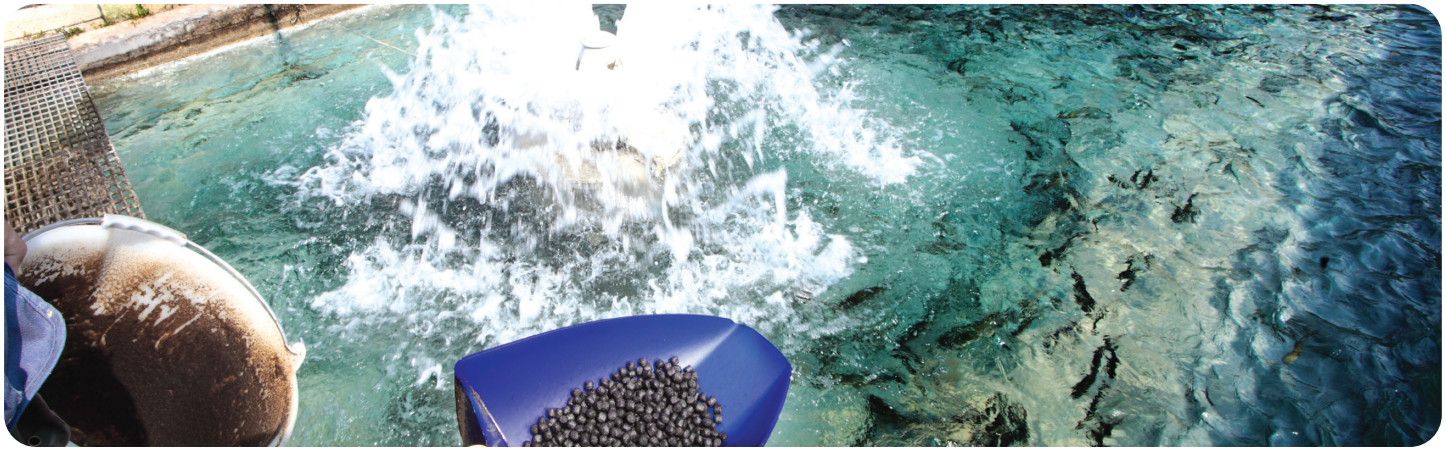
INSECT MEAL AS SUSTAINABLE FEED FOR JUVENILE EUROPEAN SEA BASS



SUMMARY

This research investigated the effect of fish meal replacement by insect mealworms (*Tenebrio molito*) in the diet of European (sea) bass (*Dicentrarchus labrax*) juveniles. Results showed that substitution of 25% ensures normal growth performance and feed utilisation of the juveniles. This finding comes at an important time for the European aquaculture industry as the updated EU 'Novel Food' Regulation (EU 2015/2283 – new rules to be applied as of January 2018) opens the door for the use of insects as an innovative food source in aquaculture.

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 a key ingredient 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 and increased susceptibility to diseases and stress. Alternative fish feed sources with high biological value and low competitiveness with human food are needed, and their safe substitution levels must be established.

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POTENTIAL IMPACT

- Substituting juvenile sea bass diets with mealworm 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 mealworms as a suitable feed substitution for juvenile basses 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.
- Economically, the substitution with mealworms is expected to reduce the feeding costs in European aquaculture as mealworms are expected to be a cheaper resource than fish meal and oil.

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

UNDERLYING SCIENCE

Insects such as mealworms are natural food sources for many fish species. Farmed fish, fed with insect-based meals, are able to perform well, depending on the level of substitution. In this study, three levels of substitution of fish meal by mealworm were applied to the diet of juvenile sea bass: 0% (control group), 25% and 50%. The experimental trial lasted 70 days and three replicates were performed per diet, each containing 50 fish.

The following performance and functions were monitored: initial and final body weight (individual and total biomass); percentage mortality; weight gain; feed consumption and feed conversion rate; specific growth rate; protein efficiency ratio; and whole body composition (proximate analyses and fatty acids profile).

RESULTS

- **Substituting 25% of the diet with mealworms did not lead to adverse effects** on weight gain or changes in fatty acid composition.
- **Some negative effects were seen at the 50% substitution level**, with significant growth reduction, less favourable outcomes for specific growth rate and feed consumption ratio, as well as a change in fatty acid composition, particularly a decrease in the contents of omega-3 fatty acids.
- Protein efficiency ratio and feed consumption were **not affected** by either level of substitution.
- The whole-body proximate composition analysis **did not show any differences** between treatments.

END-USERS & POTENTIAL APPLICATIONS

END-USER 1: Aquaculture fish feed producers
APPLICATION: Developing and producing novel feed formulations based on alternative, safe and sustainable feed sources (like mealworms) with high biological value and low competitiveness with human nutrition.

END-USER 2: Aquaculture fish farmers
APPLICATION: Feeding of aquaculture fish stocks with cheaper and more sustainable fish feeds while keeping good production levels, leading to higher profits and reduced impact on the environment.

END-USER 3: Aquaculture marketing and lobby groups
APPLICATION: Promoting aquaculture as a sustainable, dynamic sector, working towards improving global food security while decreasing environmental impact.

END-USER 4: Scientific Community
APPLICATION: Furthering knowledge relating to fish meal replacement and its effect on many aspects (such as growth, health, taste of the final product, etc.), in both sea bass juveniles, adults and other fish species. This will support development of the aquaculture sector and contribute to increased levels of Technology Readiness, and 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 *Tenebrio* substitution rate in juvenile sea bass diets
- Investigate further effects of the *Tenebrio* diet substitution on other crucial elements such as digestive organs and their tissues, 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

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