



## Weaning wild flathead grey mullet (*Mugil cephalus*) fry with diets with different levels of fish meal substitution



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### ABSTRACT

The culture of flathead grey mullet (*Mugil cephalus*) is based on wild fry captured during their migration into estuarine environments and consequently, optimizing weaning diets is of special importance for this species at this particular stage of development. Thus, authors have tested a weaning protocol for wild flathead grey mullet fry (202 mg initial body weight) during 60 days ( $18.1 \pm 0.3$  °C, salinity,  $1.2 \pm 0.2\%$ ) using compound diets (36% crude protein, 16% crude fat) with different levels of fish meal (FM) substitution by plant protein (PP) sources (50% and 75% of FM replacement by a blend of corn gluten, wheat gluten, soy bean meal and soy protein concentrate). Fry were progressively weaned onto experimental diets during the first 20 days of the trial (25% *Artemia* metanauplii replacement each 5 days), whereas compound diets were offered at a feed ratio of 5% of stocked biomass until the end of the trial (day 60). A blend of PP sources (corn gluten, wheat gluten and soy protein concentrate) as the main dietary protein sources in combination with crystalline L-lysine and DL-methionine dietary supplementation were as good as a FM-based diet in terms of growth performance, digestive physiology and fish condition (*i.e.* proximate composition, oxidative stress status). As the cost-benefit proxy analysis of the tested weaning diets indicated, the inclusion of alternative PP was a satisfactory strategy in terms of feed price reduction, since PP50 and PP75 diets were 15.5 and 23.6% cheaper than the FM diet. Although wild flathead grey mullet fry were satisfactorily weaned onto diets containing 75% FM substitution by PP sources, present results indicated that complete FM replacement in weaning diets for this species might also be feasible.

**Statement of relevance:** In this study, authors have tested a weaning protocol for wild flathead grey mullet (*Mugil cephalus*) fry based on diets with different levels of fish meal substitution by alternative plant protein sources. This is of special importance due to the importance of the aquaculture of this species in several regions of the world, as well as for the use of wild animals for on-growing purposes. Results showed that diets with 75% of fish meal substitution can be successfully used for weaning and on-growing wild fry without any detrimental effect of fry performance and condition.

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### 1. Introduction

The flathead grey mullet (*Mugil cephalus*) is an economically important euryhaline and eurythermal species contributing to sizable fisheries of estuarine and coastal regions in many countries (Saleh, 2006; Whitfield et al., 2012). This fish species has been recognized as a potential species for aquaculture diversification in the Mediterranean region, as well as in other regions of the world (Republic of Korea, Taiwan Province of China, South Africa), because of its good adaptation to captivity, rapid growth, omnivorous feeding habits and high market price of its salt-cured and dried eggs named “bottarga” (Whitfield et al., 2012). Grey mullet is generally reared extensively in mono- or polyculture

systems (Oren, 1981; Biswas et al., 2012), but in order to supply an established market in the North of Africa and the growing demand in the Mediterranean area (Italy, Israel, Egypt, Tunisia), Asia and South Africa (Whitfield et al., 2012), the intensive monoculture of this species has to be developed. This fact implies the development of a breeding technology and the development of a suitable and economical grow-out diet. However, before the juveniles could be provided by the aquaculture industry, the culture of this species is still based on wild fry (Whitfield et al., 2012; Biswas et al., 2012; El-Dahhar et al., 2014). In countries where collection for aquaculture of wild flathead grey mullet fry is practiced, social problems usually result from the competition for resources between fish farmers and fishermen (Saleh, 2006).

Providing adequate nutrition and fulfilling the nutritional requirements of the species are key-factors to successful growth, development and survival of fish. Mulletts are described as omnivorous, opportunistic

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