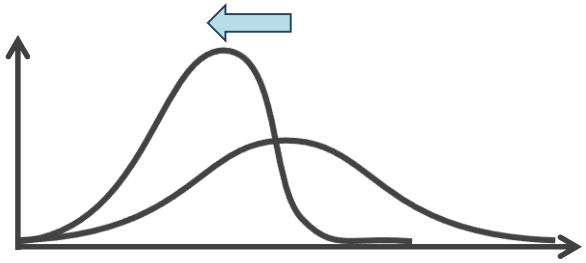
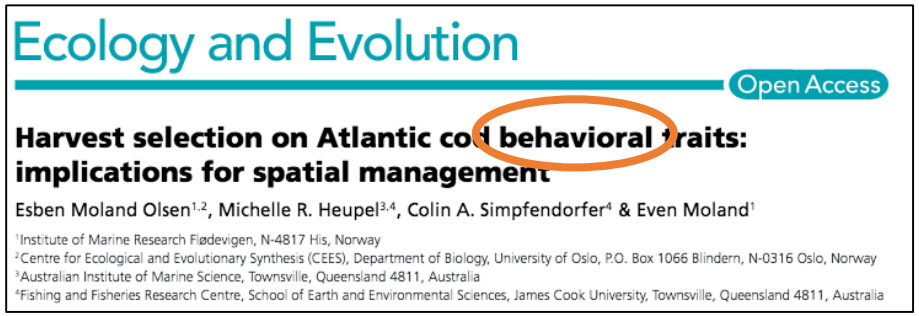
Comportement en milieu naturel

Pression de pêche





Ecology and Evolution

Open Access

Harvest selection on Atlantic cod behavioral traits: implications for spatial management

Esben Moland Olsen[1,2], Michelle R. Heupel[3,4], Colin A. Simpfendorfer[4] & Even Moland[1]

[1]Institute of Marine Research Flødevigen, N-4817 His, Norway
[2]Centre for Ecological and Evolutionary Synthesis (CEES), Department of Biology, University of Oslo, P.O. Box 1066 Blindern, N-0316 Oslo, Norway
[3]Australian Institute of Marine Science, Townsville, Queensland 4811, Australia
[4]Fishing and Fisheries Research Centre, School of Earth and Environmental Sciences, James Cook University, Townsville, Queensland 4811, Australia

Update

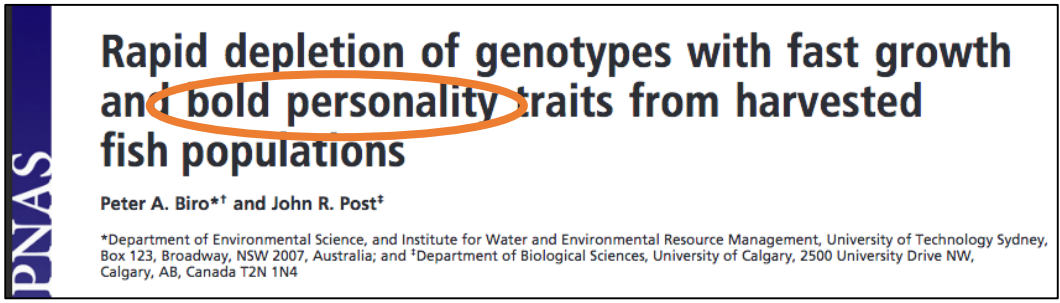
Trends in Ecology and Evolution Vol.23 No.8

Letters

A behavioral perspective on fishing-induced evolution

Silva Uusi-Heikkilä[1], Christian Wolter[1], Thomas Klefoth[1] and Robert Arlinghaus[1,2]

[1]Department of Biology and Ecology of Fishes, Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Müggelseedamm 310, 12587 Berlin, Germany
[2]Inland Fisheries Management Laboratory, Faculty of Agriculture and Horticulture, Humboldt-University at Berlin, Invalidenstrasse 42, 10115 Berlin, Germany



PNAS

Rapid depletion of genotypes with fast growth and bold personality traits from harvested fish populations

Peter A. Biro*† and John R. Post‡

*Department of Environmental Science, and Institute for Water and Environmental Resource Management, University of Technology Sydney, Box 123, Broadway, NSW 2007, Australia; and ‡Department of Biological Sciences, University of Calgary, 2500 University Drive NW, Calgary, AB, Canada T2N 1N4

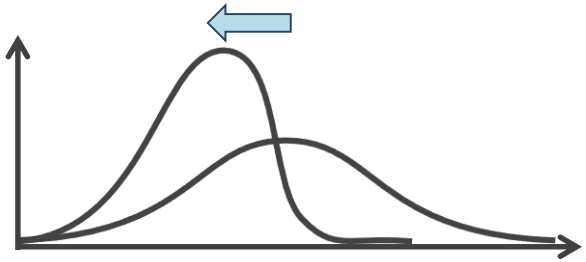
Conséquences pour l'écologie halieutique

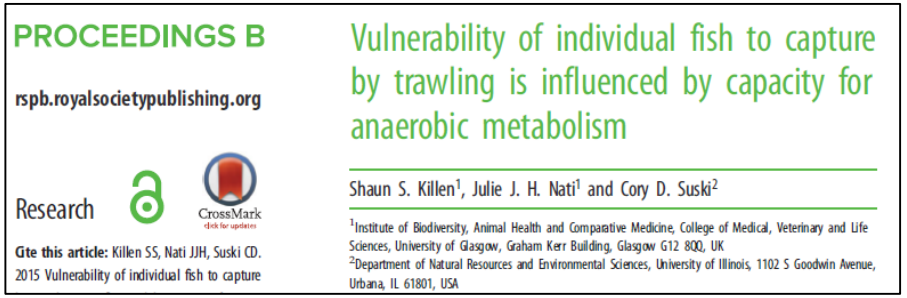
POLS

Comportement en milieu naturel ⟷ **Capacités métaboliques**

Pression de pêche

Pression de pêche





PROCEEDINGS B

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Research

Cite this article: Killen SS, Nati JJH, Suski CD. 2015 Vulnerability of individual fish to capture

Vulnerability of individual fish to capture by trawling is influenced by capacity for anaerobic metabolism

Shaun S. Killen[1], Julie J. H. Nati[1] and Cory D. Suski[2]

[1]Institute of Biodiversity, Animal Health and Comparative Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow, Graham Kerr Building, Glasgow G12 8QQ, UK
[2]Department of Natural Resources and Environmental Sciences, University of Illinois, 1102 S Goodwin Avenue, Urbana, IL 61801, USA

Conséquences pour l'écologie halieutique

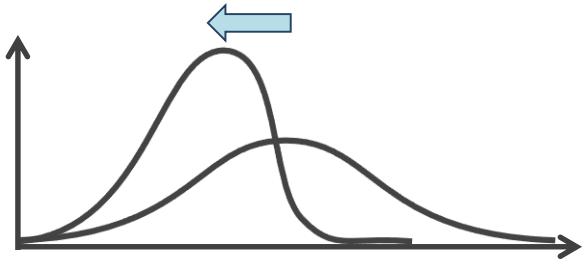
POLS

Comportement en milieu naturel ⟷ **Capacités métaboliques**

Pression de pêche

Croissance, maturation, reproduction

Pression de pêche



Conséquences pour l'écologie halieutique

Physiologie de l'adaptation

Réponse cortisol
Sensibilité au stress oxidatif
Système immunitaire

POLS

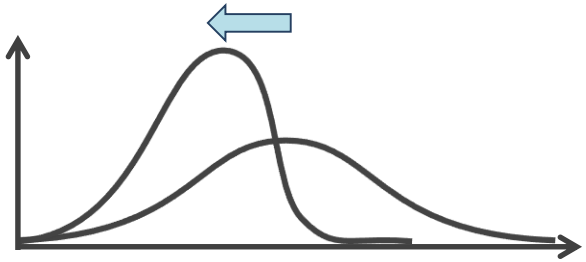
Comportement en milieu naturel

Capacités métaboliques

Pression de pêche

Pression de pêche

Croissance, maturation, reproduction



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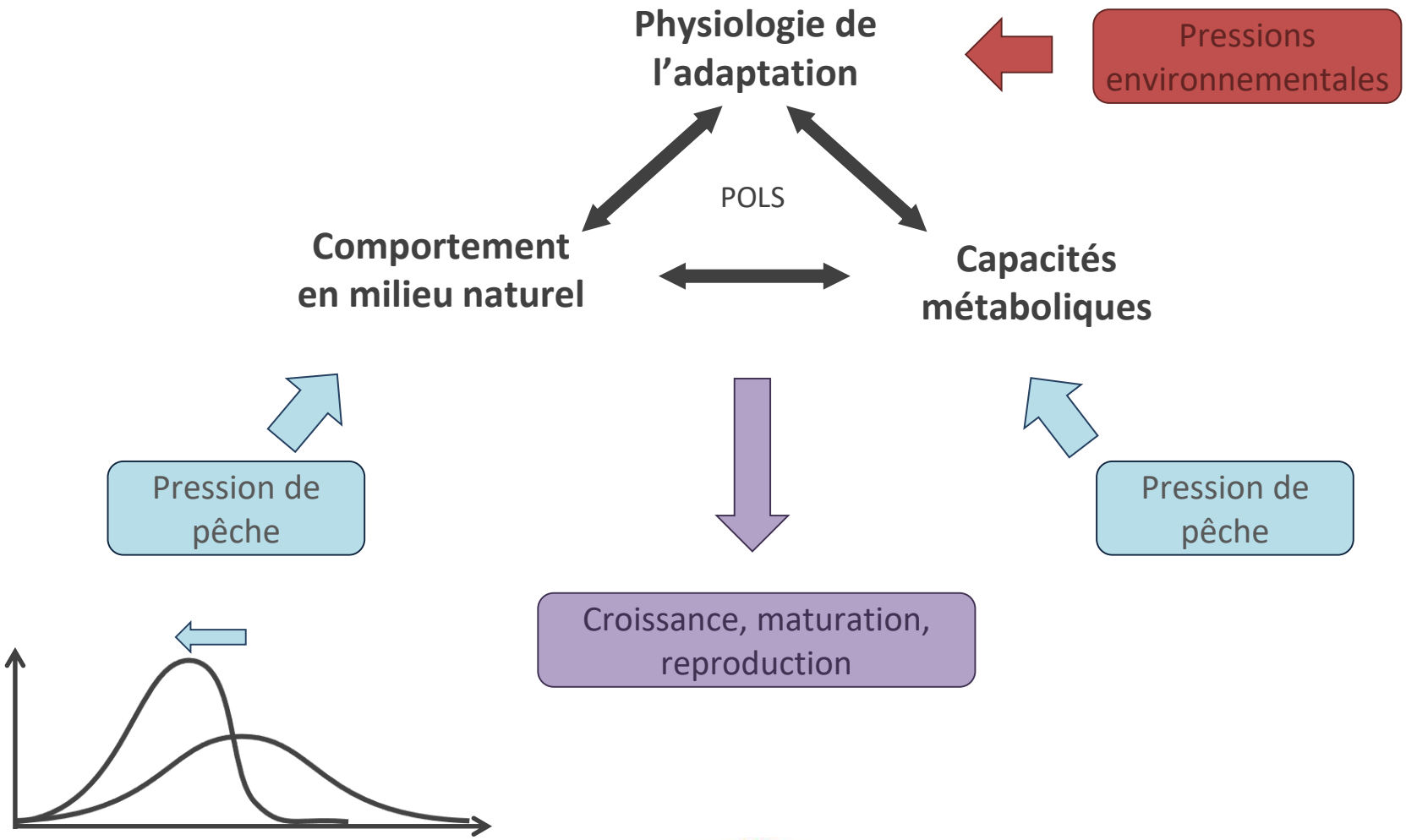

Réflexion:

Notre capacité à prédire les réponses des espèces halieutiques aux pressions environnementales repose sur notre capacité à prendre en compte la variabilité inter-individuelle

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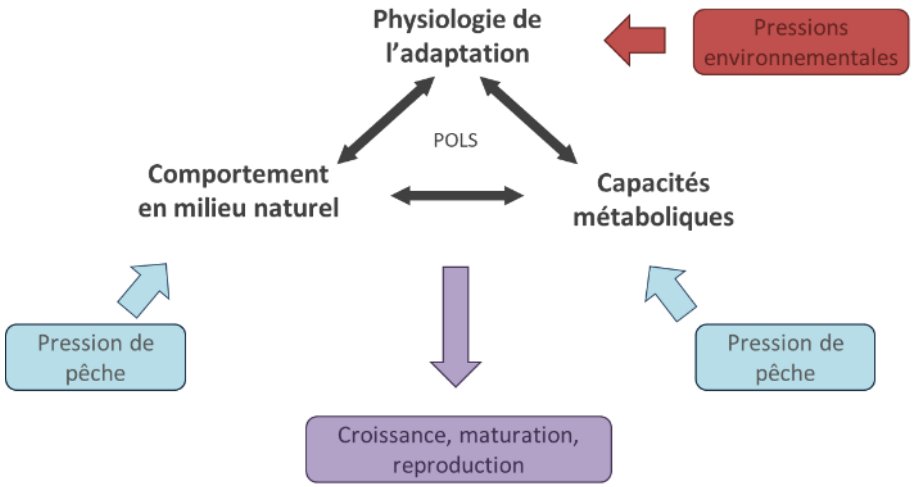
Notre capacité à prédire les réponses des espèces halieutiques aux pressions environnementales repose sur notre capacité à prendre en compte la variabilité inter-individuelle



