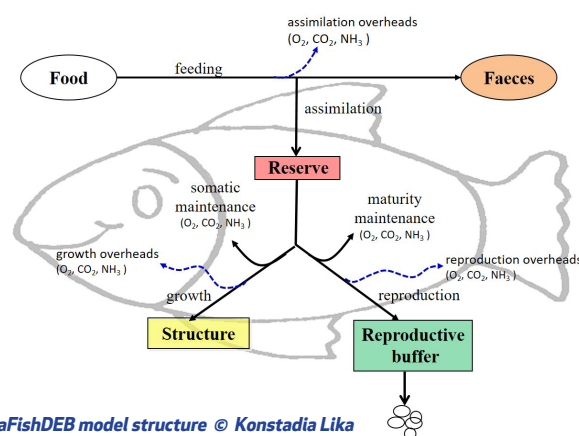


## SUMMARY

AquaFishDEB is a numerical model that captures the effects of feed quality, feeding schedule and water characteristics on individual growth, feed consumption, waste production (faecal and non-faecal nitrogen loss, faecal dry matter, CO<sub>2</sub>) as well as oxygen consumption in three aquaculture species (Atlantic salmon, gilthead sea bream and rainbow trout). The model is one of the main components of the AQUAEXCEL<sup>2020</sup> virtual laboratory for designing experiments in aquaculture research facilities. AquaFishDEB will be of interest to various end users in the aquaculture sector, including researchers, teachers, trainers and farmers.

## KNOWLEDGE NEED

The impact of different management conditions on the growth and performance of species in aquaculture must be understood to ensure the highest standards in welfare and to optimise productivity. Experiments with fish typically involve extensive use of laboratory facilities and run for long periods of time. Both from an ethical perspective (3Rs) and from a cost perspective, there is a need to use alternatives such as models and tools for design and planning of experiments.



AquaFishDEB model structure © Konstadia Lika



## POTENTIAL IMPACT

- Use of the AquaFishDEB model will help to optimise the use of experimental resources and improve experimental design, thereby greatly minimising the costs associated with traditional scientific experiments.
- The AquaFishDEB model will help to improve aquaculture management by predicting the results of feed quality, feeding schedule and water characteristics.
- The AquaFishDEB model will support researchers and teachers in designing experimental environmental conditions that optimise feed intake and growth, optimise the use of experimental resources, and improve experimental design.

**EATiP – Strategic Research and Innovation Agenda (SRIA)** Thematic Area 2 – Technology & Systems; Goal 2, Thematic Area 1 – Product, Quality, Consumer Safety and Health; Goal 3, Thematic Area 6 – Knowledge Management; Goal 2.

To see the full list and descriptions of the thematic areas and goals, please visit: [eatip.eu/?page\\_id=46](http://eatip.eu/?page_id=46)

## UNDERLYING SCIENCE

The model is based on the Dynamic Energy Budget (DEB) theory, a powerful theoretical framework for modelling the metabolic dynamics of an individual organism throughout its life cycle making explicit use of energy and mass balances. For each species, the modelling procedure had two steps. The first step involved the parameterisation of the individual DEB model. The second step incorporated the obtained DEB parameters into the AquaFishDEB model that simulates the dynamics for a group of fish exposed to specified conditions. For gilthead sea bream and Atlantic salmon, parameters were estimated using data obtained from literature and from partners of the AQUAEXCEL<sup>2020</sup> project. For rainbow trout, the parameter values were retrieved from the AmP database: [bio.vu.nl/thb/deb/deblab/add\\_my\\_pet](https://bio.vu.nl/thb/deb/deblab/add_my_pet).

## RESULTS

The result of this research is a functional model for growth, feed intake and waste production in farmed Atlantic salmon, gilthead sea bream and rainbow trout. Based on physiological rules for the assimilation and utilisation of energy and elemental matter, AquaFishDEB allows for the modelling of the processes of feeding, digestion, maintenance, maturation and growth for farmed fish. The model output includes growth (specific growth rate, weight-at-time) and feeding characteristics (e.g. feed conversion ratio, feed intake), as well as waste production (e.g. faecal and non-faecal nitrogenous loss) and gaseous exchange (O<sub>2</sub> consumption and CO<sub>2</sub> production).

## END-USERS & POTENTIAL APPLICATIONS

### ➤ END-USER 1: Aquaculture fish farmers

**APPLICATION:** To design and plan optimal fish husbandry conditions, thereby increasing productivity and hence profitability, and improving fish welfare.

### ➤ END-USER 2: Aquaculture feed producers

**APPLICATION:** To get better insight into feed conversion ratios and feed intake in different life stages of fish or in different species, implementing this knowledge by improving their feed formulations.

### ➤ END-USER 3: Aquaculture researchers and educators

**APPLICATION:** To get a better insight into growth dynamics under various experimental conditions and use the model as a tool to teach the design and planning of fish experiments, optimising the use of experimental resources and increasing fish welfare.

## STATUS

**Technology Readiness Level (TRL) level 4 – The prototype has been tested and shown that it can be integrated as a component with other modelling components.**

- The sensitivity of the model is currently being evaluated.
- The model is currently being validated with independent data for salmon, trout and gilthead sea bream. Once the validation stage has been finalised the model has the potential to be used as an operational tool.

## AT A GLANCE

**TITLE:** AquaFishDEB: A Functional Model for Fish Growth, Feed Intake and Waste Production in Aquaculture

**KNOWLEDGE TYPE:** Software / modelling tool

**WHERE TO FIND IT:** Not yet publicly available

**STATUS:** Currently validating the prototype model

**TNA FACILITY USED:** Hellenic Centre for Marine Research (HCMR), Greece ; University of Crete, Greece

**CONTACT DETAILS:** Dina Lika, Hellenic Centre for Marine Research, Greece, [lika@uoc.gr](mailto:lika@uoc.gr)

**PATENTS OR OTHER IPR EXPLOITATIONS:** No