



SIReNa



**Research Units:** UR AFPA (Lorraine University - France) and URBE (Namur University - Belgium)

**Directors:** Marielle THOMAS and Thomas LECOCQ (URAFPA); Patrick KESTEMONT (URBE)

**Scientific Pole:** A2F

**Fund category:** Bourse INRAE and FSR

**Thesis title:** Reaping the benefit of fish species diversity to enhance efficiency of aquaculture systems and fish welfare.

**Description of the project:** This project aims at developing and optimising scientific approaches and tools to promote polyculture in freshwater recirculating water systems (RAS). Polyculture consists of rearing several species at the same time and in the same rearing volume. Our work (<https://www.urfpa.fr>; <https://www.unamur.be/en/sci/sbio/urbe>) and studies of our numerous collaborators (INRAE, CIRAD, AquaExcel network) show that polyculture can be a promising way to promote the growth of species through better exploitation of all the system resources. It could also contribute to improving the welfare of some species, in accordance with the relaxing effect of one species on another through behavioural and/or chemical processes that remain to be elucidated. We therefore argue that polyculture could be a real opportunity for advancement and innovation in fish production. The thesis work is thus focused on the development of methods and tools to propose (new) associations of species, with a view to their application in RAS. The assumptions are that the association of compatible (i.e. sharing the ecological niche with minimal or no harmful interactions and competition for resources) and complementary (i.e. exploitation of different resources and/or commensal or mutualistic interactions) species could improve the efficiency and sustainability of farming systems. For ethical reasons (limiting the use of animals for scientific purposes) and practical reasons (large number of possibilities due to the large diversity of fish species), the scientific approach consists in developing a prospective *in silico* method to evaluate the degree of compatibility and complementarity between fish species with the aim of constructing combinations of species that can then and only then be experimentally tested in our facilities (<https://www.urfpa.fr/index.php/plateforme/technique/4>). To do this, we plan to work with approaches that combine biological traits and the environment. A first step has already been taken to establish the abiotic compatibility of species and work must now be continued to specify the biotic compatibility of species. To achieve this objective, various databases will be used, including the one developed by URAFPA (Traits OF Fish; <https://toff-project.univ-lorraine.fr>). The aim will be to establish correlations between biological traits of fish (Percidae and other species), to carry out exploratory multivariate analyses or to calculate similarity indices by constructing distance matrices. The prospective method is designed to produce a decision model based on a score system (degree of compatibility and complementarity between species) to select polyculture scenarios to be tested experimentally. The experimental validation will be based on monoculture and polyculture approaches, with the monitoring of zootechnical parameters (such as fish growth rates), physiological parameters (e.g. cortisol analyses to assess stress) or behavioural parameters (such as the occupation of the rearing volume to assess the exploitation of the spatial resource of the rearing environment), in combination with environmental measurements. Particular attention will also be paid to determine the fish welfare reared in polyculture, with the definition of an indicator.

**Expected skills:** We are looking for highly motivated and rigorous person, for the last quarter 2022, with an MSc in biology, physiology, or agronomy. She/he must have skills in statistical data analysis (R software R) as well as a strong scientific interest and data processing, physiological and molecular analysis (including expertise in analytical techniques) and the conduct of experimental protocols. The candidate should be able to search, read, and understand scientific literature in English and also to write in English. She/he will be supported by a qualified research team and efficient experimental facilities. The PhD student will work under the supervision of three researchers from two multidisciplinary teams strongly involved in national and international research networks. The duration of the PhD contract is 3 years.

**Applications: One file** (CV + motivation letter + two personal references) must be **sent before 1st September 2022** (by mentioning « INRAE-FSR Thesis ») to:

[marielle.thomas@univ-lorraine.fr](mailto:marielle.thomas@univ-lorraine.fr)

[thomas.lecocq@univ-lorraine.fr](mailto:thomas.lecocq@univ-lorraine.fr)

[patrick.kestemont@unamur.be](mailto:patrick.kestemont@unamur.be)