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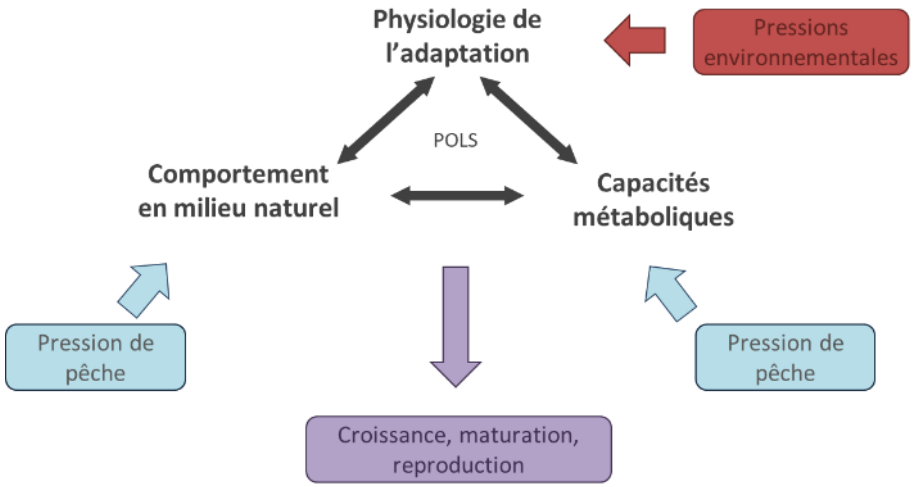
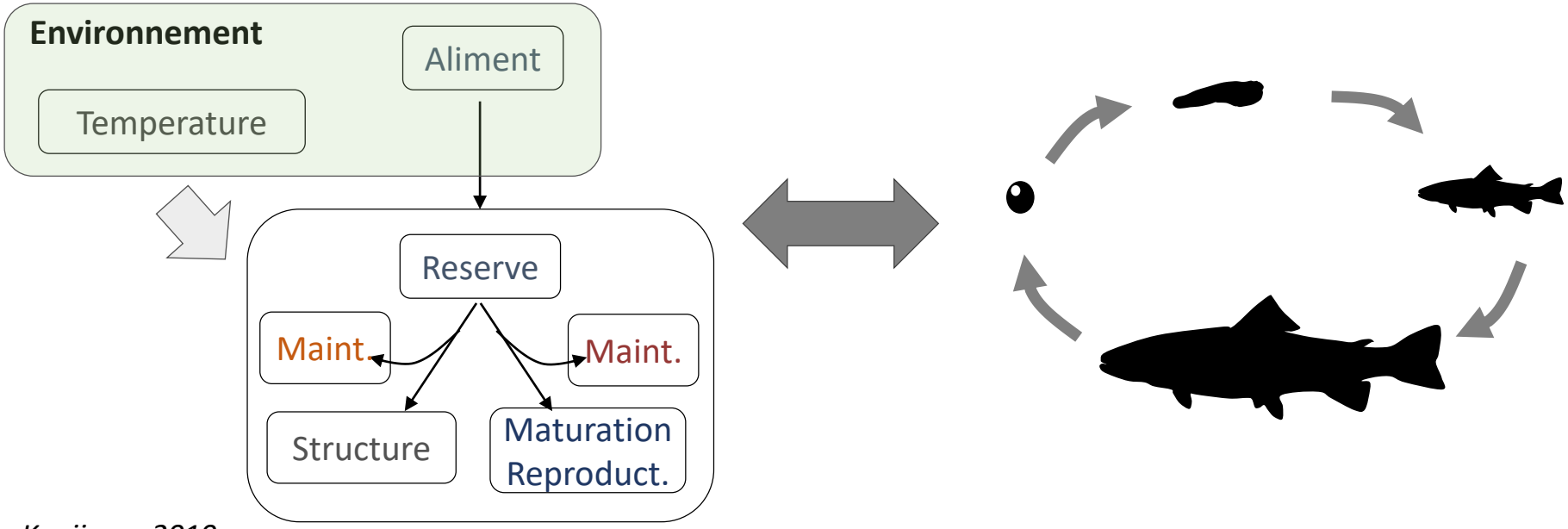


Modèle mécaniste bioénergétique

Modèle bioénergétique DEB

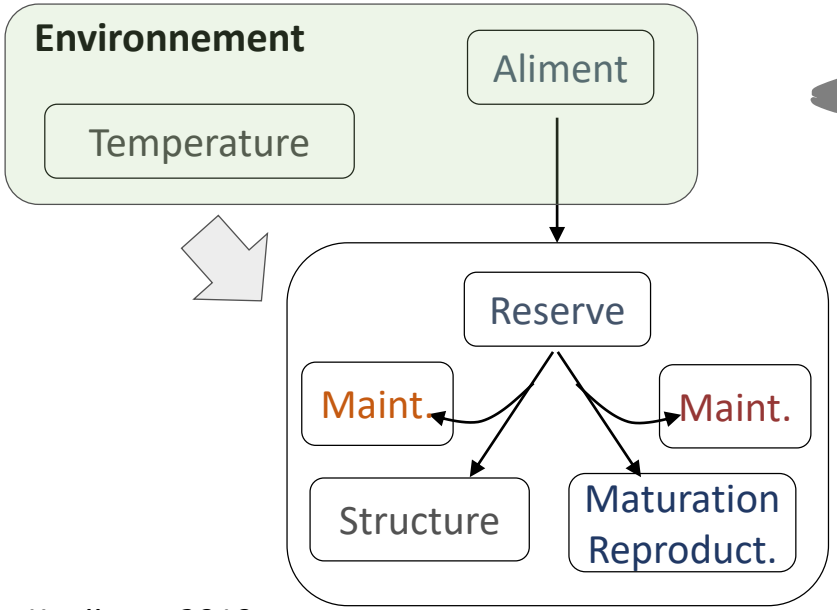
Dynamic Energy Budget Theory



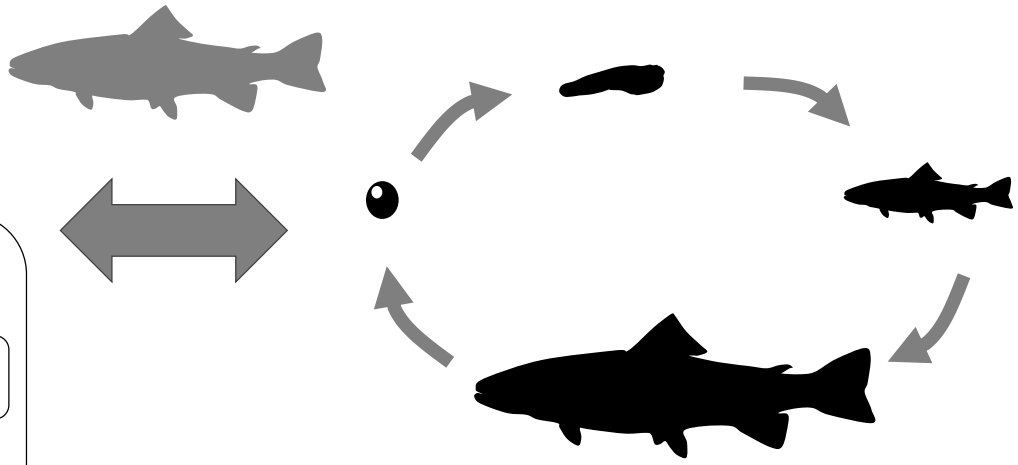
Kooijman 2010

Modèle bioénergétique DEB

Dynamic Energy Budget Theory



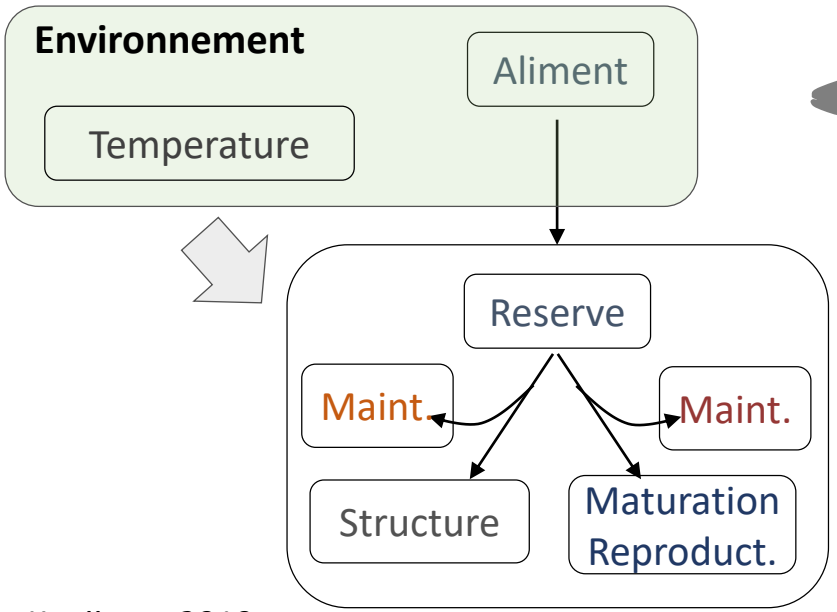
Kooijman 2010



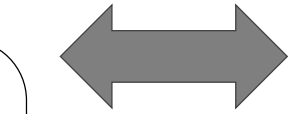
Sadoul et al. 2019a

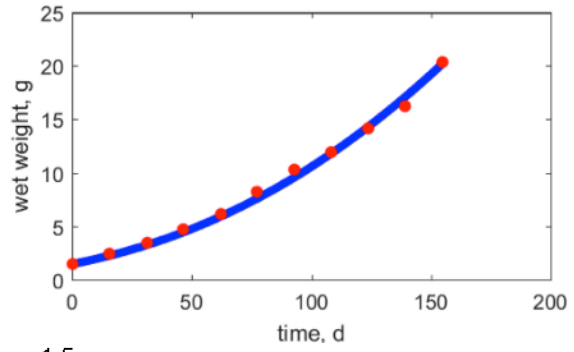
Modèle bioénergétique DEB

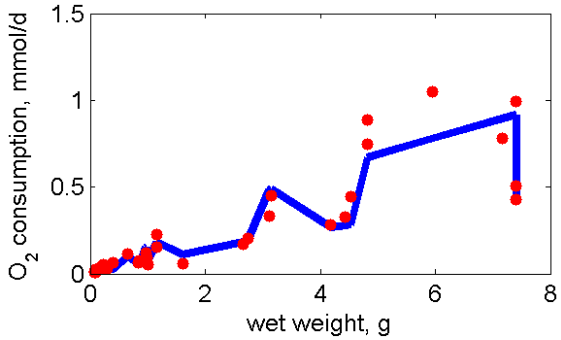
Dynamic Energy Budget Theory

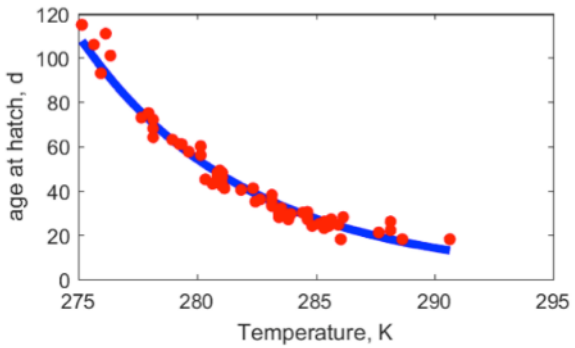


Kooijman 2010

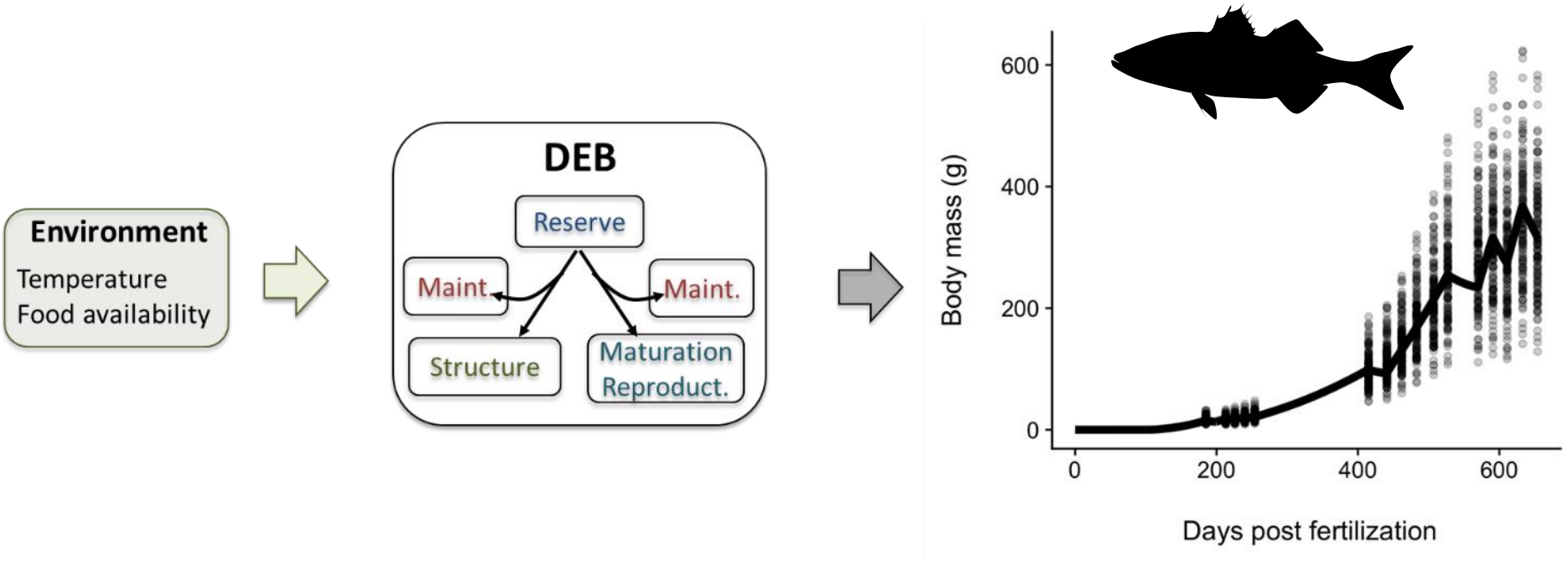








Intégrer la variation inter-individuelle



Décrit les traits d'histoire de vie de l'**animal moyen** dans un environnement dynamique

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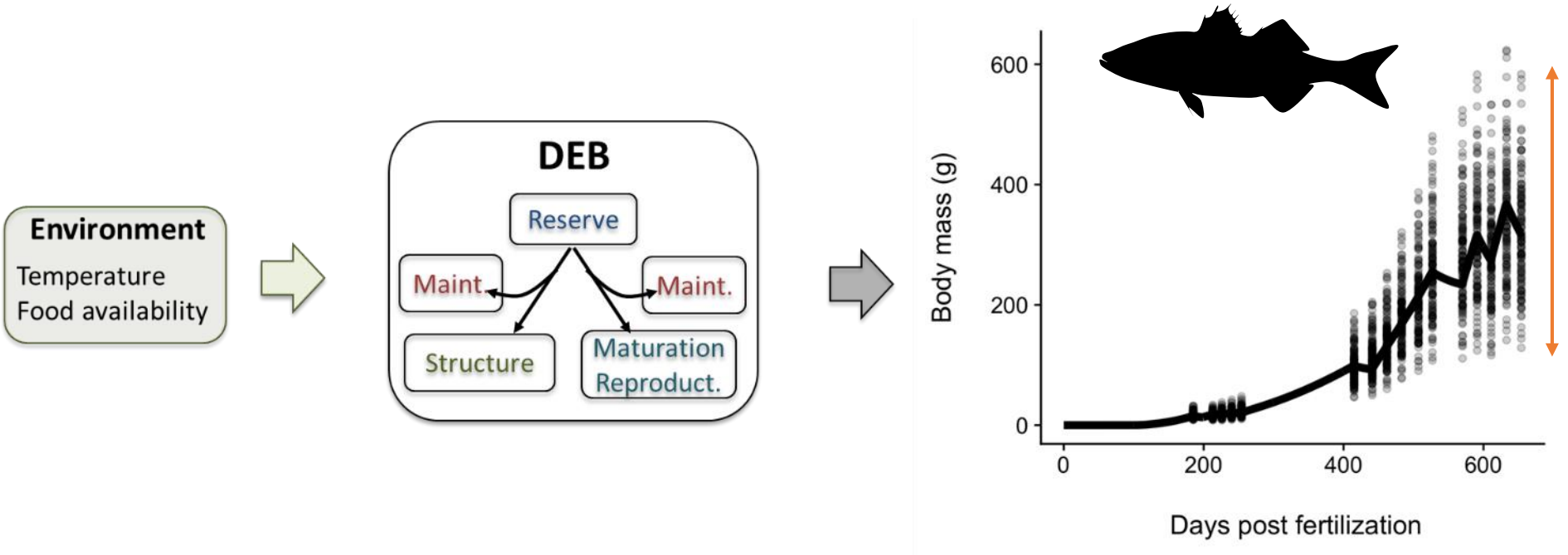

