Ph-D position – University of Lorraine (France) and University of Namur (Belgium)

Ph-D position: "Developing and implementing a conceptual approach to design efficient and pragmatic multi-function selective breeding programs as an asset for aquaculture development"

General information

Type:	Ph-D Position
Thesis title:	Developing and implementing a conceptual approach to design of efficient and pragmatic multi-function selective breeding programs as an asset for aquaculture development
Keywords:	Aquaculture, Bioassays, Domestication, Integrative approach
Directors:	Pascal FONTAINE (University of Lorraine; Professor); Thomas LECOCQ (University of Lorraine; Associate Professor); Patrick KESTEMONT (University of Namur; Professor)
Research units:	Research Unit Animal and Animal Product Functionality (UR AFPA), Team Domestication in Inland Aquaculture (DAC), University of Lorraine (Nancy, France) Research Unit in Environmental and Evolutionary Biology (URBE), Institute of Life, Earth & Environment (ILEE), University of Namur (Namur, Belgium)
Addresses:	UR AFPA, Domestication en Aquaculture Continentale (DAC), Université de Lorraine, Faculté des Sciences et Technologies, Boulevard des Aiguillettes BP 70239, F-54506 Vandœuvre-lès-Nancy, France URBE, UNamur, Rue de Bruxelles 61, B-5000 Namur, Belgium
Details:	See full description below
Deadline to apply:	31/05/2021
Starting Date:	01 /10/2021
Duration:	36 months
Fund category:	Public Funding - University
Doctoral School:	SIReNa - Sciences et Ingénierie des Ressources Naturelles
Website :	https://urafpa.fr

Ph-D student position

A Ph-D position (a three-year contract) funded by the French government (Minister of National Education, Higher School and Research) is available at the University of Lorraine (Vandœuvre-lès-Nancy, France) in the Research Unit Animal and Animal Product Functionality (UR AFPA; team Domestication in Inland Aquaculture). The Ph-D student will work in the context of the "Effects of domestication process on fish welfare and reproduction", a Project of International Research Partnership (2020-2024) between UR AFPA and Research Unit in Environmental and Evolutionary Biology (URBE, University of Namur). Several stays in Belgium will be necessary for the Ph-D.

Application should include (i) a cover letter, (ii) curriculum vitae, and (iii) the contact details of three reference persons. This should be sent as a single pdf at thomas.lecocq@univ-lorraine.fr.

Contact: Thomas Lecocq and Pascal Fontaine, Research Unit Animal and Animal Product Functionality (UR AFPA), Domestication in Inland Aquaculture (DAC), Université de Lorraine, Faculté des Sciences et Technologies, Boulevard des Aiguillettes BP 70239, F-54506 Vandoeuvre-lès-Nancy, FRANCE, Tel: +33 3 72 74 56 96, E-mail: thomas.lecocq@univ-lorraine.fr

Working environments

The Domestication in Inland Aquaculture team works on the sustainable development of aquaculture. Our works aims at fostering the fish production diversification thanks to new species domestication. We study (i) the domestication consequences on fish biology and (ii) the domestication process through interspecific and intraspecific comparative approaches in order to improve the fish domestication. The team has all facilities for molecular and physiological analyses as well as fish bioassays (i.e. experimental platform in aquaculture, a part of the European network AQUAEXCEL since 2015; see https://www.urafpa.fr/index.php/plateforme/technique/4).

The Research Unit in Environmental and Evolutionary Biology (URBE) studies aquatic organisms and environments, at all integration levels, from molecules to ecosystems. Rather than focusing on specific molecular and cellular approaches of life, URBE investigates of biochemistry, physiology, evolution, and ecology.

