Spatio-temporal evolution of life history traits related to dispersal, Brown trout colonization of the sub-antarctic Kerguelen islands

Lucie Aulus Giacosa

SPATIO-TEMPORAL EVOLUTION OF LIFE HISTORY TRAITS RELATED TO DISPERSAL

Brown tout colonization of the sub-antarctic Kerguelen islands.

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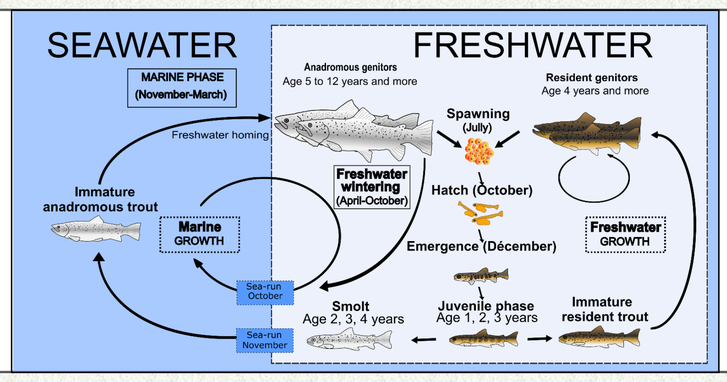
UMR ECOBIOP, ÉCOLOGIE COMPORTEMENTALE ET BIOLOGIE DES POPULATIONS DE POISSONS

Context

In a context of global change, biological invasions are one of the main causes of biodiversity loss, because non-native species can disperse naturally at the expense of others. As a consequence of ice retreat in the highest latitude, newly opened rivers could become welcoming habitats for the establishment of colonizing fish. Salmonids are thought to be good candidates for colonizing such environments since they display ability to become invasive.

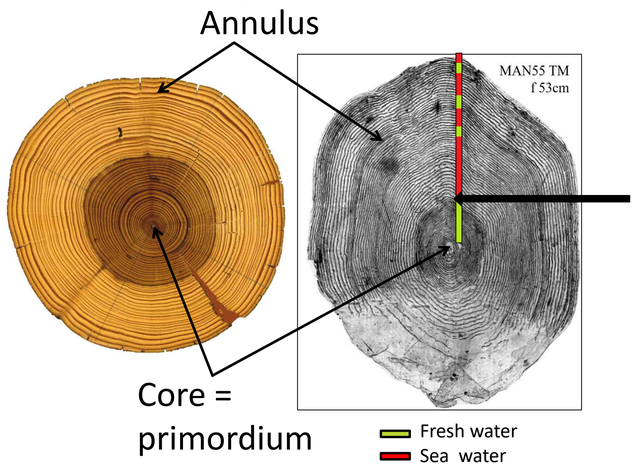


Objectives

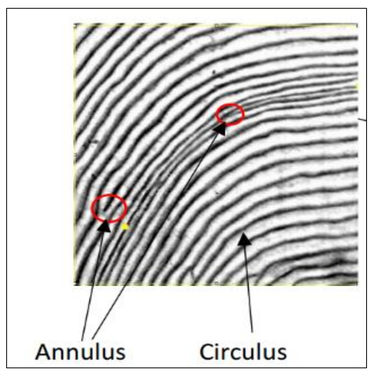
This study aims at understanding the evolution of life history traits related to dispersal, through the quantification of variation in freshwater growth and age at first marine migration at various spatio-temporal scales with respect to the colonization process.

Determining life history traits related to dispersal: age, environment and size-at-age

Age by counting

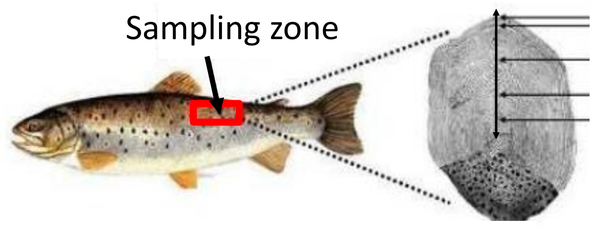


Environment by discerning growth patterns



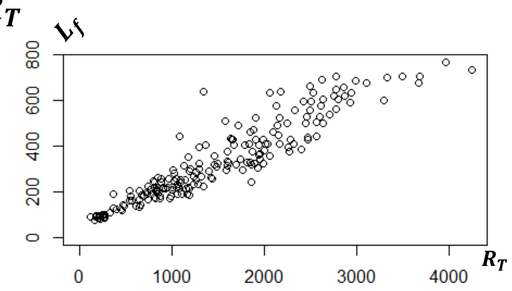
And size-at-age by relating fish size to scale size

