



European sea bass (*Dicentrarchus labrax*) © Maria Mastoraki

SUMMARY

This research investigated the effect of fish meal substitution with three different insect meals on European sea bass (*Dicentrarchus labrax*) growth. Results show that 30% substitution of fish meal with either *Hermetia illucens* or *Musca domestica* larvae meal had no negative effects on growth performance and somatic indices. The results also reinforce previous observations that the dietary inclusion of *Tenebrio molitor* should be no more than 25%. This study will be of particular interest to sea bass farmers who wish to use insect-based meals as an alternative food source for their stock.

KNOWLEDGE NEED

Fish farmers rely on sustainable feed that can make fish strong and healthy. The aquaculture industry is looking for alternative feed sources because the supply of key ingredients of fish feed found in fish meal and fish oil is limited. However, completely replacing these with a different feed source in the fish's diet can lead to adverse effects on the fish, for example decreased digestion efficiency leading to lower growth rates. Alternative fish feed sources with high biological value and low competitiveness with human food are needed, and their safe substitution levels must be established.



Yellow mealworm (*Tenebrio molitor*) larvae, freeze-dried © Maria Mastoraki



POTENTIAL IMPACT

- Partly substituting sea bass diets with insect meal reduces the need for fish meal and oil, which are costly, volatile and unsustainable sources. This could lead to a more sustainable and competitive aquaculture sector.
- The establishment of the optimum level of fish meal substitution with insect meal opens the door for further research into its applicability for other aquaculture species.
- The findings contribute towards improving ecological and social sustainability of fish feeds, especially if applied to multiple species.

EATiP - Strategic Research and Innovation Agenda (SRIA): Thematic Area 4 - Sustainable Feed Production, Goal 1 and Goal 2; Thematic Area 2 – Technology and Systems, Goal 1. To see the full list and descriptions of the thematic areas and goals, please visit: eatip.eu/?page_id=46

UNDERLYING SCIENCE

360 fish were randomly divided into 12 indoor 500 litre tanks. The fish were fed with formulated diets in which 30% of fish meal was replaced by insect proteins (*Tenebrio molitor*, *Hermetia illucens*, or *Musca domestica*). A control group was fed fish meal with no insect substitutions. Calculations were performed to obtain the specific growth rate, feed conversion ratio, viscerosomatic index, hepatosomatic index, mesenteric fat index (ratio of visceral to subcutaneous fat), relative gut length and the condition factor of the fish.

RESULTS

- Results show that 30% substitution of fish meal with either *Hermetia illucens* or *Musca domestica* larvae meal had no negative effects on growth performance and somatic indices of European sea bass.
- The fish fed with the *Tenebrio molitor* substitution diet at a level of 30% had a significantly higher feed conversion ratio, indicating poorer utilisation of food. These results reinforce previous observations that the dietary inclusion of *Tenebrio molitor* should be no more than 25%.
- The fish groups fed fish meal and *Hermetia illucens* had significantly higher condition factors than the groups fed on *Musca domestica* and *Tenebrio molitor*, which could indicate a better general condition.
- Fish from the *Hermetia illucens* group had higher mesenteric fat indices and viscerosomatic indices than the fish meal group.

END-USERS & POTENTIAL APPLICATIONS

END-USER 1: Sea bass fish feed producers

APPLICATION: Developing and producing novel feed formulations based on alternative, safe and sustainable feed sources (insect meal) with high biological value and low competitiveness with human nutrition.

END-USER 2: Sea bass farmers

APPLICATION: Feeding of aquaculture fish stocks with more sustainable (and potentially cheaper) fish feeds while maintaining good production levels, leading to higher profits and reduced environmental impact.

END-USER 3: Aquaculture marketing and lobby groups

APPLICATION: Supporting a sustainable, dynamic image of the aquaculture sector, working towards improving global food security while decreasing environmental impact.

END-USER 4: Aquaculture research community

APPLICATION: Furthering knowledge relating to fish meal replacement and its effect on many aspects, such as growth, health, and taste of the final product, in sea bass and other fish species. This will support development of the aquaculture

sector and contribute to increased levels of Technology Readiness, and aid progression towards commercialisation.

STATUS

Technology Readiness Level (TRL) 4 - the knowledge has been validated in a laboratory environment.

Further research is needed to:

- Establish the precise optimal *Hermetia illucens* and *Musca domestica* substitution rate in sea bass diets.
- Investigate further effects of the *Hermetia illucens* and *Musca domestica* diet substitutions on other crucial elements such as microbiota composition.
- Understand changes in susceptibility to stressors under different diet compositions.
- Explore suitability for other species and/or life stages.
- Examine potential effects on the fish product, e.g. on texture, odour and taste.
- Perform feeding trials on a commercial scale (i.e. validated and demonstrated in an industrially relevant environment).

AT A GLANCE

TITLE: Effects of Insect Meal on the Growth of European Sea Bass

KNOWLEDGE TYPE: Exploitable scientific result

WHERE TO FIND IT: To be published. Contact details below.

STATUS: To be published

TNA FACILITY USED: Hellenic Centre for Marine Research (HCMR), Greece

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PATENTS OR OTHER IPR EXPLOITATIONS: No