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# Balanced Diversity in Aquaculture Development

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ABSTRACTS

## SPIRULINA *Arthrospira platensis* AND PROCESSING INDUSTRY FISHERY BY-PRODUCTS AS ALTERNATIVE PROTEIN SOURCES TO MARINE ORIGIN MEALS IN WEANING DIETS OF MUGIL *Liza aurata*

Christian Monzón-Rivero\*, Raquel Quirós-Pozo, Lidia Esther Robaina Robaina and Francisco Javier Roo Filgueira

Grupo de Investigación en Acuicultura (GIA  
IU-ECOQUA)  
Universidad de Las Palmas de Gran Canaria (ULPGC)  
Carretera de Taliarte s/n. E-35214  
Telde, Las Palmas, Spain  
Email: christian.monzon101@alu.ulpgc.es

The present study evaluated the use of *Arthrospira platensis* cyanobacterium and fish by-products as alternative protein sources in *Liza aurata* larvae of 31 dph (days post-hatching) with an initial weight and length of  $1.92 \pm 0.12$  mg and  $10.47 \pm 1.01$  mm, respectively. Five microdiets were tested: Control diet, with 100% protein from squid meal; Arth10, Arth20 and Arth40 diets with 10%, 20% and 40% *A. platensis* as partial substitution of squid meal; and Circular diet, with 100% squid meal substitution by fishery by-product. This research revealed that *Spirulina* can be included in the microdiet of mullets up to 40% maximum selected replacement, reporting high growth rates in size and weight, as well as high survival rates and resistance to stress. The inclusion of aquafeed by-products, despite reflecting significantly lower growth, it presented similar survival rates and proximal composition in *L. aurata* larvae. The skeletal anomalies analysis showed that mullet larvae do not present high percentages of severe deformities, except for the presence of stones in the urinary ducts. These results open a path towards sustainability for *L. aurata* production and the use of fisheries by-product resources, giving rise to a circular economy necessary for the aquaculture sector.

### Introduction

The continuous expansion of the aquaculture sector as well as the high demand of the population and the decreasing production of fishmeal and fish oils are speeding up the search processes for new raw materials and/or alternative protein and lipid ingredients to supply, effectively, proper feeding of cultured aquatic organisms. For this, the sector must focus on growing to offer products both in greater quantity and quality following the principle of sustainability of the environment and natural resources (FAO, 2022). Numerous scientific studies are directing their investigations towards the search for the highest percentage of fishmeal replacement by different routes and in a multitude of potential species for aquaculture industry (Yarnold *et al.*, 2019). However, research on mugilids, candidate species for diversification, is scarce.

For this reason and taking into account that the exorbitant increase in prices will affect the composition of diets in the future and, therefore, the cultivation of species with high requirements, the species of *Liza aurata* has been selected. Omnivorous organism with a low trophic level that presents a high potential in terms of the use of alternative ingredients and by-products of low added value, as well as the potential that its cultivation presents in different environments and even extreme conditions, and the opportunity for introduction into the regional aquaculture production in a differentiated way from the rest (Crosetti and Blaber, 2016; Rosas *et al.*, 2019a).

Therefore, the main objective of the work is to evaluate the effect and potential use of these ingredients as alternative protein sources to squid meals used in microdiets for weaning of *Liza aurata* larvae.

### Material and methods

The trial was carried out in the Parque Científico Tecnológico de Taliarte (PCTM) of the ECOQUA University Institute of the University of Las Palmas de Gran Canaria.

*Liza aurata* larvae of 31 dpe (N=400) were randomly seeded in 15 200-L cylindrical tanks (5 treatments in triplicate). A co-feeding protocol was carried out with metanauplii of *Artemia* sp. and 5 different experimental microdiets according to the percentage of inclusion and replacement of squid meal by the cyanobacteria *Arthrospira platensis* in 10% (Arth10 Diet), 20% (Arth20 Diet) and 40% (Arth40 Diet) and by marine origin by-products not intended for human consumption (Sandach III) in 100% (Circular Diet). To evaluate the effect of the inclusion of the alternative ingredients, the larvae

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