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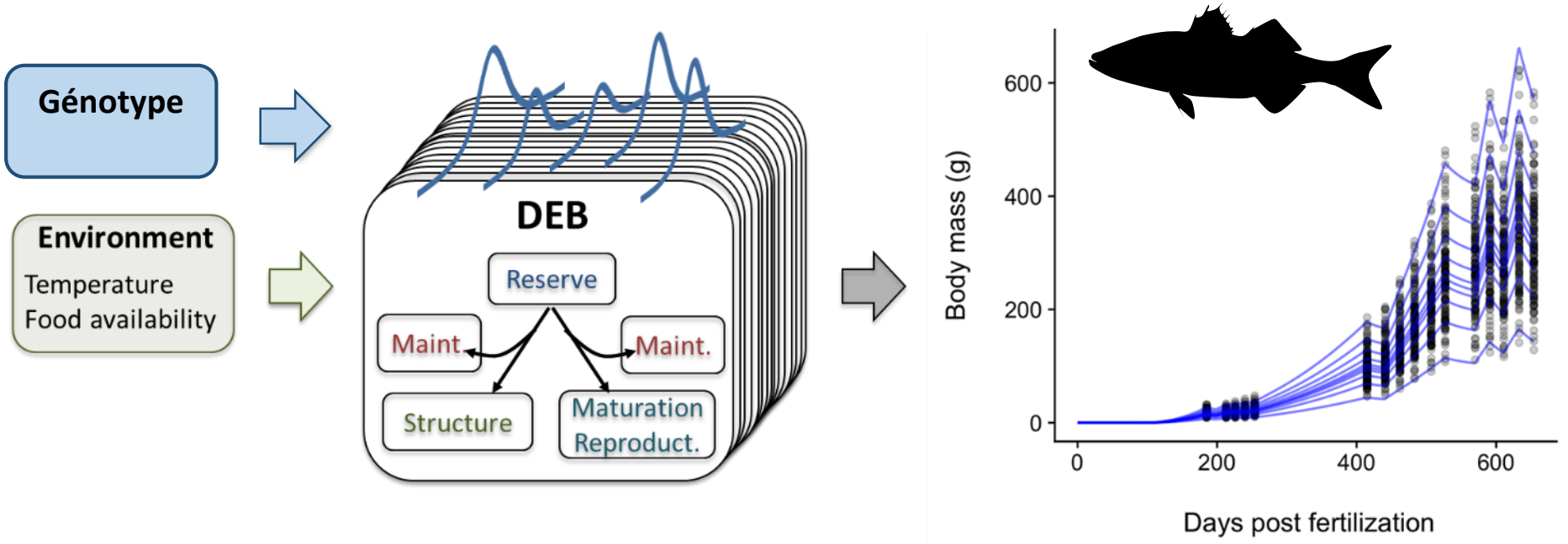

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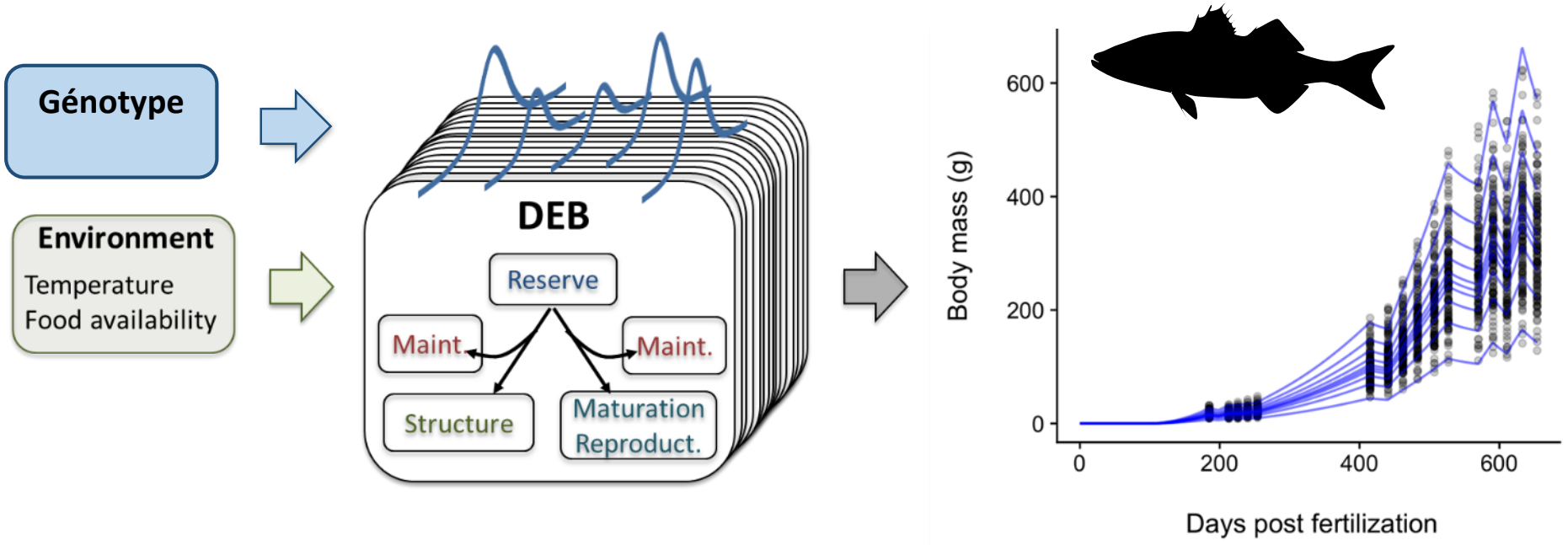

Nécessite :

1. Des conditions environnementales connues pour chaque individu
2. Des données longitudinales de croissance et reproduction
3. Des environnements variés

Intégrer la variation inter-individuelle

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Estimer la composante génétique de cette variabilité

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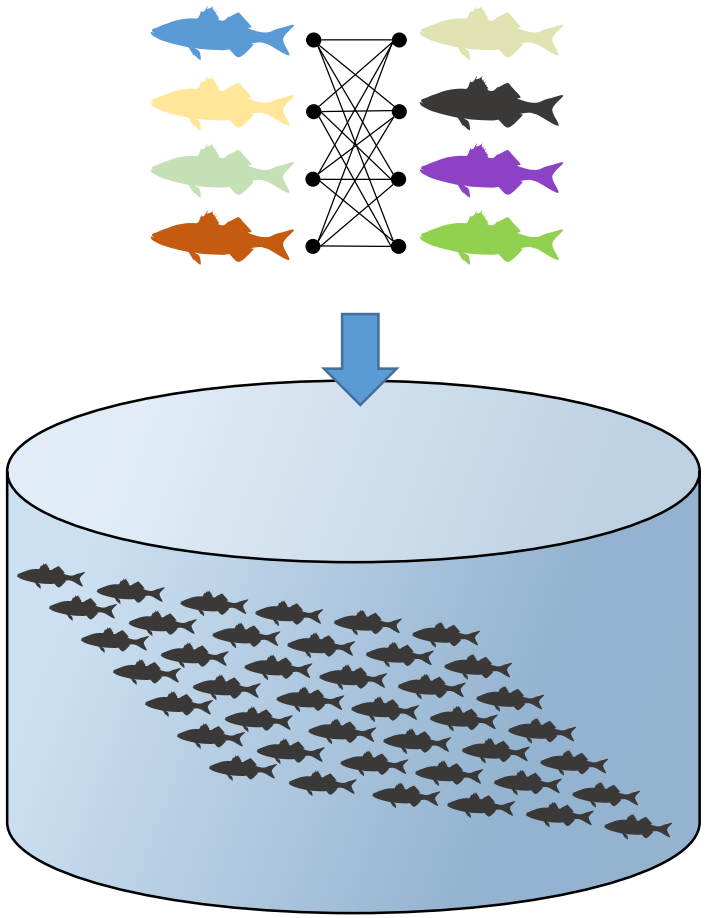
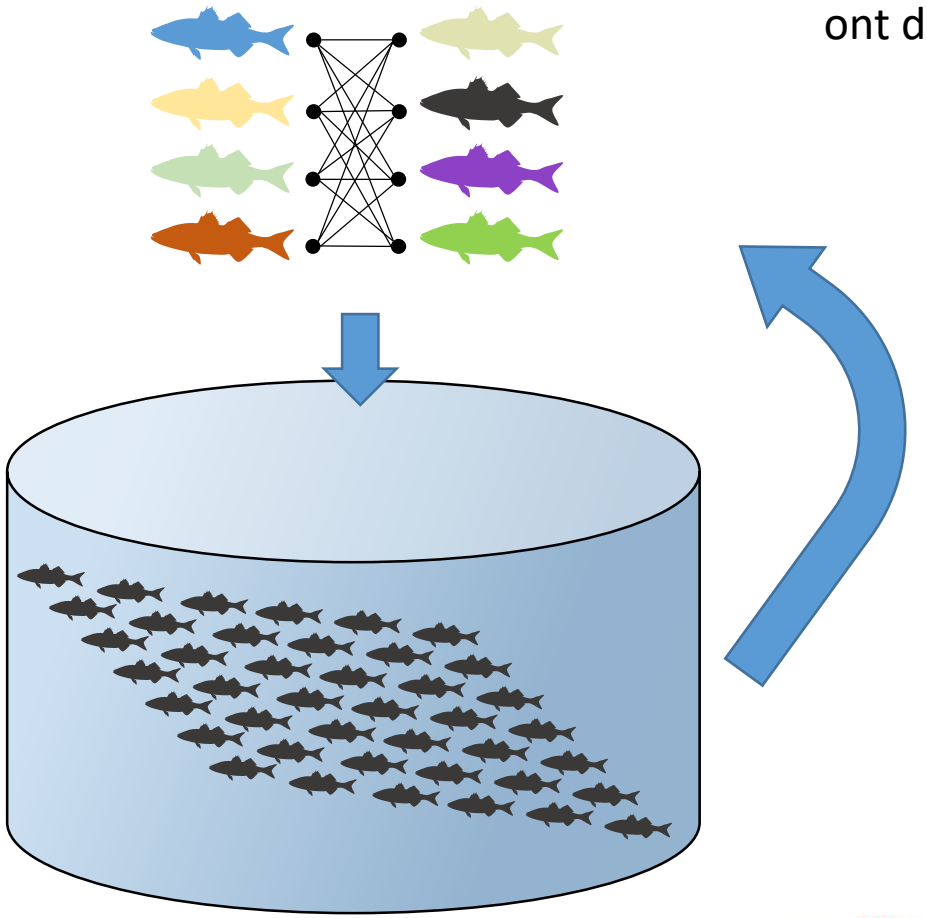


Est-ce que des individus génétiquement proches ont des caractéristiques bioénergétiques similaires?

Estimer la composante génétique de cette variabilité



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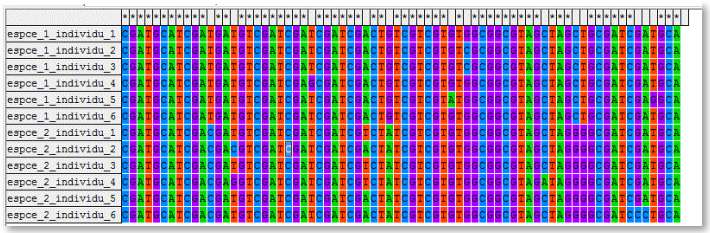

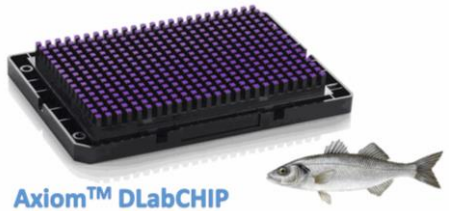

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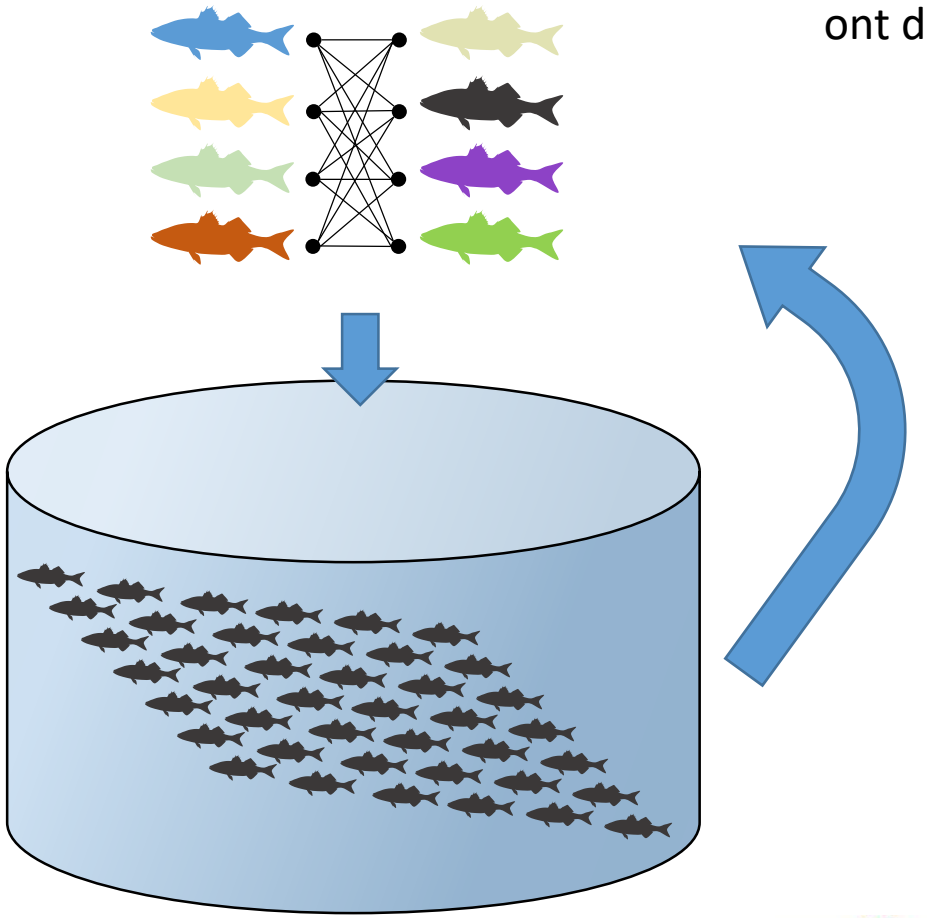