$Total\ radius: R_T$



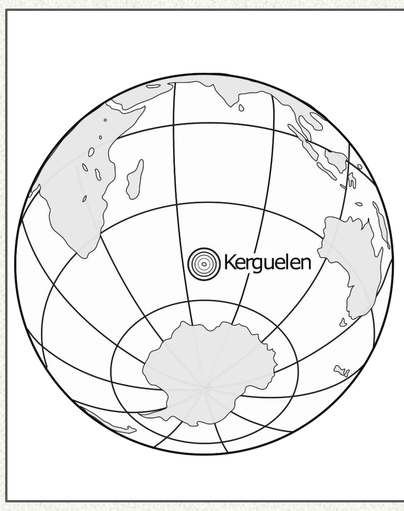
Female, 329 mm, resident trout

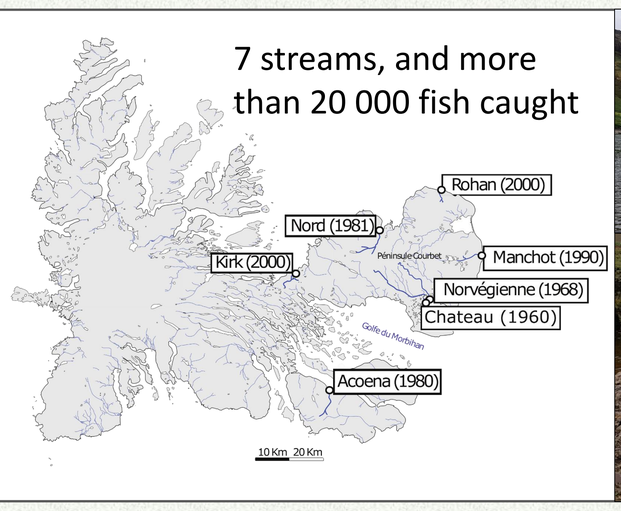
$Fork\ length: L_f$



$L_f \sim R_T$

Localization

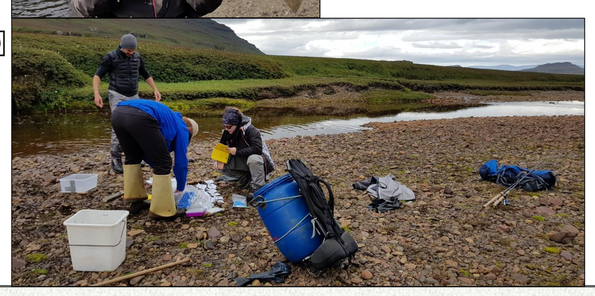




7 streams, and more than 20 000 fish caught

Sampling

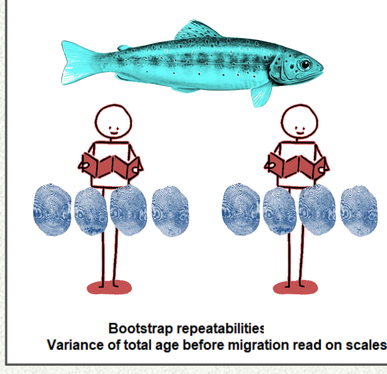
Additional data acquired during the field campaign 2018-2019.



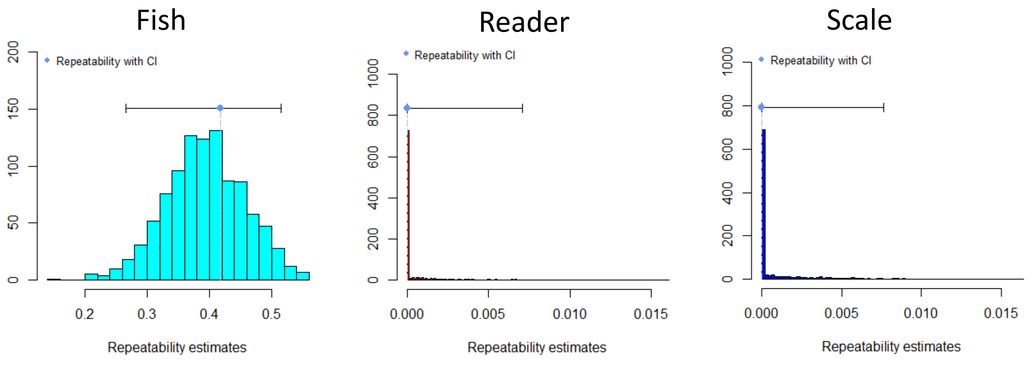
Selection of the fish by streams and cohort in the database (long-term monitoring).

