

## PhD research fellowship "PROYECTOS CCAA-INIA"

**Funded by:** INIA (Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria)  
INIA fellows are equivalent to those offered by the FPU and FPI programs

### Details of the call at:

[http://www.ciencia.gob.es/portal/site/MICINN/menuitem.791459a43fdf738d70fd325001432ea0/?vgnextoid=14d767e8fd8cd610VgnVCM1000001d04140aRCRD&vgnnextchannel=115222e988f75610VgnVCM1000001d04140aRCRD&vgnnextfmt=formato2&id3=695779e29e9cd610VgnVCM1000001d04140a\\_\\_\\_\\_\\_](http://www.ciencia.gob.es/portal/site/MICINN/menuitem.791459a43fdf738d70fd325001432ea0/?vgnextoid=14d767e8fd8cd610VgnVCM1000001d04140aRCRD&vgnnextchannel=115222e988f75610VgnVCM1000001d04140aRCRD&vgnnextfmt=formato2&id3=695779e29e9cd610VgnVCM1000001d04140a_____)

**IF YOU NEED ADDITIONAL DETAILS, PLEASE CONTACT [amaliagrau@dgpesca.caib.es](mailto:amaliagrau@dgpesca.caib.es)**

### Supervisors:

1) Main supervisor: Dra. Amalia Grau<sup>1,3</sup>

2) Co-supervisor: Dr. Palmer<sup>2,3</sup> (<https://www.fishecolgy.es/>)

3) Co-supervisor: Dr. Diaz<sup>4</sup>

1: Laboratori d'Investigacions Marines i Aquicultura (LIMIA). Direcció General de Pesca i Medi Marí. Conselleria de Medi Ambient, Agricultura i Pesca. Govern de les Illes Balears.

2: Institut Mediterrani d'Estudis Avançats (IMEDEA). CSIC and Univeritat de les Illes Balears.

3: Unitat Associada IMEDEA-LIMIA

4: CULMAREX (aquaculture company)

**Base:** LIMIA (Port d'Andratx, Mallorca) and IMEDEA (Esporles, Mallorca)

**Research line (INIA):** Environmental sustainability. Improving efficiency, sustainability and resilience of the farming/forest food production systems

**Project (LIMIA):** Reconciling animal welfare in aquaculture with efficiency, sustainability and resilience.

**Motivation:** Aquaculture is growing due to the social demand for fish and the decline of some fisheries. The fundamental objective of any aquaculture production plant is to improve fish growth rate. From the opposite side, some concern is arising about the ecological effects of aquaculture and about the ethical implications for animal welfare.

The growth process of fishes can be represented as a dynamical system controlled by both environmental factors such as diet and temperature, and internal metabolic factors which are partially constrained by the genetic origin. In addition, metabolism is probably modulated and modified by many processes and variables, among which the role of animal behavior and animal welfare stand out. However, surprisingly, the details of the mass/energy fluxes driving fish growth are only superficially known, which makes difficult to effectively transfer scientific advances to the daily practice of an aquaculture production plant.

Our working hypothesis, far from being an imposition of a misunderstood animalism, postulates that improving animal welfare can increase physiological/metabolic efficiency. We will face the problem of finding the optimal culture conditions by considering the growth as the outcome of a dynamic system affected by external forcing variables.

**Profile:** We are looking for a profile at the frontier between biology and physics: She/He will be either a biologist with some background (or genuine willingness to learn) in mathematical modeling and statistics or a physicist/mathematician/engineer with some background (or genuine willingness to learn) on biological processes and without fear for being involved in animal experimentation.

### Workplan:

1) To develop the theoretical framework (i.e., mathematical modeling) needed for describing the mass/energy fluxes involved in fish growth. The type of model to be developed is a coupled system of differential equations (Dynamic Energy Budget or similar models). Biologists: don't panic! you will be trained.

2) To develop the tools for accurately monitoring fish and how different variables and processes are affecting growth. The applicant will take advantage of a huge amount of data coming from the routine production of an aquaculture production plant (CULMAREX). Moreover, theoretically driven experiments will be designed and completed at the LIMIA facilities in Port d'Andratx. Physicists: don't panic! you will be trained.

3) To develop the skills for connecting empirical data and models. Specifically, to estimate model parameters and to make predictions of growth under different scenarios of environmental conditions (temperature, feeding, welfare/behavior,...)