

EFFECTS OF NOVEL INGREDIENTS ON GROWTH PERFORMANCE IN EUROPEAN SEA BASS, *Dicentrarchus labrax*

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Introduction

Limited availability of ingredients in aquaculture feeds is crucial in order to maintain the increasing demands of aquaculture industry (Gamboa-Delgado & Márquez-Reyes 2018). However, to safeguard sustainable exploitation of natural resources, the use of capture fisheries-based fishmeal and fish oil needs to be reduced in conventional fish feeds (Tacon & Metian, 2015). Accordingly sources with high quality protein and essential nutrients are imperative need otherwise fish performance (Kousoulaki et al., 2012), health status and final product quality (Kousoulaki et al., 2016) may be jeopardized when substituting dietary fish meal by alternative ingredients of lower nutritional value. The main objective of this study is to test ingredients and design formulations for commercially relevant tailored-made aqua feeds, ensuring high performance, maintaining or enhancing nutritional value and environmental friendliness.

Materials and methods

Ten experimental feed mixes were prepared (Table I). The levels of conventional and trimmings fish meal and oil and that of the novel feed ingredients, balanced to same proximate composition, EPA+DHA and total phospholipid content with rapeseed or fish oil, soy lecithin, wheat and wheat gluten, were predetermined by a chosen range in the applied three component mixture design. Juvenile European sea bass of an initial average body weight of 5.72±0.72g were fed the experimental diets. Fish were weighted individually at the beginning and end of the experimental trial under mid anesthesia with clove oil. Fish were fed *ad libitum* twice a day. Mortalities and feed consumption were recorded daily in order to be able to evaluate accurately values for feed utilization (FCR, SGR, % daily feed consumption).

Results and Discussion

The results so far show that there is a significantly positive effect in sea bass performance of moderate dietary inclusion of innovative ingredients in the presence of minimum 10% conventional fish meal and 2.7% conventional fish oil. The inclusion of fish trimmings at any level had negative effect on fish performance. In the absence of any kind of fish meal, and the highest inclusion level of bacterial, yeast, microalgae and sunflower meal, feed intake was lowest (Figure 1- able II).

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Figure 1. Preliminary mixture models ($R^2>0.87$, $p<0.01$) for SGR (a), feed intake (b) and FCR (c).

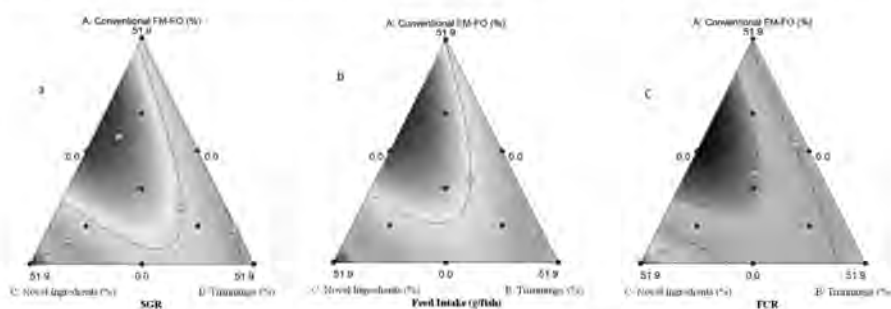


Table I. Diet formulation and nutrient composition of the experimental diets %.

Diets	1	2	3	4	5	6	7	8	9	10
Fish Meal	-	-	-	10.0	20.0	10.0	6.7	3.3	13.3	3.33
Fish Oil	-	-	-	2.7	5.5	2.7	1.8	0.9	3.6	0.9
Trimmings FM	20.0	10.0	-	-	-	10.0	6.7	3.3	3.3	13.3
Trimmings FO	5.50	7.90	10.3	5.15	-	2.75	5.27	7.78	2.63	5.38
Bacterial protein	-	7.00	14.0	7.0	-	-	4.7	9.3	2.3	2.3
Yeast meal	-	3.00	6.00	3.00	-	-	2.0	4.0	1.0	1.0
Microalgae	-	3.7	7.5	3.7	-	-	2.5	5.0	1.2	1.2
Sunflower meal	-	6.4	11.6	6.40	-	-	4.2	8.5	2.1	2.1
Wheat	19.3	9.6	-	9.64	19.3	19.3	13.2	7.1	15.5	15.7
Soya lecithin	1.3	1.9	2.6	1.9	1.3	1.3	1.7	2.1	1.5	1.5
Rapeseed oil	9.5	5.5	1.6	5.5	9.5	9.5	6.8	4.2	8.1	8.1
Wheat gluten	13.5	11.7	10.0	11.7	13.5	13.5	12.3	11.1	12.9	12.9
SPC	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Maize gluten	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5

Table II. Growth performance parameters and feed utilization.

Diets	1	2	3	4	5	6	7	8	9	10
Initial Weight	5.53	5.49	5.94	5.78	5.75	5.69	5.83	5.73	5.45	5.73
Final Weight	14.9	16.2	13.8	19.0	16.7	16.2	17.7	17.2	16.8	16.7
Weight increase	9.4	10.7	7.87	13.3	11.0	10.5	11.9	11.5	11.4	10.9
FCR	0.94	0.89	1.00	0.81	0.93	0.88	0.85	0.86	0.86	0.8
SGR	2.55	2.79	2.16	3.06	2.74	2.69	2.86	2.82	2.90	2.7
% Consumption	2.3	2.3	2.1	2.3	2.4	2.2	2.3	2.3	2.3	2.3