Variance analyses

Aulus-Giacosa L., Aymes J-C., Gaudin P., Vignon M., A hierarchical variance decomposition of fish scale growth and age to investigate the relative contributions of readers and scales, Marine and Freshwater Research, Special issue Otolith 2018. (Accepted).



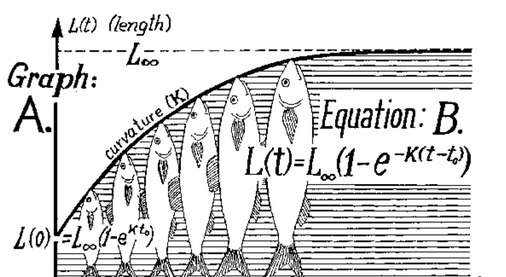
Bootstrap repeatabilities
Variance of total age before migration read on scales



$$AGE \sim rpt(age \sim (1|Fish) + (1|Reader) + (1|Scale), datatype = Poisson, \dots);$$
$$MEASURE \sim rpt(rt \sim (1|Fish) + (1|Reader) + (1|Scale), datatype = Gaussian, \dots)$$

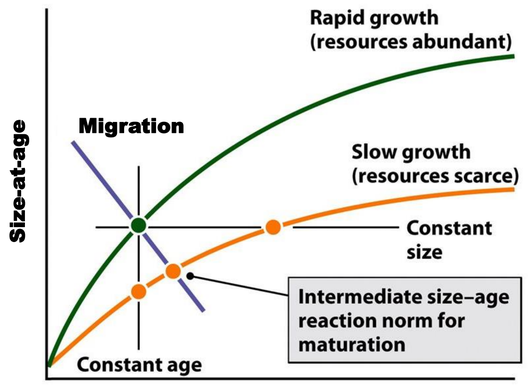
Main variation in size and age are attributable to Fish.
Reader and Scale contribute little to inter-individual variance, suggesting that inference was insensitive to intra-organism biological variation.
Using additional scales or readers was an inefficient use of sampling resources.

Model the evolution of traits, ongoing work



$$L_{i,t} = L_{\infty_i} + e^{-K_i (t_i - t_0)}$$

Is growth evolving through space and time, according to future fish strategy (resident *versus* migrant)?



And what about the probabilistic migration reaction norm?

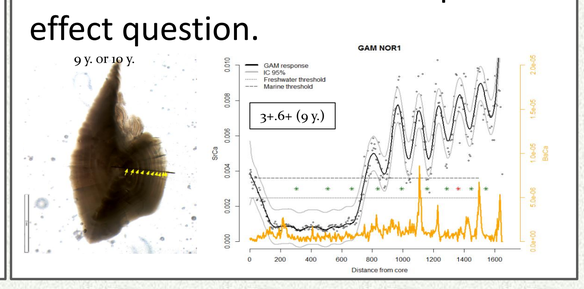
$$Y_i \sim \mathbf{Bernoulli}(p_i)$$
$$\text{logit}(p_{i,j,k}) = \beta_{0_{j,k}} + \beta_{1_{j,k}} \mathbf{x}\ L_{i,j,k}$$

Is the probablity to migrate at a certain age or size stable?

Perspectives

Carry on the ongoing work and answer the main questions.

Then continue on the parental effect question.



Aulus Giacosa L., Vignon M., Gaudin P., Evolution of anadromy and its impact on invasion dynamics: the case of long term monitored introduced brown trout (*Salmo trutta* L.) in the Kerguelen Islands, Groupement de Recherche Invasions biologiques, Talk, Rennes, FRANCE, October 22, 2018
Aulus Giacosa L., Vignon M., Gaudin P., Spatio-temporal evolution of life history traits: Brown tout colonization of the sub-Antarctic Kerguelen Islands, Colloque de la Société Française de l'Ecologie, Talk, Rennes, FRANCE, October, 22-25, 2018
Aulus Giacosa L., Vignon M., Gaudin P., Gueraud F., Aymes J.C., The effect of ageing errors on Von Bertalanffy parameters estimation using a Bayesian sensitivity analysis approach, 6th International Otolith Symposium 2018 (IOS2018), Poster session: Statistics and modelling, Keelung, TAIWAN, 15-20 April 2018
Aulus Giacosa L., Vignon M., Buoro M., Gaudin P., Gueraud F., Aymes J.C. *Growth models and estimation of migratory reaction norm for invasive brown trout (Salmo Trutta L.) in Kerguelen Islands,* "International Long Term Ecological Research Network & LTER-France (Zones Ateliers Network & Critical Zone Observatories) joint conference" followed by the ILTER Coordinating Committee Meeting, General poster session, Nantes, FRANCE, October, 2 - 4, 2017

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