In ovo immune stimulation - A tool to improve fish larvae welfare

Summary:

The production of high-quality juveniles is still a bottleneck in the farming of numerous fish species. Survival until the juvenile stage is typically as low as 10-15% for many species. Both scientific evidence and experience in hatcheries for a variety of fish, support the hypothesis that detrimental fish–microbe interactions are the cause of these problems. Intensive cultivation conditions and climate change effects (rising temperature, hypoxia, salinity and acidification) may also induce stress, and thus depress larvae fish immune system. In many important cultured species such as the sea bream and sea bass, maturation of lymphomyeloid organs is delayed. Synthesis of specific antibodies is lagged until several weeks after hatching. Therefore, vaccination is not an option at larval stages. Among the recommended strategies to prevent these health problems in larval cultures is the induction of larvae innate immune capacity. In view of this, the major objective of this project is to evaluate the potential of stimulating the developing embryo immune system at the earliest possible point in time as a strategy to reduce fish larvae mortality. Therefore, we propose to explore a new and exciting approach; the delivery of immunostimulants while embryos are still inside the egg by a bath immersion. By using a bath immersion instead of microinjection, administration of the immunostimulant can be scaled up to simultaneously treat many eggs/embryos in a highly versatile and potentially cost-effective manner suitable for its application in the industry.

Main Metodologies:

This project will start with in vitro cell culture assays in which the candidate, working closely with the PI, will identify the best potential candidate to serve as immunostimulant. To overcome the barriers that any compound faces before being taken up by the embryo, we will use a molecular transporter effective to penetrate the egg chorion. The chosen immunostimulant will be chemically modified to incorporate both the molecular transporter and a fluorescence group, making real-time monitoring of immunostimulant uptake by eggs/embryos achievable immediately after immersion treatment by fluorescence microscopy. Administration of the immunostimulants can be done to eggs (pre-fertilization) or embryos (post-fertilization), depending on the characteristics of the eggs and embryos in different fish species. Conditions during egg incubation will be optimized for zebrafish, rainbow trout and sea bass eggs. The PhD candidate will develop his/her work mostly in the wet lab and will receive one-to-one training in basic cell culture techniques, biochemical techniques and gene expression techniques essential for evaluating the effect of the immunostimulants both in vitro and at the embryo level. The candidate will also have hands-on training in fluorescence microscopy and gain technical skills in metabolism and biotransformation (MALDI-TOF), bacterial challenge tests for fish larvae and high resolution in situ spatial genomics. The candidate should be receptive to travel abroad, as this project may include research stays at partners institutions to develop specific tasks. The supervisor will engage the candidate in scientific activities and stimulate acquisition of important knowledge, skills and competencies raising the candidate scientific independence and confidence.

Main Supervisor

Ana Rocha / Aquatic Animal Health (A2S)

CO

Benjamín Costas / Aquatic Animal Health (A2S) and Ana Gómez / Physiology of Fish Reproduction (Instituto de Acuicultura de Torre la Sal -CSIC)

Place of Work

CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, Terminal de Cruzeiros do Porto de Leixões;
Torre de la Sal Aquaculture Institute (IATS) from the Spanish National Research Council (CSIC), Spain

Will the Proposal research idea be funded by a specific project?

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Contact

anasantosrocha@ciimar.up.pt