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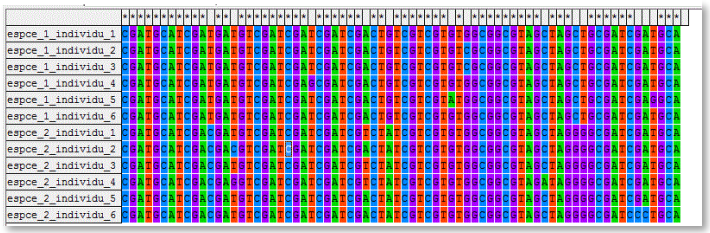
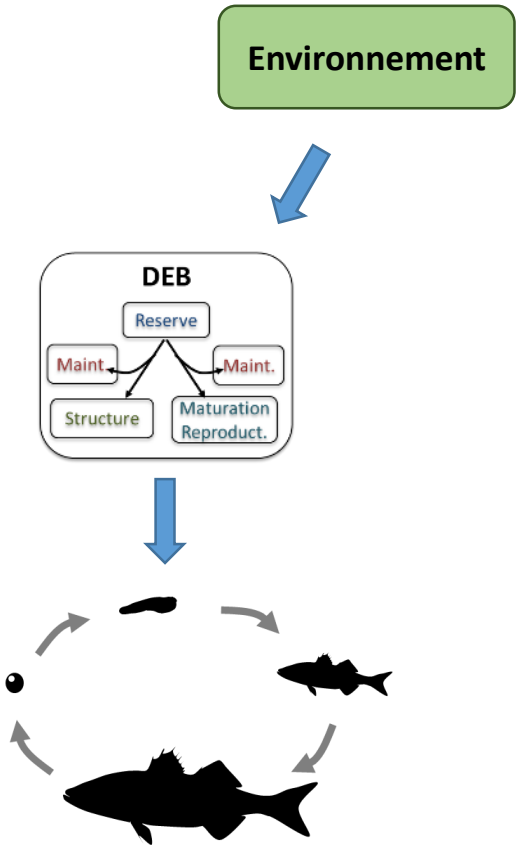
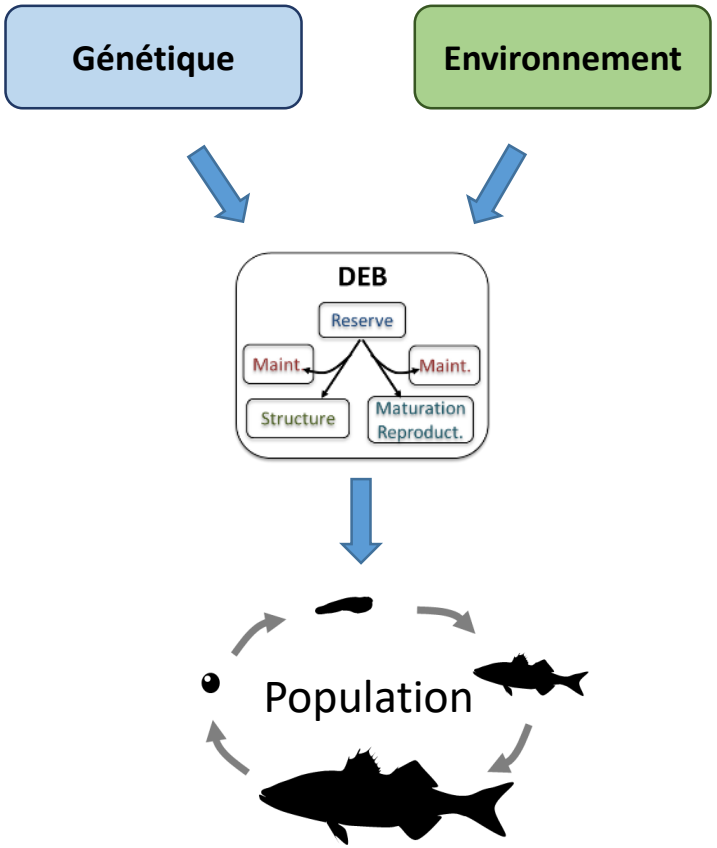


Calcul l'héritabilité des traits
Identifie des QTL
Décrit la covariance génétique

Dynamique éco-évolutive



Dynamique éco-évolutive



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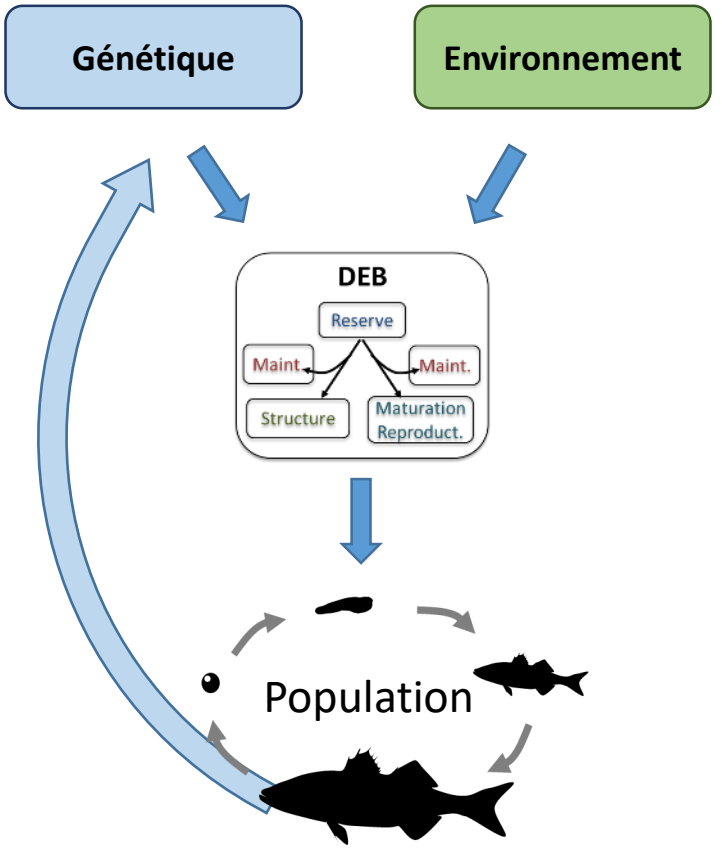
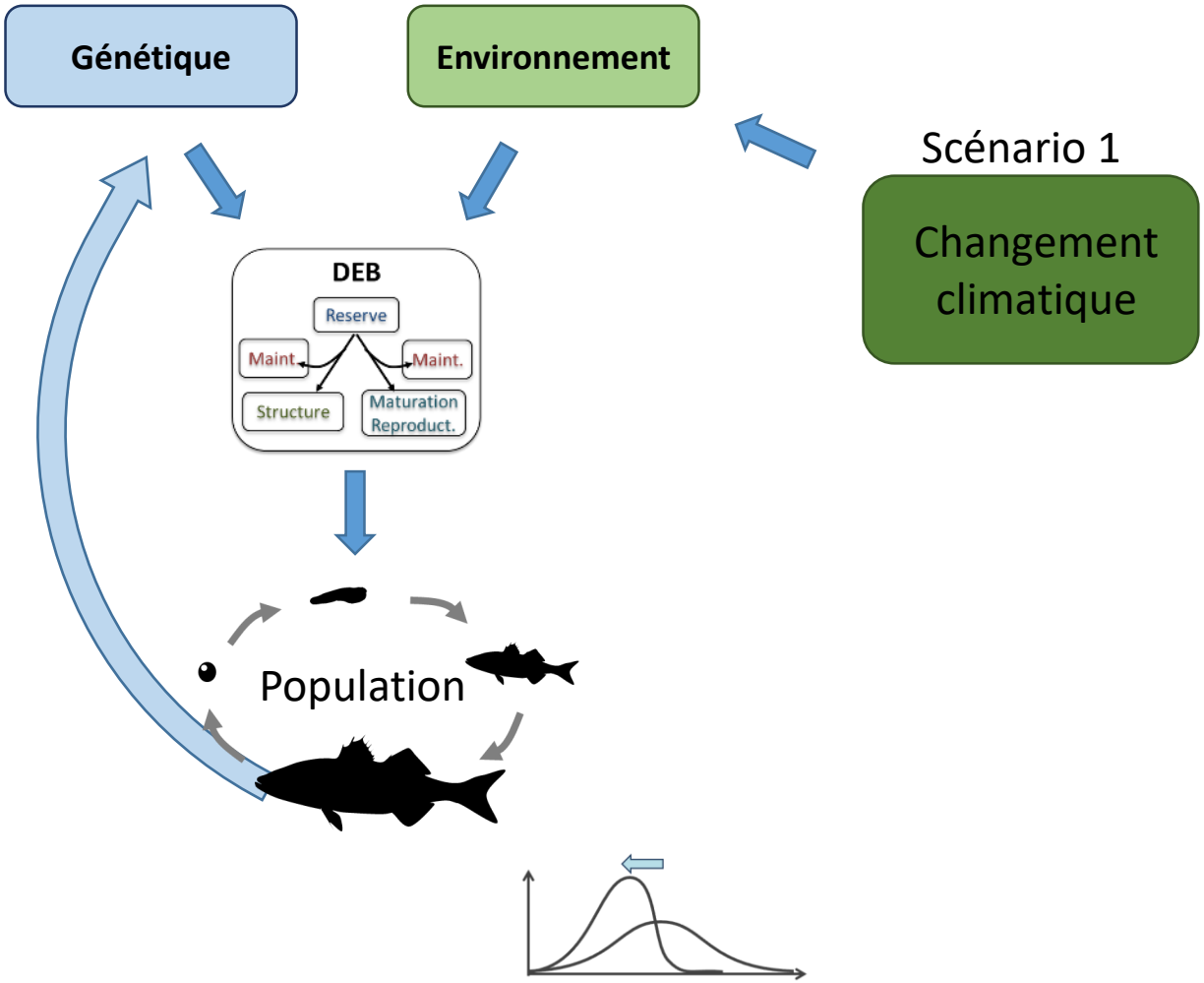
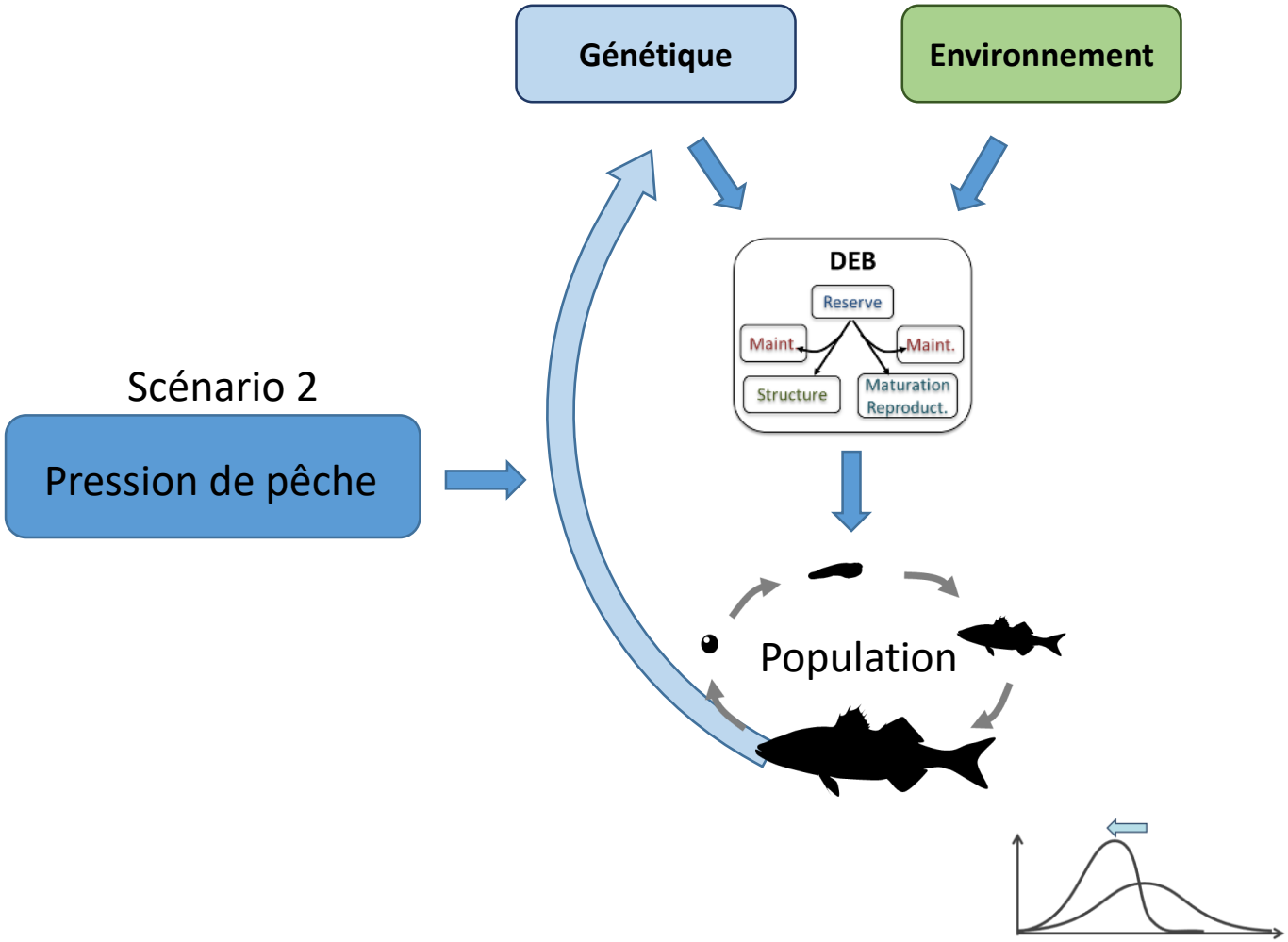


