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# EVALUATING FEED DISCRIMINATION IN SEABREAM *Sparus aurata* USING A DUAL-CHOICE SELF-FEEDING SYSTEM

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## Introduction

Feed intake is a critical variable in aquaculture that limits growth and survival of reared animals. The inclusion of new raw materials in fish diets to meet cost-efficient production and sustainability goals may compromise the organoleptic quality of diets and, by extension, fish growth (Yaghoubi et al., 2016). Therefore, it seems reasonable to evaluate the fish s discriminatory capacity towards feed in order to discern the organoleptic preferences of aquacultured species. The goal of this study was to develop an experimental model to test feed discrimination in the gilthead seabream (*Sparus aurata*), an important species for Mediterranean seawater aquaculture.

## Materials and methods

We set up a dual-choice feeding system using self-feeders activated by a string sensor placed 3cm below the water surface. Feeders were connected to a computer system that recorded the date, time and tank from which each feed demand originated (Leal et al., 2009). The feed reward per sensor activation was set at approximately 1g/demand. Initially, 500 juvenile gilthead sea bream of approximately 10g were maintained in two 2500 l tanks provided with self-feeding systems during eight months for accommodation and learning. Subsequently, animals (body weight around 100g) were transferred to eleven 500 l experimental tanks (n=10/tank) provided with a dual choice feeding system consisting of two string sensors, each activating a different self-feeder. During 28 days, all feeders were provided with a control diet (44% CP and 18% CF, containing 12.5% fishmeal) for accommodation to the experimental tanks, but especially to the dual choice feeding system (phase I). Subsequently (phase II), in four tanks, one feeder was filled up with control diet supplemented with quinine (1.5%, negative diet) whereas the second feeder contained the control diet. In other three tanks, the tester-feeder distributed a positive diet (isoproteic and isolipidic but containing 46% fishmeal, 6% squid meal and 6% krill meal) and the second feeder delivered control diet. Finally, both positive and negative diets were confronted in the remaining four tanks. After eight consecutive days, the position of feeders was switched in the tanks and animals were allowed to feed for further 21 days (phase III). At the end of the experiment, the total amount of feed distributed was calculated by weighing the feed remaining in the feed hoppers. This quantity was used to calculate the delivery rate for each electronic feeder. The amount of feed delivered daily was calculated using the feeder delivery rate and number of daily demands. The experimental tanks were inspected daily to ensure the absence of feed on the bottom. Consecutively, and utilizing the same animals from the previous experiment, an additional trial was set up to corroborate the feeding deterrent effect of quinine using a single feeder per tank for 14 days. Three tanks were fed with quinine-supplemented diet and four tanks with control diet. Feed intake levels were calculated as before.

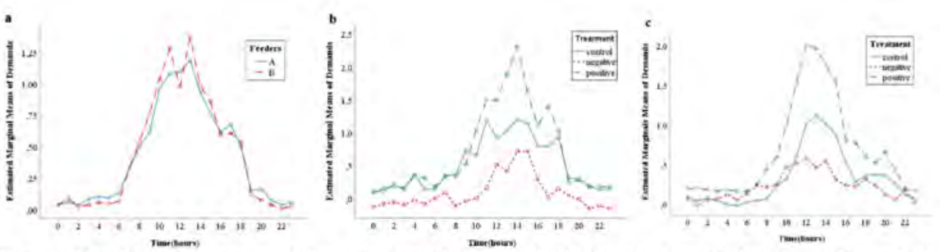

Fig. 1. Feeding demand profiles estimated during 24 h for a) phase I, b) phase II, and c) phase III (estimated marginal means are forecasted means in function of the independent variable).

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**Results and discussion**

During phase I of the dual-choice experiment, using a univariate general linear model that analyzes all sensors jointly, independently of the tank, no significant differences in feeder activation were found, thus demonstrating that fish demanded feed in a similar way independently of feeder. Sensor activation differed according to time (hour of the day), day and tank. It was demonstrated that fish exhibited a similar daily pattern of demands (figure 1a) in all sensors/feeders. Number of demands was different between tanks but also between the different experimental days, thus indicating the instability of feed intake (data not shown). During phase II, when experimental diets were introduced, we found significant differences in sensor activation, with the lowest values being measured in feeders provided with quinine-supplemented diet and highest demand levels being found in those containing positive diet (figure 1b). This demonstrated that fish exhibited preferences towards sensors coupled to feeders delivering positive diets but avoided feeders supplying a deterrent feed (provided by quinine inclusion), when compared to the control diet. Similarly to the accommodation phase (I), feed intake levels differed according to day and tank, but this time we also recorded significant differences in the 24h-feeding pattern. In this respect, the activation period of sensors delivering quinine-rich diet was narrower (figure 1b). Finally, in phase III when the position of feeders was inverted, fish continued to demand less from feeders delivering the quinine diet, and had higher demands from feeders supplying the positive diet. Results suggest that fish are able to discriminate the position of the feeder according to the type of diet delivered or, what is the same, they can discriminate the diet independently of the feeder position. Similar to phase II, feeder sensor activation differed according to day, tank and time (figure 1c).

Finally, using a different experimental set up in which animals were fed exclusively with one type of diet, either control or quinine-supplemented, we confirmed that, when presented with a diet containing quinine, gilthead seabream reduce their voluntary feed intake (data not shown), thus corroborating that the lower preference towards this feed, when an alternative feed is presented, is associated with a feeding deterrent effect.

**Conclusions and future directions**

Seabream exhibited variable feed intake levels along different days and fish groups/tanks but were able to discriminate the diet’s organoleptic properties using a dual-choice self-feeding system. This opens the possibility to use the system to evaluate new raw materials in terms of feed acceptance/preference, as well as the potential of flavorings to overcome the negative effects of antinutritional compounds or medication on feed intake.

**References**

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