



LIFECYCLE

Building a biological knowledge-base on fish lifecycles for competitive, sustainable European aquaculture

The Challenge

European fish farms are to be globally competitive and produce the best fish in terms of ethics and quality. A better understanding of physiological and behavioural features throughout the fish life-cycle will allow for a better insight on key biological processes, and help to overcome bottlenecks in the production cycle of commercially important species.

Substantial resources and biological information exists on the major species but need to be further exploited to potentiate the overall impact. State-of-the-art physiological research will be combined with functional genomics to advance current knowledge on mechanisms governing essential biological functions in fish.

Project Objective

LIFECYCLE will deliver a knowledge-base to improve competitiveness and sustainability of European aquaculture through a combination of question-problem driven approaches. The focus will be on early developmental events, growth and environmental adaptation throughout the lifecycle, and on the physiology and immunology of key life-stage transitions, such as metamorphosis, smoltification and puberty. LIFECYCLE will focus on all major life stages of sea bass, sea bream, Atlantic salmon and rainbow trout.

Key Points

- Deliver improved competitiveness of the EU aquaculture industry by establishing the knowledge-base required for improved stress control, disease prevention and control, new breeding technologies, better environmental performance and diversification into new species
- Clarify the mechanisms of essential biological functions related to the most relevant stages of aquaculture fish life-history (larval development, growth, maturation, reproduction) at both a physiological and molecular level
- Changes in physiological systems at different points during the lifecycle will be studied to establish how early factors impact on later stages.
- Cross-cutting experiments will address integration and crosstalk between physiological systems.



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EATiP *Thematic Area of Relevance*

TA1: Product Quality, Consumer Safety and Health

TA2: Technology and Systems

TA3: *Managing the Biological Lifecycle*

TA4: Sustainable Feed Production

TA5: Integration with the Environment

TA6: Knowledge Management

TA7: Aquatic Animal Health and Welfare

TA8: Socio-Economics and Management

Key Words

Biological lifecycle, growth, development, environmental adaptation, immunology, puberty, sex determination

Project Information

Contract number:

222719

Contract type:

Large-scale integrating project

Research area:

KBBE - Essential biological functions related to the most relevant stages of aquaculture fish life-history

Duration:

48 months (01/02/2009 – 31/01/2013)

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Key New Knowledge Expected

This project will clarify the mechanisms of essential biological functions related to the most relevant stages of aquaculture fish life-history (larval development, growth, maturation, reproduction) at both a physiological and molecular level. Despite the recent developments in aquaculture, our knowledge on basic life-requirements of farmed fish in modern, high-intensity aquaculture remains limited. The combined use of genomic tools with a better understanding of physiological and behavioural features throughout the fish life-cycle will allow for a better insight on key biological processes, and help to overcome bottlenecks in the production cycle. New knowledge within the field of **growth and development** is expected to be generated on maternal transcripts and impact of broodstock stress, the musculoskeletal system, metabolism and energy balance - ghrelin and leptin, modulation of hormone action, and metamorphosis. In the field of **adaptation and homeostasis**, new knowledge is expected on the differentiation and plasticity of transporting epithelial cells, multi-functionality of transporting epithelia and sexual maturation and changes in osmoregulatory functions. In the area of **immunity**, new knowledge is expected on ova and larval immune gene expression, primary barriers and disease resistance, immune-endocrine-physiological cross-talk, and maturation and specific immune responses. New knowledge is expected to be generated in the field of **sex differentiation and puberty**, on brain and gonad sex differentiation, puberty control, and paracrine signalling and testicular gene expression.

Potential Impacts



RTD

- The knowledge generated about development and growth, adaptation and homeostasis, the immune system, sex differentiation and puberty will have a **major impact on alleviating problems** linked to abnormal larval development, skeletal deformities, poor growth and energy utilization, mortalities related to life stage transitions, poor environmental performance, and unwanted sexual maturation
- The project results will pave way for future advances within fields of stress and disease control, breeding selection, environmental performance and species diversification.



SME

- Insight on key biological processes will help to overcome bottlenecks in the production cycle of sea bass, sea bream, Atlantic salmon and rainbow trout.



Knowledge Transfer

- The Knowledge transfer of the results to the sector will be carried out by presenting information on the project and its results in aquaculture journals and at aquaculture conferences, through the project website and through the “LIFECYCLE aquaculture project group” accessible through www.Linkedin.com

Related Publications/Projects

Recent features on the project:

- “LIFECYCLE, esencia científica para resolver problemas reales” in IPAC.acuicultura (vol 5, no 48, pages 1-4, 15 April, 2010). <http://www.ipacuicultura.com/ipac/noticia.php?idNoticia=3179> (in Spanish).
- “LIFECYCLE: an EU success story” <http://www.uib.no/rg/mdb/nyheter/2010/09/lifecycle-an-eu-success-story>.

Scientific publications:

- Servili A, Lethimonier C, Lareyre J-J, López-Olmeda JF, Sánchez-Vázquez FJ, Kah O, and Muñoz-Cueto, J A 2010. The highly conserved gonadotropin-releasing hormone-2 form acts as a melatonin-releasing factor in the pineal of a teleost fish, the European sea bass *Dicentrarchus labrax*. **Endocrinology** 151: 2265–2275
- Bouraoui L, Capilla E, Gutiérrez J and Navarro I 2010. Insulin and insulin-like growth factor I signaling pathways in rainbow trout (*Oncorhynchus mykiss*) during adipogenesis and their implication in glucose uptake. **Am J Physiol Regul Integr Comp Physiol** 299: 33-41