Dynamique éco-évolutive



Dynamique éco-évolutive



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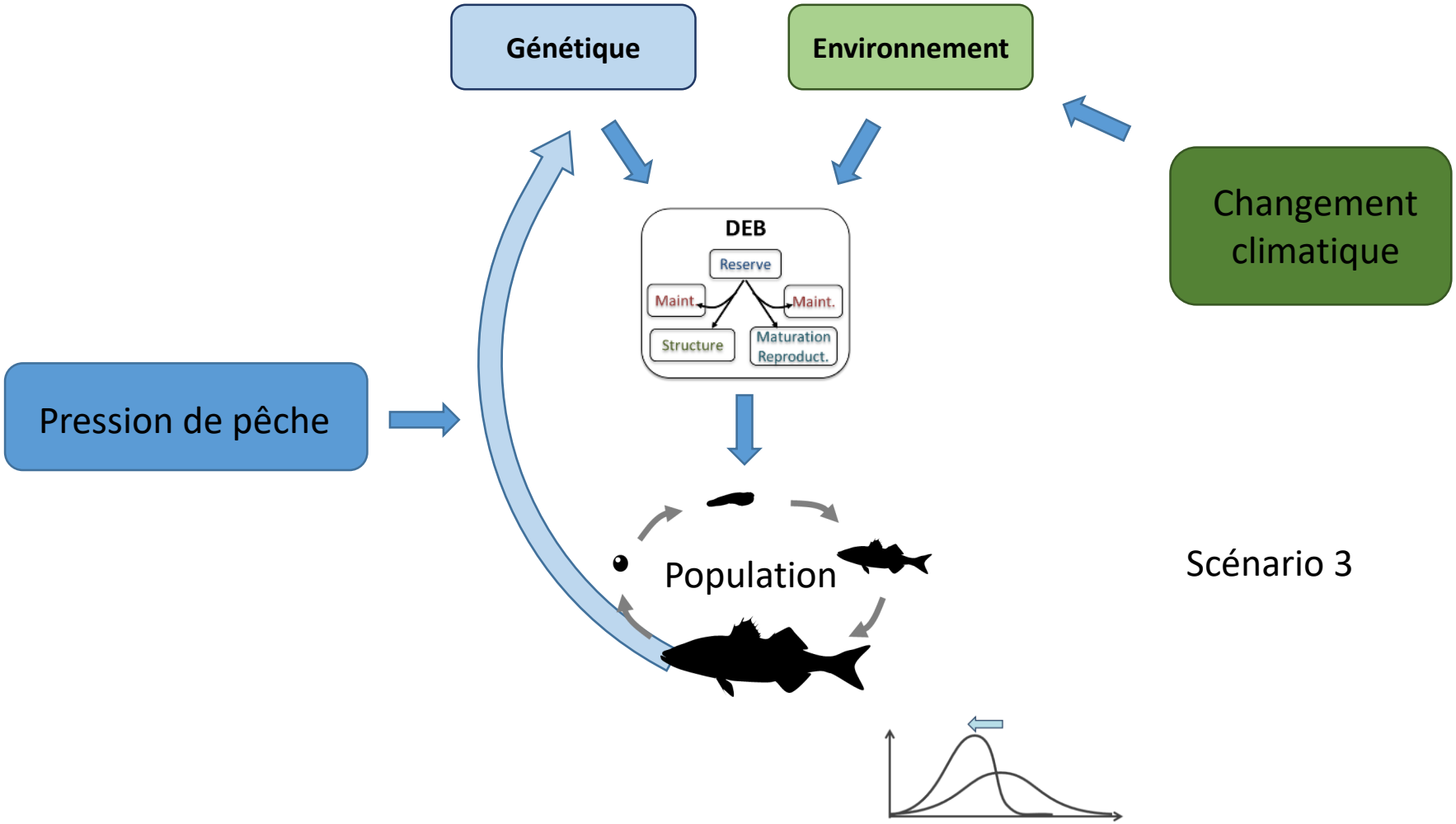


Scénario 3

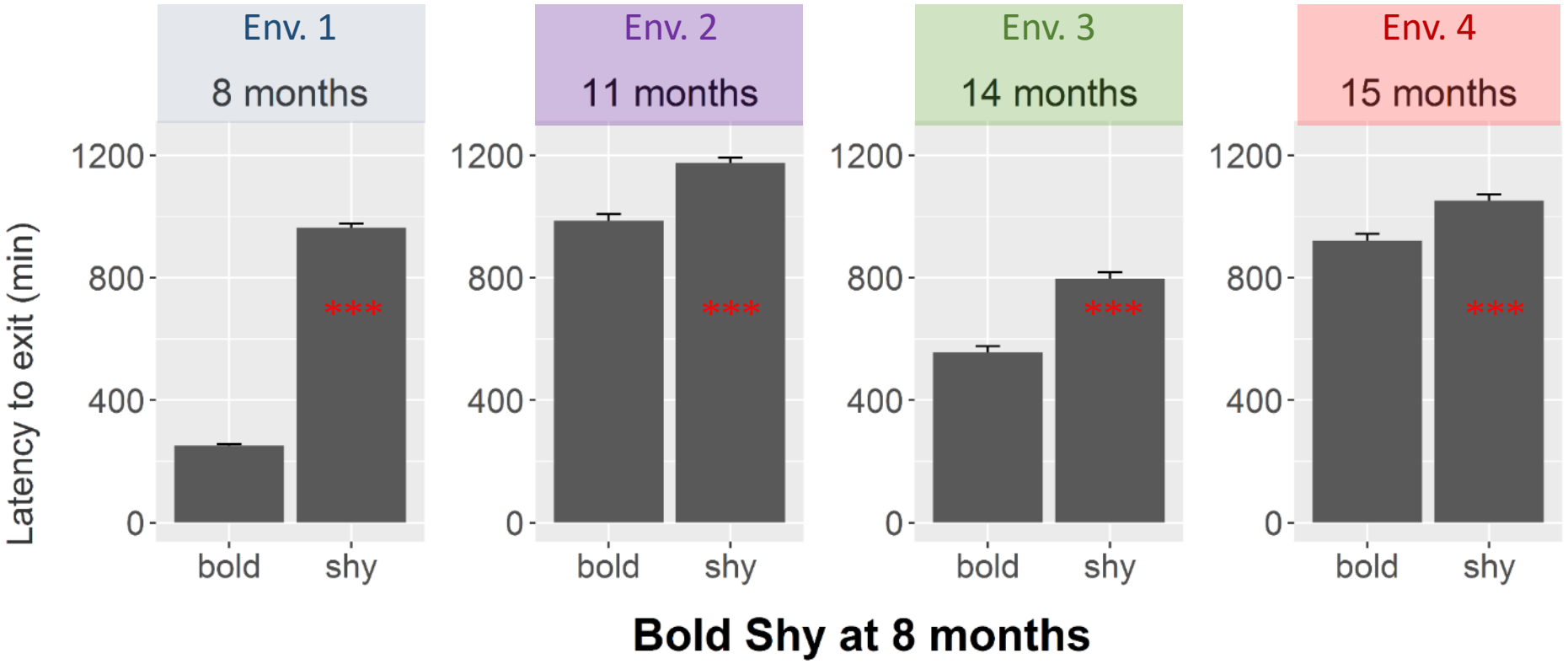
Conclusions/points de discussion

Conclusions/points de discussion

- Les corrélations physiologiques et comportementales sont nombreuses
- Chaque individu d'une population répond différemment aux pressions environnementales
- La sélection par la pêche de certains traits d'histoire de vie entraîne la sélection d'autres phénotypes
- Notre capacité à prédire les réponses aux pressions anthropiques doit passer par une prise en compte mécaniste de ces effets
- La modélisation bioénergétique associée à la génétique quantitative peut probablement répondre à cette problématique
- Difficulté réside dans notre capacité à avoir les données suffisantes pour calibrer le modèle

Merci pour votre attention

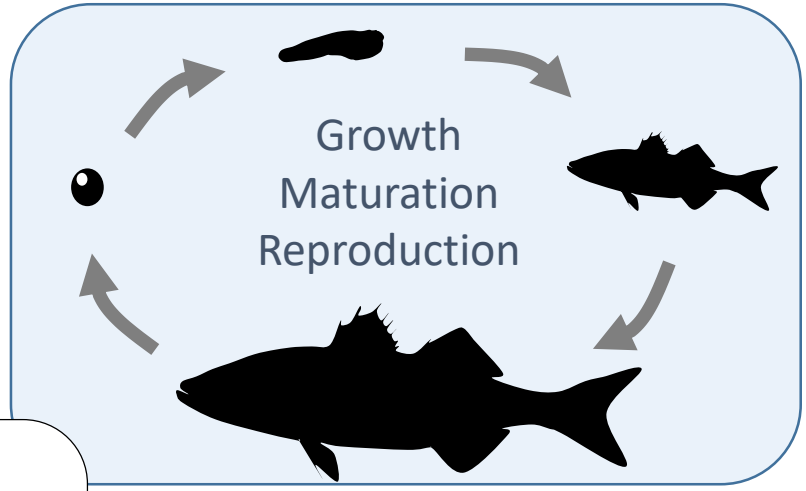
A robust behavior

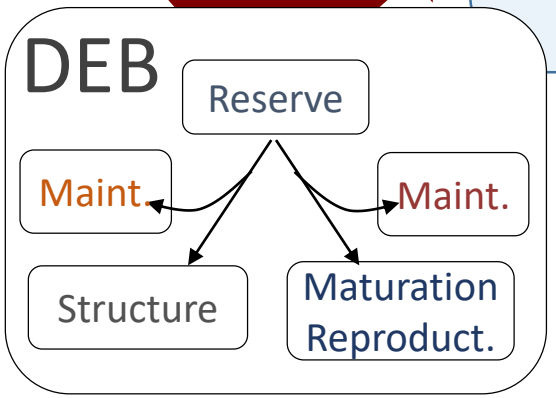


→ A consistent trait over time and contexts

Hypothesis

Risk taking behavior can explain part of the genetic variability in life history traits

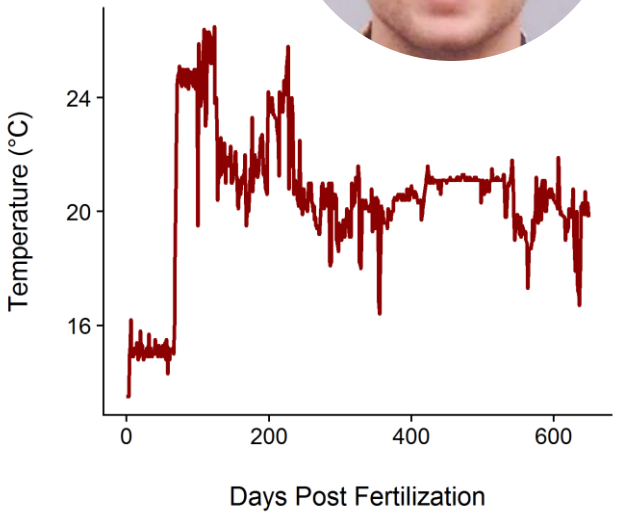


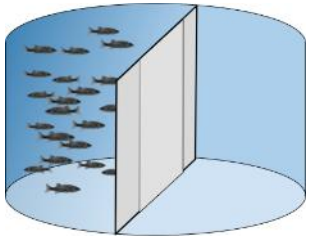


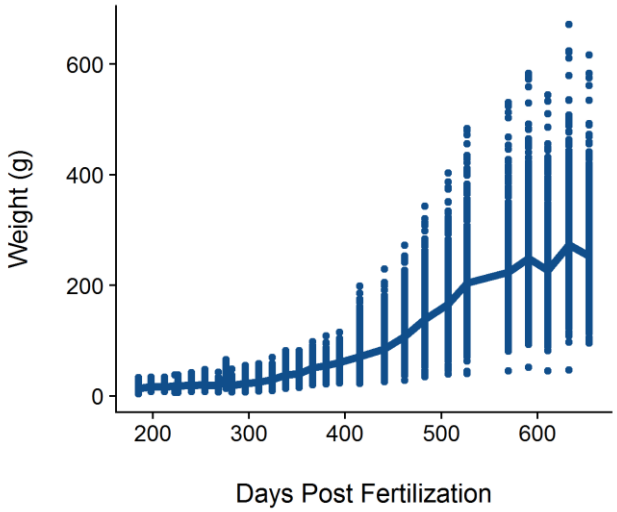
Prediction

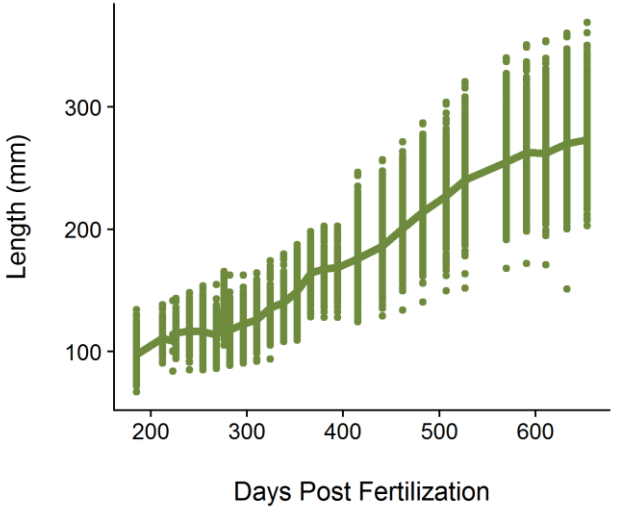
Method

-  X 588
- Individually tagged
- Genotyped (3000 markers)
- Risk taking behavior at 6 months
- W, L et Temp up to 2 years



