

**Summary:**

Finishing feeds can improve the growth and feed utilization of gilthead sea bream grown previously on diets containing low levels of fishmeal and fish oil. N-3 HUFAs can be partly restored in fish previously fed diets in which vegetable oil with high n-6 PUFA levels largely replaced fish oils. Skin coloration can also be improved.

Sea bream fed a finishing diet for 105 days (right) showed much brighter coloration than those fed a control diet (left).



# Finishing Diet Improves Sea Bream Quality

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With the high pressure on prices for sea bream – *Sparus aurata*, a high-value and important aquaculture species in the Mediterranean – aquafarmers want to differentiate their product from the competition. Quality in sea bream is defined by the main criteria of appearance, slaughter quality, freshness, cooking quality, and nutritional value.

The appearance of sea bream is judged by the presence of a pigmented operculum, distinct abdominal yellow line, bright yellow arc between the eyes, and golden shine over the dorsal area. Nutritional value mainly focuses on the omega-3 content of the consumed fillets.

## Experimental Diets

With financial support from the Commission of the European Community Quality of Life and Management of Living Resources program, the authors recently carried out research to improve the visual appearance and nutritional status of sea bream by applying finishing diets.

Three growout diets were formulated, including a standard control diet (HIGH FM) with high amounts of fish oil and fishmeal, and two diets in which part of the fishmeal and fish oil was replaced by vegetable protein and fat sources in different amounts (MED FM+ and LOW FM) (Table 1). In the MED FM+ diet, the nutritional concentrate Fish Essence was included to compensate for nutrient losses caused by the fishmeal replacement.

A fourth diet (FIN) was formulated with a finishing premix that included nutrients and ingredients to optimize the nutritional status and enhance the visual appearance of the fish. All diets were formulated with standard raw materials and produced on a twin-screw cooking extruder.

## Experimental Setup

A first experiment evaluated the

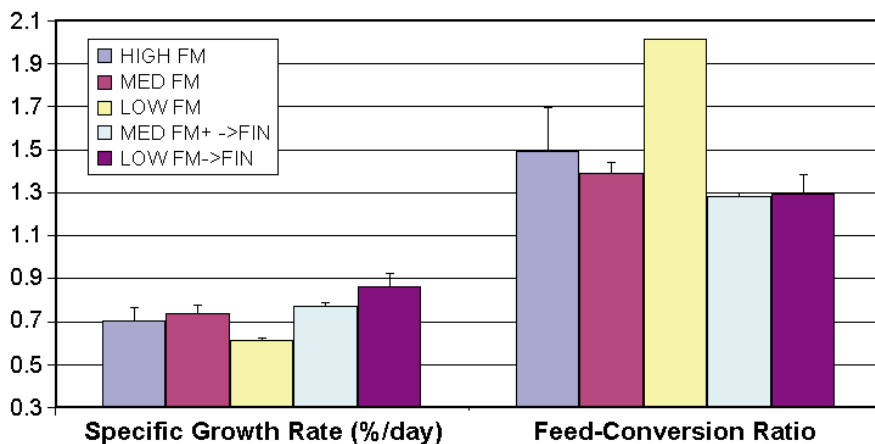
effects of the finishing diet on the growth and nutritional profile of the end product. Experimental fish of 48 g initial weight were randomly assigned to 300-l tanks placed in a partial recirculation system with bore-hole water at an average 22° C. Water quality parameters were monitored daily and kept within accepted limits for the species. Fish were fed with automatic belt feeders. Uneaten feed was retrieved, with feed intake corrected accordingly.

During the first 126 days, the fish were fed the different three growout diets. After this acclimatization period, fish of the MED FM+ and LOW FM groups were subdivided into a first group that continued on the acclimatization diet and a second group switched to a finishing diet (MED FM+→FIN and LOW FM→FIN). This finishing period lasted 58 days, after which fish were weighed and sampled for fillet and liver composition.

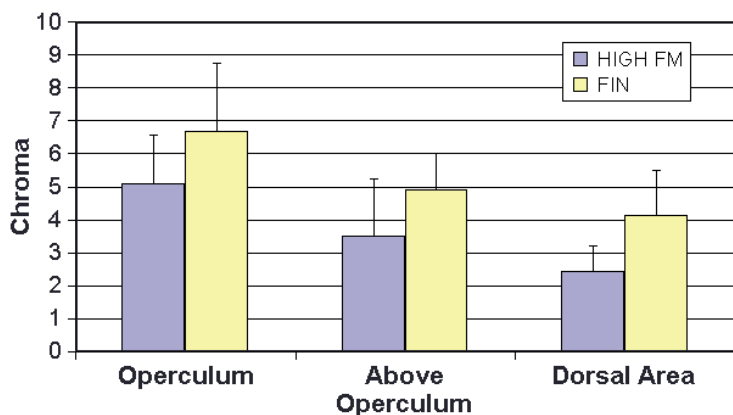
A second trial was set up under the same experimental conditions as the first, but in larger 600-l tanks. After a short acclimatization period in the system, 200-g experimental animals with the same feeding history were divided into groups fed the HIGH FM diet or FIN diets. After 105

**Table 1. Composition of experimental diets.**

Diet	HIGH FM	MED FM+	LOW FM	FIN
CP/CF	46/18	46/18	46/18	48/17
% Protein from fishmeal	65	35	25	65
% Fat from fishmeal/oil	85	33	31	85



**Figure 1.** Mean effects of finishing feed on growth and FCR during a 58-day finishing period.



**Figure 2.** Mean effects of finishing feed on chroma values in different areas of sea bream integument.

days, the fish were weighed and sampled for analysis of the integument.

### Finishing Diet Improves Growth, Nutritional Status

Throughout the first trial, there were no statistically significant differences in growth and feed conversion between fish fed the HIGH FM and MED FM+ diets, although they

performed significantly better than the LOW FM animals. The group fed the LOW FM diet showed a 14.5% lower daily growth rate and 34% higher feed-conversion ratio (FCR) than the HIGH FM fish during the acclimation period (Figure 1).

When these fish were switched to a finishing diet, growth and FCR improved drastically. The fish acclima-

tized on the LOW FM diet showed a major compensatory growth response, ending up at 264 g final weight – very close to the 271-g weight achieved on the HIGH FM diet.

Fillets of fish fed the MED FM+ and LOW FM diets, where fish oil was largely replaced by vegetable oils, showed high levels of n-6 polyunsaturated fatty acids (PUFAs) and reduced levels of n-3 highly unsaturated fatty acids (HUFAs). These fatty acid profiles are not recommended for consumers. The finishing feeds, containing high levels of marine protein and fats, restored the n-3 HUFA content in the fillets and washed out the n-6 HUFAs to some extent.

No clear effects were observed on the proximate composition of the fillets when switched to the finishing diet, but a positive effect on fat content of the liver was detected.

### Skin Pigmentation

In the second trial, the focus was skin pigmentation. Visual observations, which showed greatly improved skin pigmentation, were confirmed by chromometer measurements (Figure 2). A chromometer is a device that measures color intensity.

Chemical analysis of the skin also showed improved carotenoid content. The fish fed the finishing diet had 4.4 mg total carotenoids/kg compared to the control diet value of 1.9 mg/kg. No significant differences in growth or feed utilization were observed in the trial, although the finishing diet performed slightly better.