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The effect of live food enrichment with docosahexaenoic acid (22:6n-3) rich emulsions on growth, survival and fatty acid composition of meagre (*Argyrosomus regius*) larvae

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ABSTRACT

While spawning induction and larval rearing of meagre (*Argyrosomus regius*) have advanced as forcing factors to move this finfish species into the commercial aquaculture sector, larval nutrition still has unanswered issues to address, specifically in regard to live prey enrichment and fatty acid composition. In this study, two experimental trials for larval rearing of meagre utilizing different methods of live prey enrichment with emulsions of different specialist oils having distinct fatty acid composition, have demonstrated that docosahexaenoic acid (DHA) requirements may be species-specific, with a DHA supplement of 12–15% in live prey enrichment diets yielding optimum larval growth. Cannabilism in early life stages (post 20 dph) in this species also remains a challenge and requires stocks to be managed accordingly. Further, we found evidence suggesting meagre larvae are not capable of elongation or desaturation of fatty acids when precursors such as LA, GLA, LNA or SDA are offered in the live prey.

1. Introduction

The understanding of nutrition and feeding during early development is a major prerequisite to counter the challenges of marine fish larvae culture. The success of larval rearing is greatly influenced by first feeding regimes and the nutritional quality of starter diets, with dietary lipids being recognized as one of the most important nutritional factors affecting larval growth and survival (Watanabe, 1993).

Marine lipids are rich in saturated and monounsaturated fatty acids, which are a vital source of metabolic energy for the rapidly developing and growing fish larvae. In addition, they supply polyunsaturated fatty acids (PUFA) which are considered essential fatty acids (EFA) for marine fish since they cannot be biosynthesized and hence must be provided in the diet. Three long chain PUFA (LC-PUFA), namely docosahexaenoic acid (DHA, 22:6n-3), eicosapentaenoic acid (EPA, 20:5n-3) and arachidonic acid (ARA, 20:4n-6) have a variety of vital functions in fish species, as in most vertebrates, being the main components of membranes and precursors of bioactive metabolites such as eicosanoids (Tocher, 2010). DHA plays an important role during larval development as it is incorporated into nervous and retina tissue (Mourente and Tocher, 1992; Bell et al., 1996), and when absent from the larval diet, leads to poor growth and high mortality as well as to several behavioral, physiological and morphological alterations (Lingenfelser et al., 1995; Tocher, 2010).

Meagre, *Argyrosomus regius*, is a valuable new finfish species for European aquaculture desired for its rapid growth during ongrowing and the quality of its meat (Poli et al., 2003; Grigorakis et al., 2011). At present, spawning induction (Duncan et al., 2012), larval development (Jimenez et al., 2007; Cardeira et al., 2012) and larval rearing protocols (Roo et al., 2010; Vallés and Estevez, 2013; Campoverde et al., in press) have already been established. However, nutritional requirements of the larva, including LC-PUFA, have not been established yet, although some preliminary information, using commercial enrichment products or microdiets for larval feeding, already exist (Vallés and Estevez, 2015; El Kertaoui et al., 2017). According to Monroig et al. (2013) they express at least one fatty acyl desaturase (Fads2) and one elongase (Elovl5) involved in the endogenous production of LC-PUFA.

Hemp seed oil has been dubbed “Nature's most perfectly balanced oil” (Callaway, 2004), due to the fact that it contains the perfectly balanced 3:1 ratio of Omega 6 (18:2n-6, linoleic, LA) to Omega 3 (18:3n-3, α-linolenic, LNA) essential fatty acids, determined to be the optimum requirement for long-term healthy human nutrition. In addition, it also contains smaller amounts of three other PUFA such as γ-linolenic acid (18:3n-6, GLA), oleic acid (18:1n-9, OA) and stearidonic acid (18:4n-3, SDA). This fatty acid combination is unique among edible oil seeds and can be used to check the capacity of marine

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