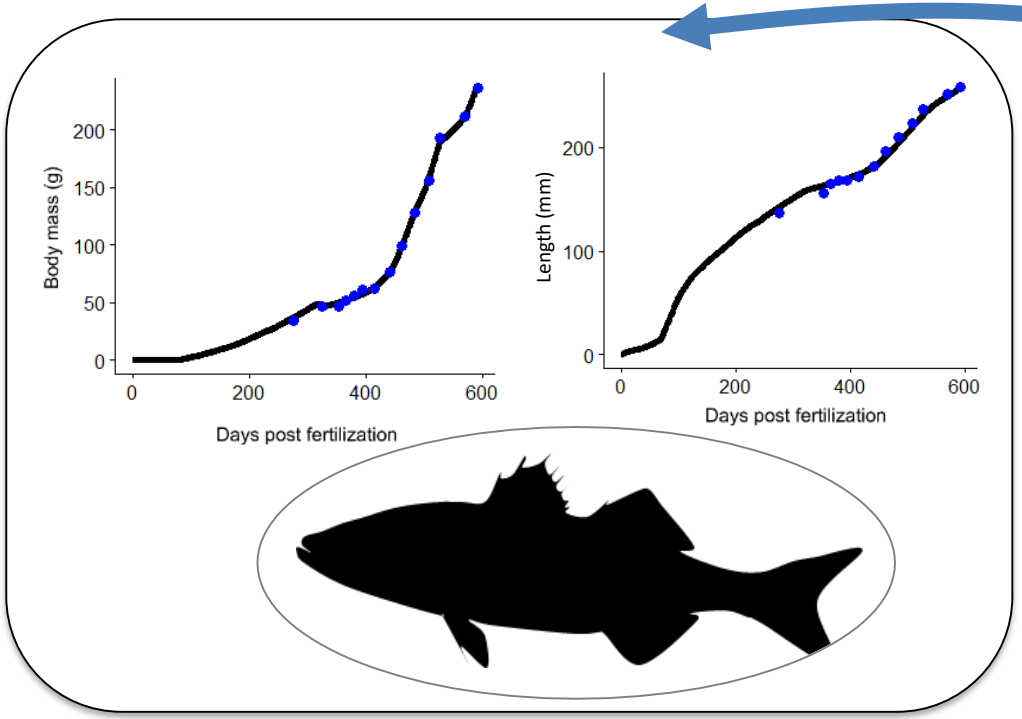




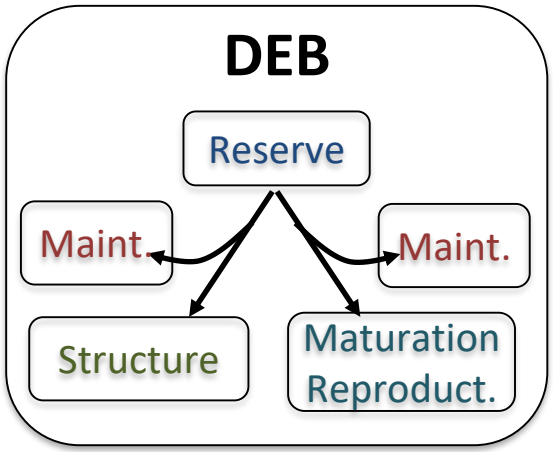


Method

1. Let one parameter vary for each individual



Optimize one parameter



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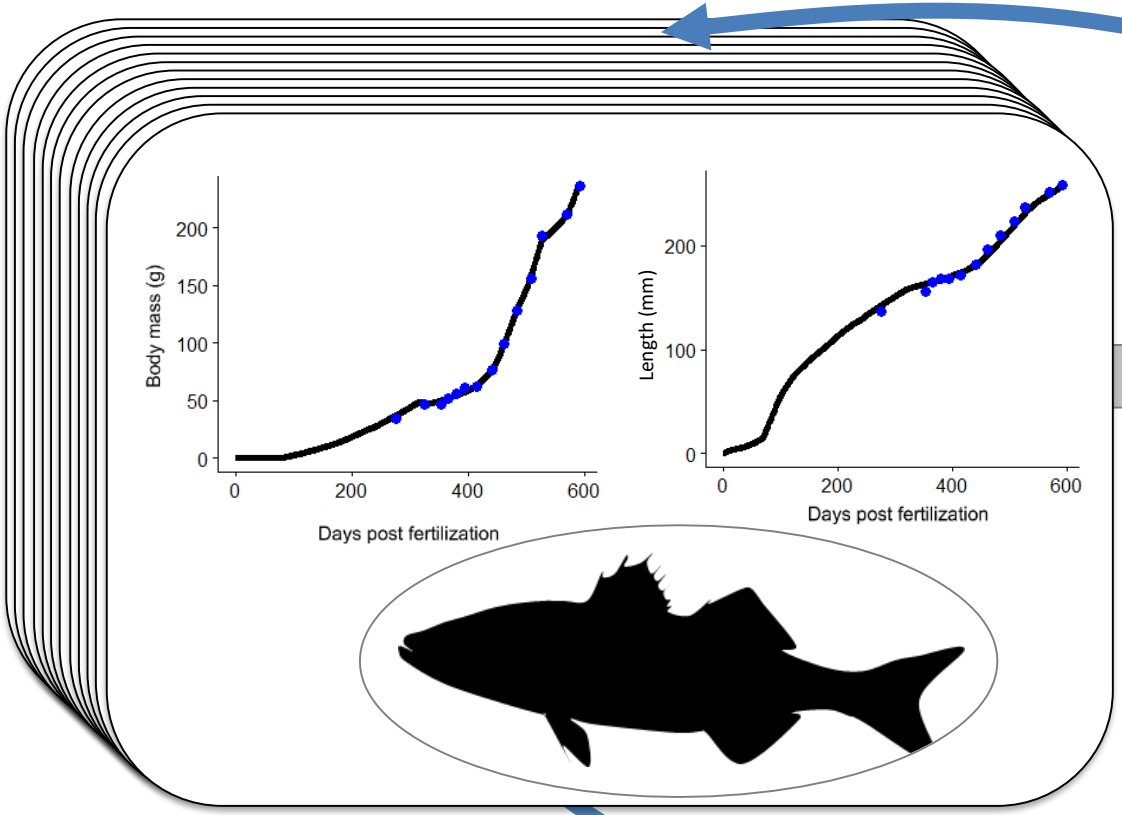
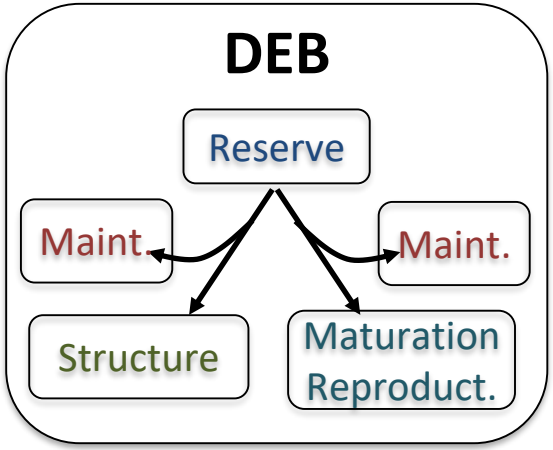


Optimize one parameter



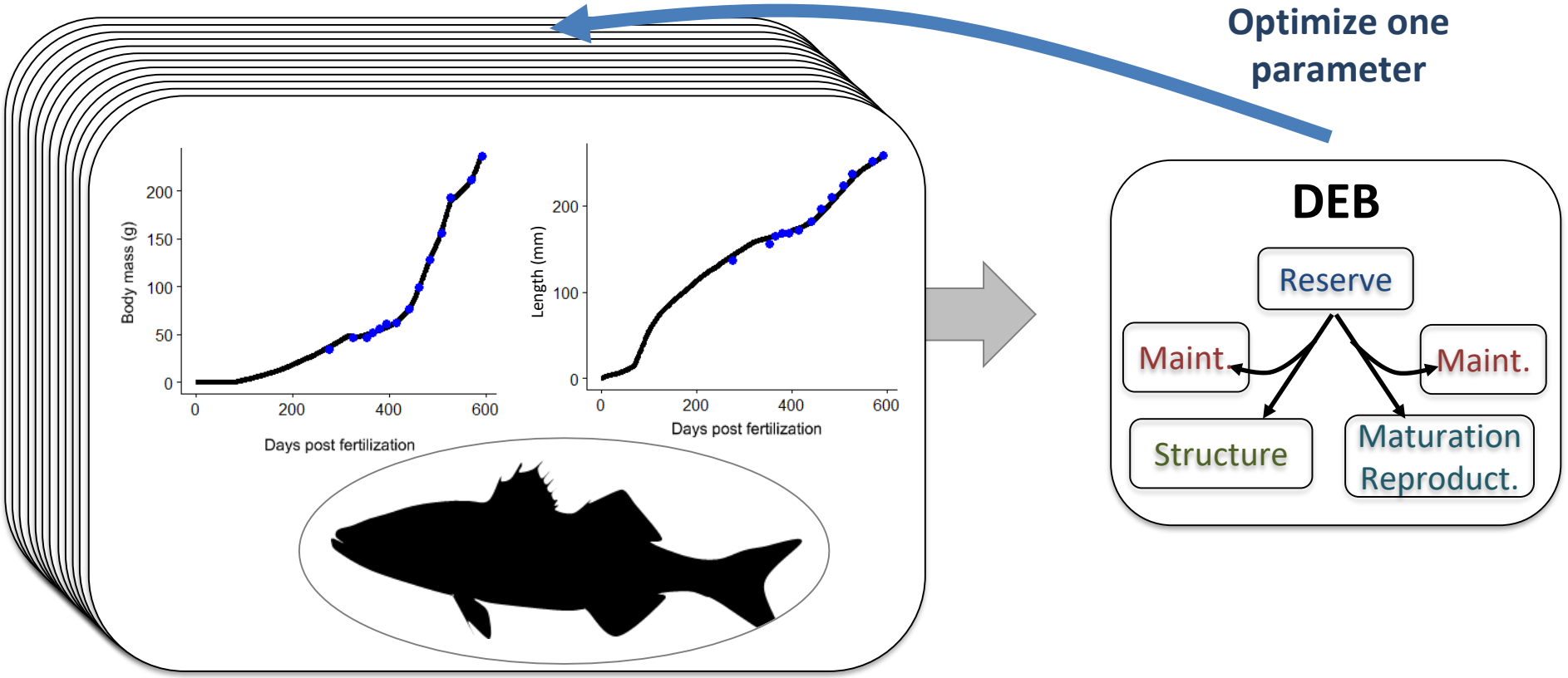
Mean relative error

$$\mathrm{MRE} = \frac{1}{n}\sum_{i=1}^{n} \mathrm{RE}_i$$

i = individual

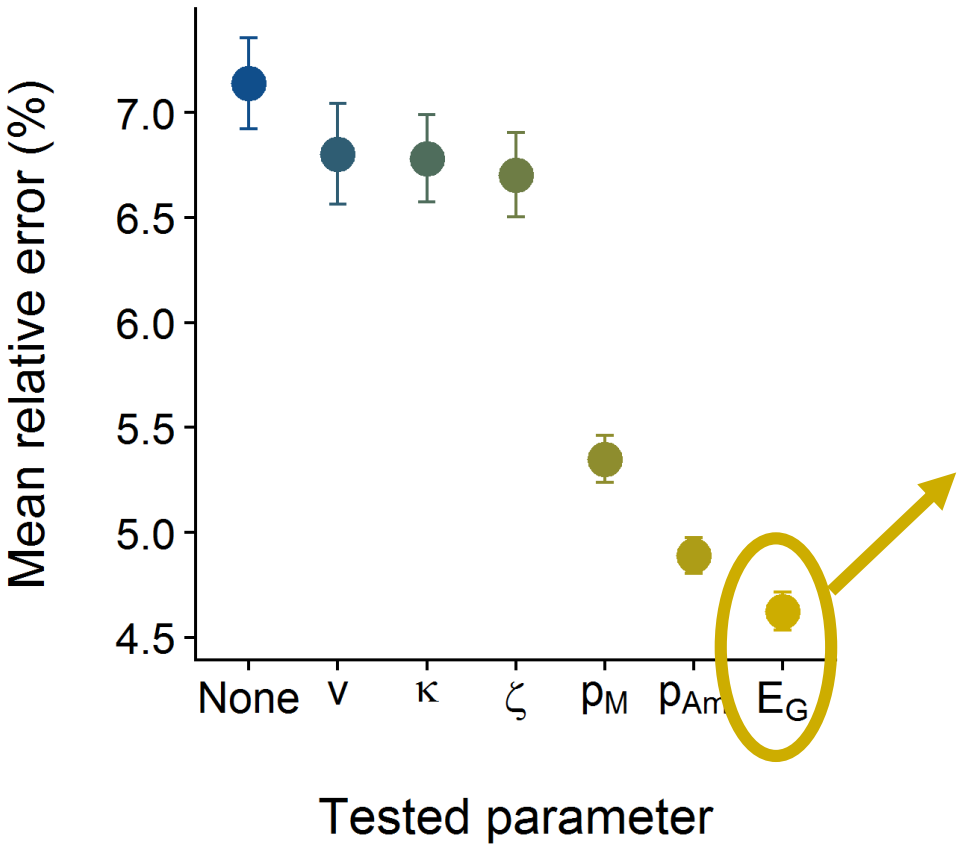
Method

1. Let one parameter vary for each individual

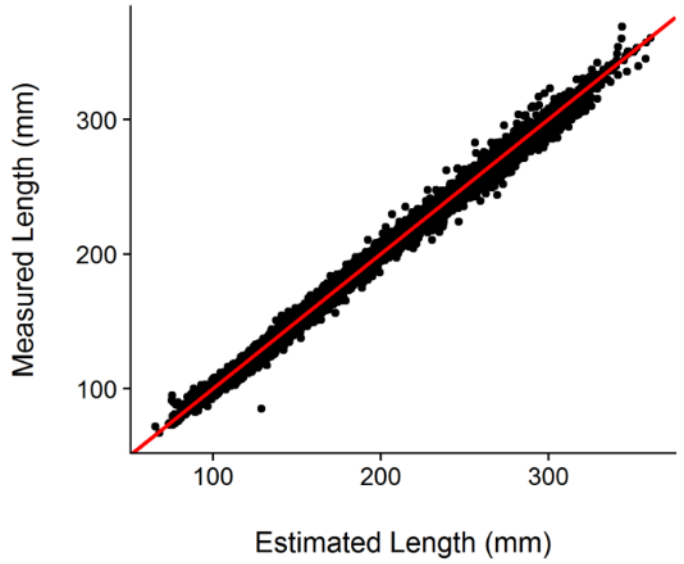


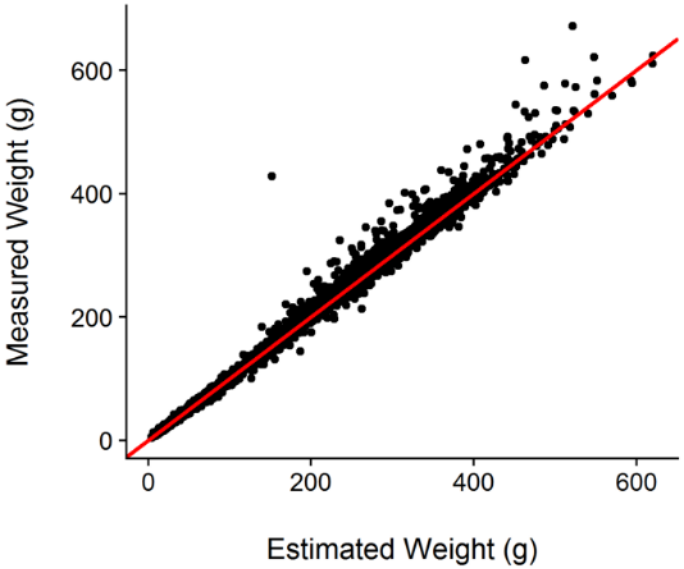
2. Choose the best parameter and verify if it makes genetical and biological sense