Research background

Domestication is one of the most important developments in human history [1]. Starting during the Neolithic Age, this process is far from over: new domestication events are still going on today (e.g., [1]). The earliest as well as the latest domestication instances follow a same stepwise process ranging from (i) the first trials of acclimatization to the rearing environment (ii) to the life cycle completion in captivity, and (iii) eventually to the selective breeding programs setting up [2,3]. Overall, domestication is still a long and hard process often resulting in unfruitful attempts due to either zootechnical limitations, economic restrains, or intrinsic species/population features [1]. This places a premium on developments of technical and methodological improvements to facilitate current and future domestications. In the last decades, selective breeding programs have been continually improved thanks to advances in genetics, genomics, and physiology (e.g., [4,5]). These programs aim at intentionally modifying some traits or biological functions of the human-controlled populations to improve performance of farmed organisms [6,7]. Looking back at past domestications, most selective breeding approaches (SBA) aim at improving one or very few particular biological functions (i.e. single-function SBA) while disregarding the evolution of other traits and functions over the domesticated generations (review in [8]). Yet, a successful domestication process requires the favorable expression of several traits involved in various biological functions (review in [9]). The risk of co-selecting deleterious trait expressions during single-function SBA is a well-known fact in land species domestication history. For instance, continuous selection towards milk yield and growth led respectively to a decrease of fertility in dairy cow[10] and reproductive and immune performances in broilers[11]. Developing selective breeding programs that consider all, or at least most, important biological functions (i.e. multi-function SBA) impacting the domestication process is regarded as a solution to overcome single-function SBA pitfalls (review in [8]). However, development of multi-function SBA is challenging since they require (i) performing integrative assessment of various traits (from gene to phenotypes of all biological functions), (ii) defining sought optimal trait expressions which can vary according to domestication objectives, and (iii) making consensus between sometimes discordant results obtained for different functions (for aquaculture see [8,9,12]). In aquaculture, these challenges are being the focus of an increasing research, but previous studies have only scratched the surface of multi-function SBA. The lack of conceptual approaches to guide the design of efficient and pragmatic multi-function SBA still limit its potential to foster a more efficient and sustainable aquaculture.

Ph-D objectives

The Ph-D student will develop, jointly with the project consortium, a conceptual approach to guide the design of efficient and pragmatic multi-function SBA for aquaculture. With the directors, she/he will define (i) which traits and functions (e.g. reproduction, growth, welfare, immunity, behavior) must be integrated in multi-function SBA, (ii) which trait expressions are sought through investigative work on aquaculture stakeholders (e.g. farmers, researchers, regulation organizations), and (iii) how making consensus among traits involved in different biological functions (e.g. integrative index development). Based on this new conceptual approach, she/he will develop a

multi-function SBA on a model species, *Danio rerio*. On the same species, the Ph-D student will develop a single-function SBA (focused on growth function). Through bioassays, she/he will study the consequences of the two SBA over several generations to highlight benefits and pitfalls of multi-function SBA compared to traditional approach. All analyses will take place at the University of Lorraine and University of Namur, but some short-term works in other French and European institutions are likely. At the end of her/his Ph-D thesis, the candidate will have developed high skills in genetic/physiological/integrative analyses and fish experiment designing required for the next steps of her/his researcher career.

Ph-D student profile

We are looking for highly motivated person with a MSc in a related discipline (e.g., zoology, evolutionary biology, ecology). The project includes molecular, physiological, and behavioral analyses, such that experience with or affinity to these analyses is required as well as skills in statistics and knowledge of or the willingness to learn R-language. Experimental works in the lab also involves fish stock management and development of experimental designs. The candidate is expected to (i) search, read, and understand scientific literature in English, (ii) have team skills along with a sense of responsibility, and (iii) develop, quickly, excellent skills in statistical data analysis and scientific writing in English.

References

1. Diamond, J. Nature 418, 700–707 (2002).
2. Teletchea, F. & Fontaine, P. Fish Fish. 15, 181–195 (2014).
3. Lecocq, T. in Animal Domestication (ed. Teletchea, F.) 35–68 (IntechOpen, 2019). doi:10.5772/intechopen.81834
4. Zhou, Z., Yang, H. & Zhong, B. F. Acta Biochim. Biophys. Sin. (Shanghai). 40, 601–611 (2008).
5. Larson, G. & Fuller, D. Q. Annu. Rev. Ecol. Evol. Syst. 45, 115–136 (2014).
6. Gjedrem, T., Robinson, N. & Rye, M. Aquaculture 350–353, 117–129 (2012).
7. Vaughan, D. A., Balázs, E. & Heslop-Harrison, J. S. Ann. Bot. 100, 893–901 (2007).
8. Toomey, L. et al. Sci. Rep. 10, 11564 (2020).
9. Toomey, L., Fontaine, P. & Lecocq, T. Rev. Aquac. 12, 2212–2227 (2020).
10. Pryce, J., Royal, M., Garnsworthy, P. & Mao, I. Livest. Prod. Sci. 86, 125–135 (2004).
11. Rauw, W. M., Kanis, E., Noordhuizen-Stassen, E. N. & Grommers, F. J. Livest. Prod. Sci. 56, 15–33 (1998).
12. Toomey, L., Lecocq, T., Pasquet, A. & Fontaine, P. Aquaculture 530, 735807 (2021).