

<https://doi.org/10.7250/CONNECT.2023.064>

LIFE CYCLE ASSESSMENT OF BLACK SOLDIER FLY, YELLOW MEALWORM AND SOYBEAN PROTEIN FOR USE IN FISH FEED

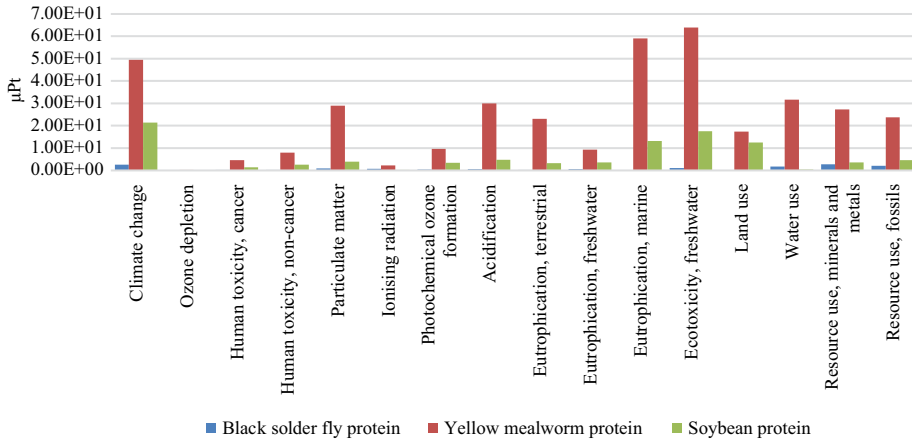
Beate ZLAUGOTNE^{1*}, Fabian ANDRES DIAZ SANCHEZ², Jelena PUBULE³, Dagnija BLUMBERGA⁴

¹⁻⁴ Institute of Energy Systems and Environment, Riga Technical University, Āzenes iela 12/1, Riga, LV-1048, Latvia

* **Corresponding author.** E-mail address: beate.zlaugotne@rtu.lv

Abstract – As the consumption of fish in the human diet increases, a larger amount of production is needed. The growing demand for fish also has an impact on fish feed, its production efficiency and the sustainability of using raw materials. To evaluate the sustainability of raw materials and the impact on the environment, three protein alternatives are compared – black soldier fly, yellow mealworm and soybean. Each alternative has advantages and disadvantages. The advantages of black soldier fly and yellow mealworm are a valuable source of protein, sustainable growth (as feed can be used for food waste) and no need for arable land. Disadvantages of black soldier fly and yellow mealworm are price, an unbalanced diet can negatively affect growth, and nutritional value effect on the fish vary depending on fly or mealworm species. The advantages of soybeans are price, availability and high protein content, but the disadvantages are a lack of essential amino acids that affect the quality of fish and poor palatability. An LCA study has been carried out for the black soldier fly, yellow mealworm and soybean protein. From PEF CR most relevant impact categories are climate change, particulate matter, acidification, land use, eutrophication terrestrial and water use. The total single score value for black soldier fly protein is 1.43E+01 μPt, for yellow mealworm protein is 3.89E+02 μPt and for soybean protein is 9.72E+01 μPt. Large impact is from electricity consumption, used components for feed. Sensitivity analysis was performed for black soldier fly protein and yellow mealworm protein production, where feed composition was changed. In sensitivity analysis environmental impact is less from the new feed structure. The reason might be that the new feed structure has used food waste and wheat as feed ingredients.

Keywords – *Black soldier fly; fish feed; LCA; protein sustainability; soybean; yellow mealworm*



Weighted protein results for impact categories.

Acknowledgement

The research has been supported within the framework of the European Regional Development Fund project No. 1.1.1.5/17/I/002 “Integrated national level measures for strengthening interest representations for research and development of Latvia as part of European Research Area” by funding project No. 23-11.17e/21/165 “Non-Food Organic Resources-based feeds optimised for salmon until post-smolt stages” (NON-Fôr).