Results



E_G : Energetic cost for structure



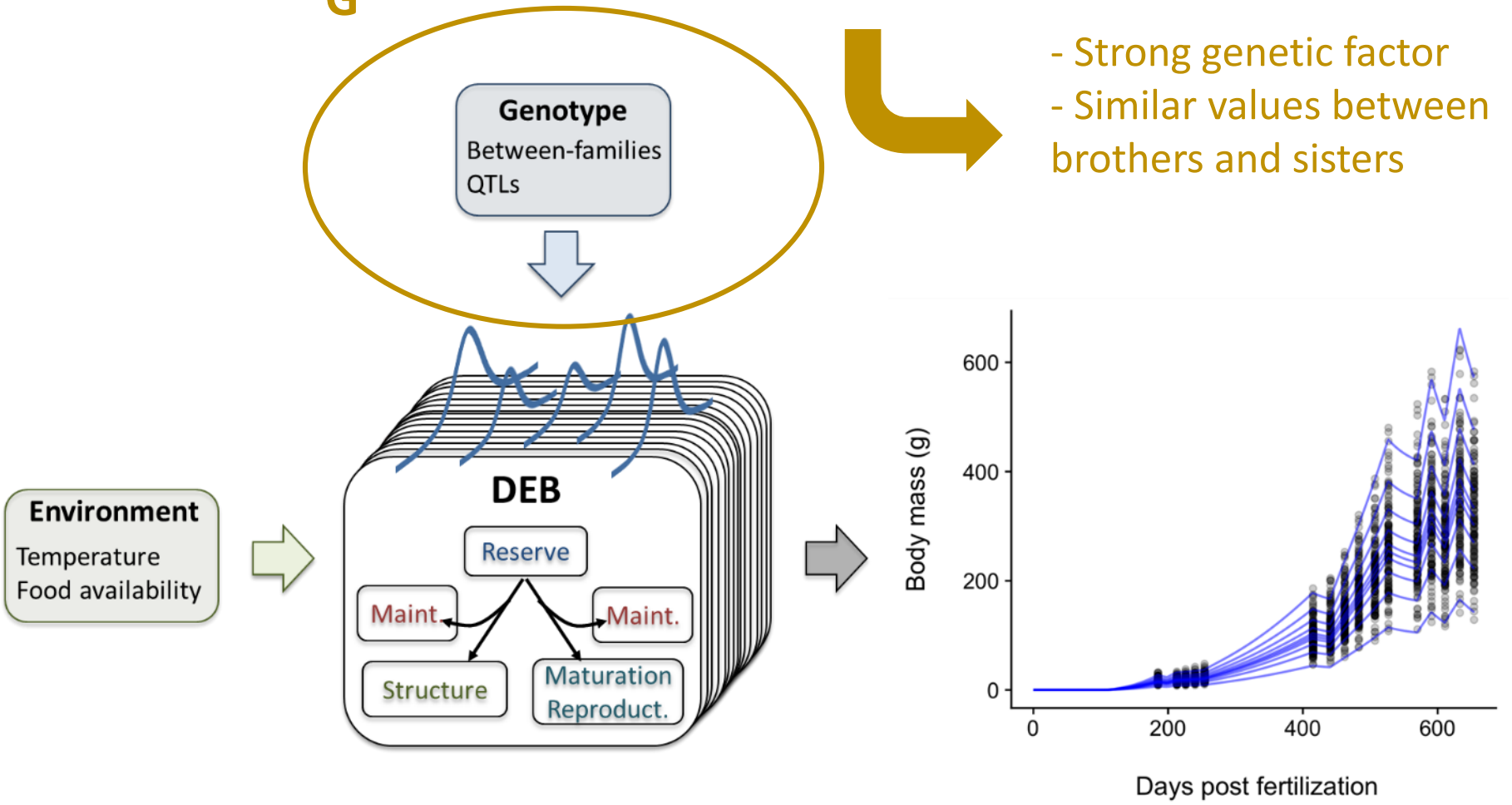


Results

E_G

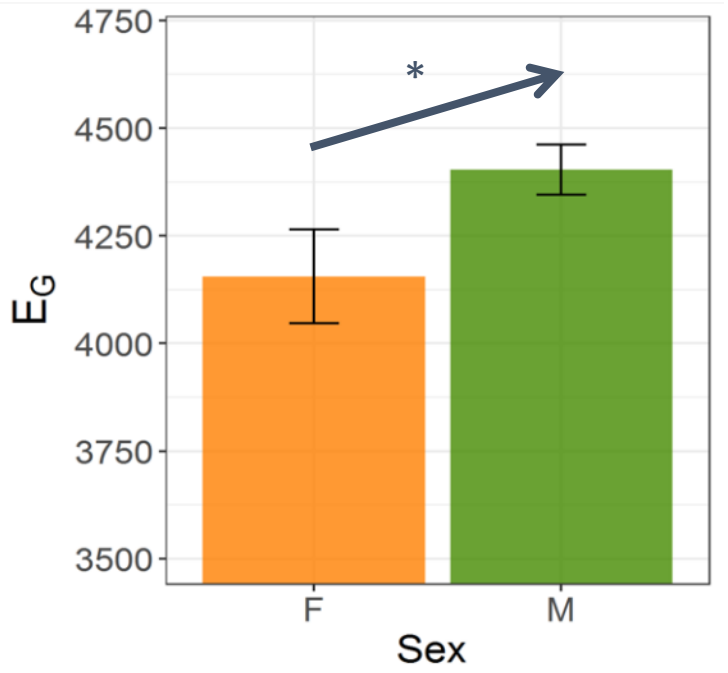
Heritability = 0.7

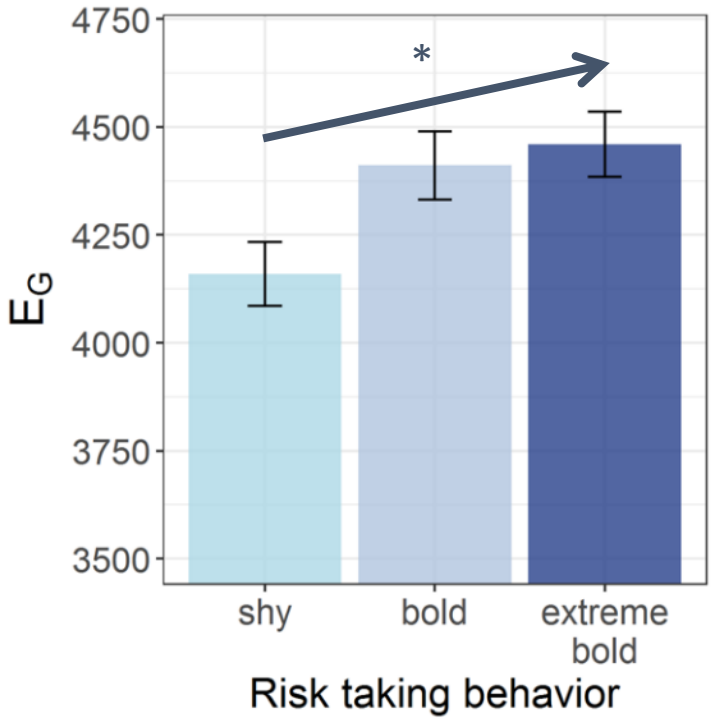
- Strong genetic factor
- Similar values between brothers and sisters



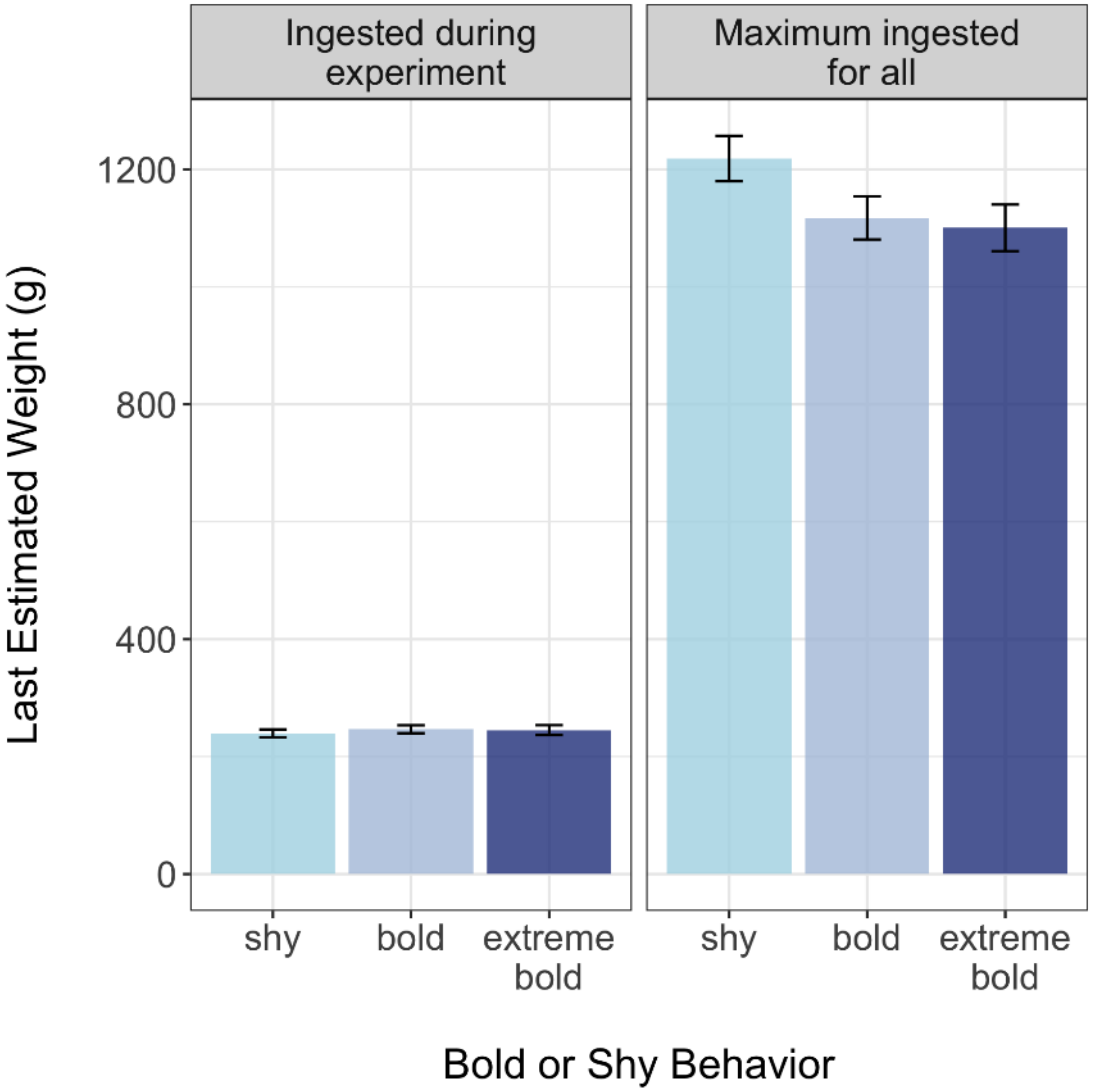
Results

♀ ♂

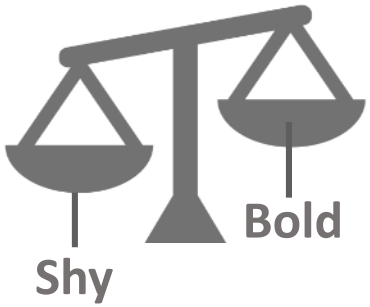

4750
4500
4250
4000
3750
3500
E_G
*
F
M
Sex


4750
4500
4250
4000
3750
3500
E_G
*
shy
bold
extreme bold
Risk taking behavior

Discussions

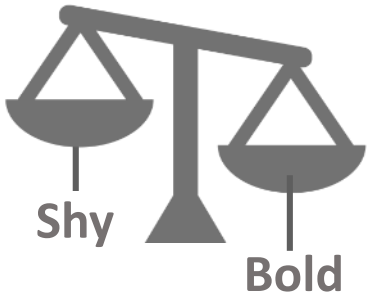


Non-competitive environment



Favored

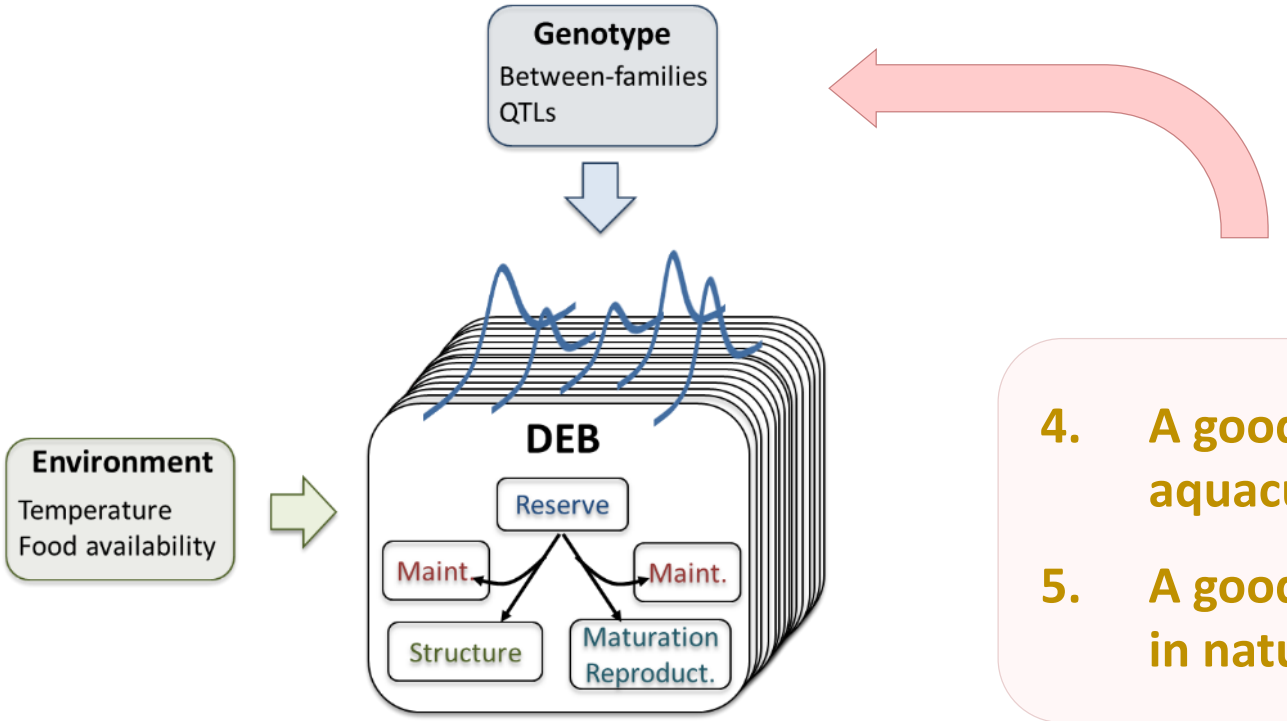
Competitive environment



Favored

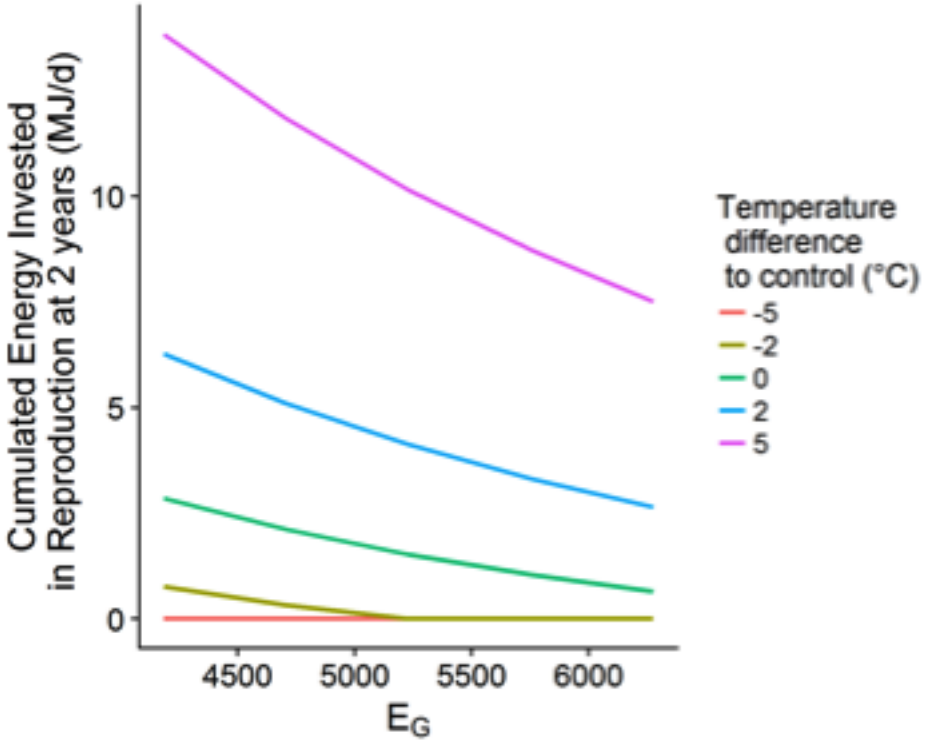
Conclusions

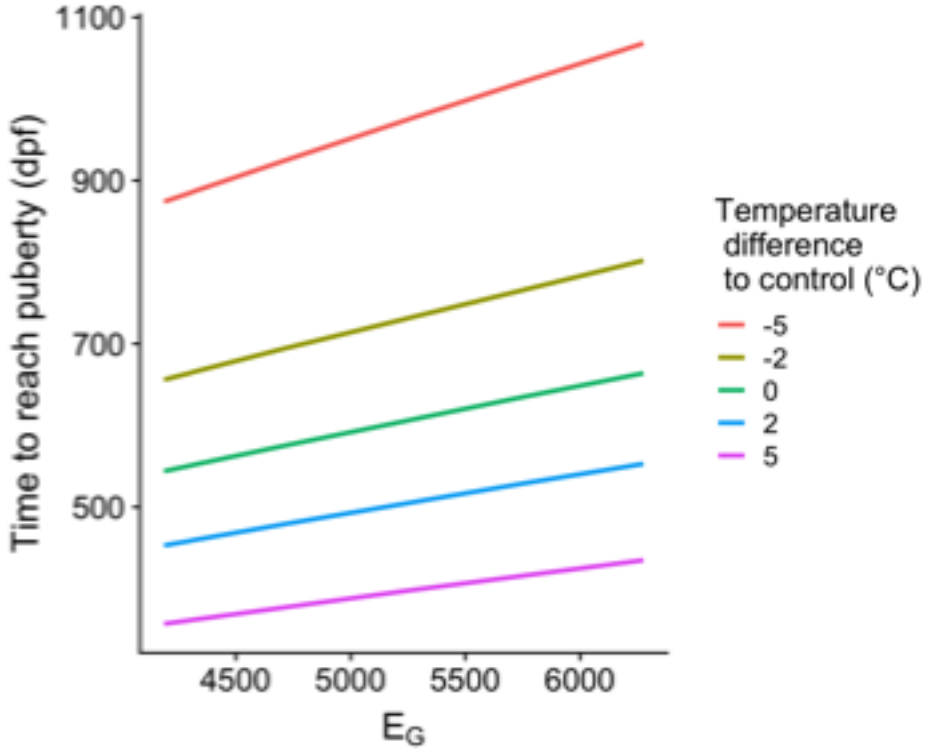
1. **Parameter E_G is the best parameter to describe phenotypic variability between-individuals in this experiment**
2. **This parameter is heritable and explains biological differences between individuals**
3. **Enables to make predictions in a new environment**



4. **A good selection criteria in aquaculture?**
5. **A good indicator of fitness in nature?**

SIMULATIONS WITH IDENTICAL FEED INTAKE



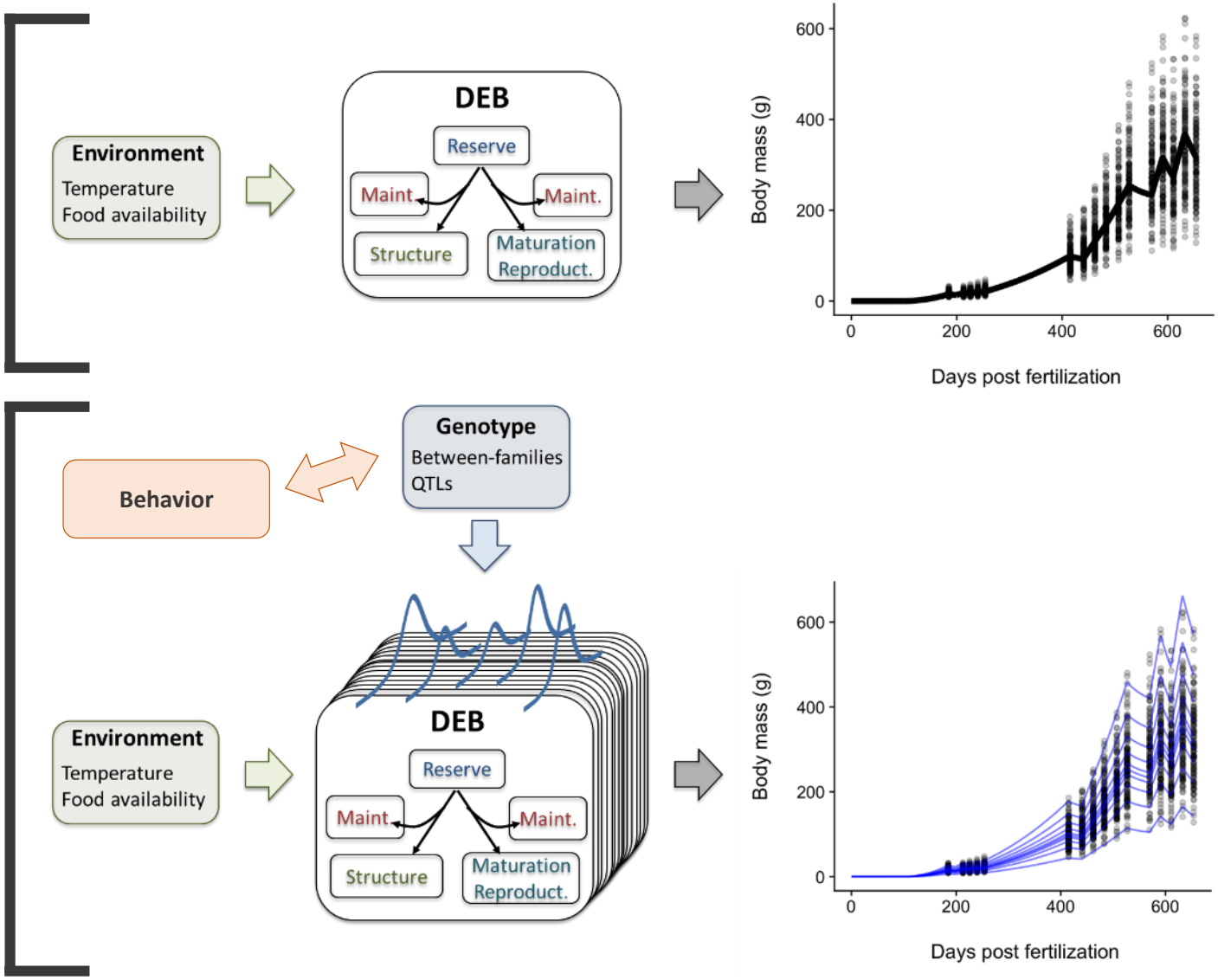


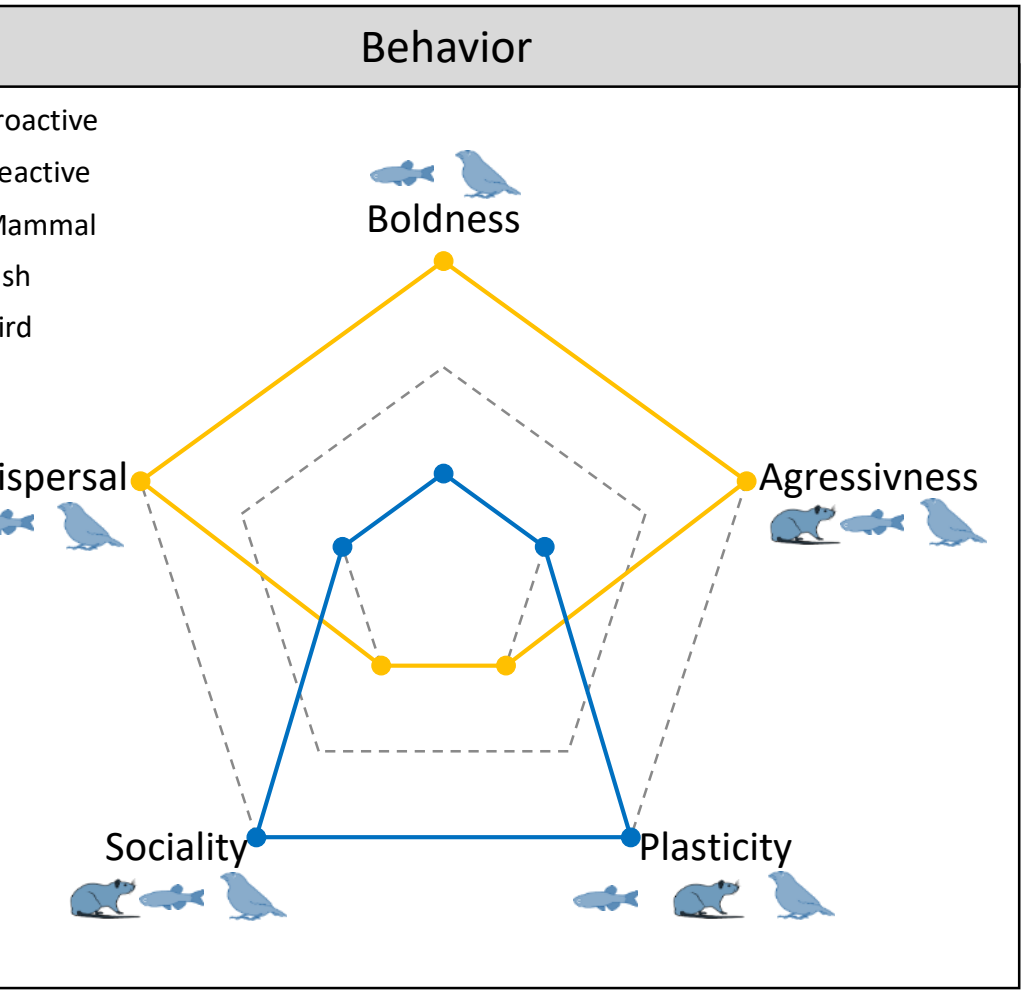
Aim

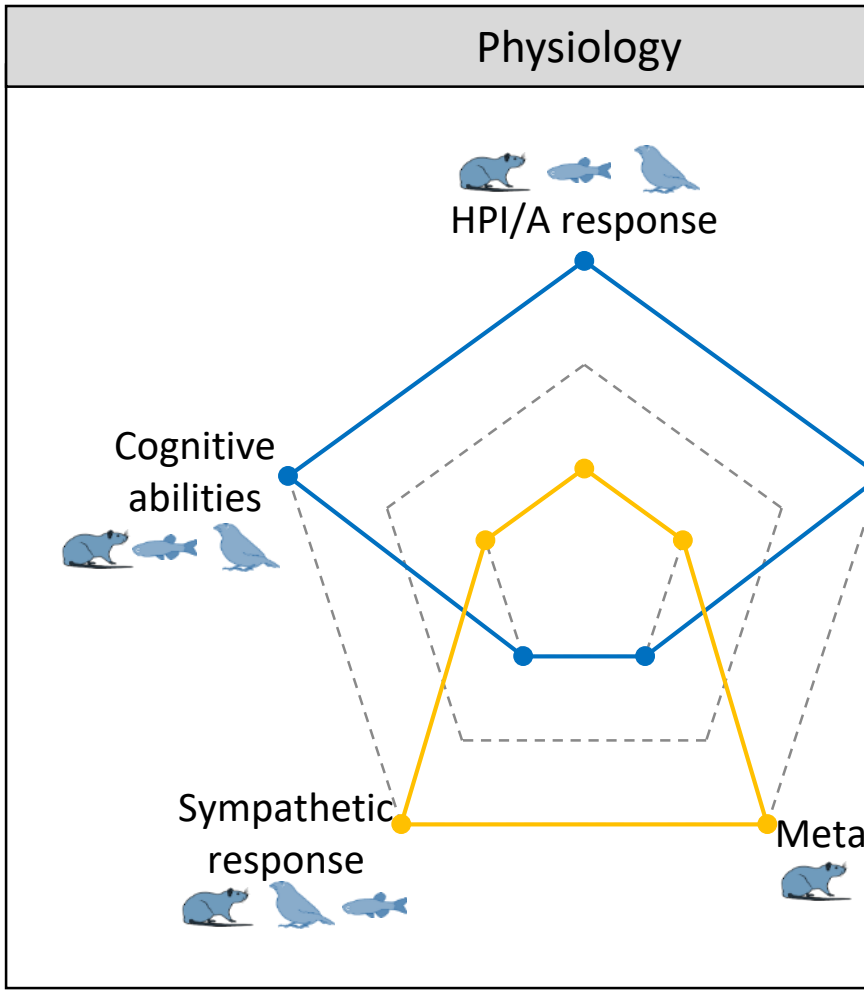
Classic DEB

Variation of one parameter

Individual DEB




Behavior
roactive
eactive
Mammal
sh
ird
Boldness
ispersal
Agressivness
Sociality
Plasticity


Physiology
HPI/A response
Cognitive
abilities
Sympathetic
response
Meta