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LIVESTOCK SYSTEMS – AQUACULTURE

O102

Effects of rearing density on growth, welfare indicators and digestive conditions of gilthead sea bream (*Sparus aurata*, L. 1758) fed different fish meal and fish oil dietary levels

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In Mediterranean aquaculture, the improvement of feeding management represents a key factor to maximise productivity and improve sustainability. For this reason, the relation between feed composition and relevant farming parameters such as rearing density might be investigated and used to choose the best feed according the specific rearing conditions. This study explored the effect of high and low rearing density on growth, plasma biochemistry, skin mucus, gut enzymes activity and gut microbiome structure in Gilthead sea bream (*Sparus aurata*, L. 1758) fed low and high fishmeal (FM) and fish oil (FO) dietary level. Two isoenergetic diets with high and low FM/FO percentages, (30/15 and 10/3, respectively) were tested in triplicated fish groups until a final high (30 kg/m^3) and low (10 kg/m^3) biomass density. Fish (initial body weight: 96.15 g) were fed to satiation twice a day (10% overfeeding) over 97 days period. At the end of the trial, specific growth rate (SGR), voluntary feed intake (VFI), feed conversion rate (FCR), protein efficiency ratio (PER), gross protein efficiency (GPE), lipid efficiency ratio (LER), gross lipid efficiency (GLE) were estimated. Fish welfare was evaluated through plasma biochemistry and gut microbiome structure. Furthermore, skin mucus enzymatic activity was analysed. Two-way ANOVA was performed on data, followed by a Tukey's multiple comparison test. Differences among treatments were considered significant when p-value was <.05. According to the results, density seemed to negatively influence feed intake. Diet also had a significant effect on final weight, weight gain, growth rate and FCR, being higher in high FM/FO diet. Highest peroxidase and protease level were obtained in skin mucus from fish fed low FM/FO diet. Enzymatic activity of digestive enzymes and gut microbiota by Next-generation sequencing were also analysed. In conclusion, rearing density negatively affected feed intake but did not compromise fish health.

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O103

Pre-fattening of Manila clams in a Po Delta lagoon: effect of stocking density in suspended lanterns

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This study assessed the growth and mortality of Manila clams (*Tapes philippinarum*) (initial weight, 0.04 g) during a 3-month pre-fattening (April–June 2018) in suspended net lanterns at three stocking densities (low, 10,000 clams/m^2; medium, 20,000 clams/m^2; high, 30,000 clams/m^2; 21 lanterns/stocking density). Lanterns were located in two sites of Sacca degli Scardovari (Rovigo, Italy) characterised by different hydrodynamism. A total of 21 lanterns (7 per stocking density) were located at the northern site, which was at the most far and inner side of the lagoon with respect to the sea water entrance (average water temperature 23.4 ± 2.99 °C; dissolved oxygen: 6.18 ± 1.23 ppm). Other 42 lanterns (14 per stocking density) were located at the western site, at half of the lagoon (temperature 22.6 ± 3.20 °C; dissolved oxygen 7.12 ± 1.13 ppm). At the end of the pre-fattening (10 and 11 weeks in the northern and western sites, respectively), a subsample (about 50 g) was collected from every lantern to measure clam biometric traits. Data were analysed by PROC GLM (SAS), with stocking density as the main effect. In the northern site, after 10 weeks of pre-fattening, clams exhibited an average weight of 0.50 ± 0.23 g, a length of 13.45 ± 2.46 mm, and a width of 9.38 ± 1.48 mm. Clam growth varied as stocking density increased (p<.001): weight decreased from 0.75 g to 0.55 g to 0.47 g from low to medium to high stocking density; length from 15.6 mm to 13.9 mm and 13.2 mm, and width from 10.8 mm to 9.66 mm and 9.18 mm. Mortality was 1.8%, 0.9%, and 1.4% in lanterns kept at low, medium, and high stocking density,

respectively (p>.10). In the western site, after 11 weeks of pre-fattening, clams exhibited an average weight of 0.64 ± 0.31 g, a length of 14.13 ± 2.46 mm, and a width of 10.25 ± 1.66 mm. Clam growth also varied as stocking density increased: weight decreased from 0.88 g to 0.62 g to 0.45 g; length from 16.1 mm to 14.3 mm and 12.7 mm, and width from 11.5 mm to 10.2 mm and 9.23 mm (p<.001). In this site, mortality increased from 1.0% to 4.3% and 8.9% as stocking density increased (p>.10). To conclude, under our conditions in Sacca degli Scardovari, clams in suspended lanterns successfully reached the minimum sowing size (0.3 g, length of 11 mm) in 3 months. Nevertheless, the increase of stocking density decreased clam growth and size in both sites.

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O104

Integrated freshwater aquaculture: potentialities and limitations of freshwater bivalves utilisation

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Aquaculture productions significantly differ from other sectors of land animal productions for the direct relation with aquatic ecosystems. Reduction of environmental impact of aquaculture is a central question and integrated marine aquaculture has presented good responses. Freshwater natural ecosystems are more vulnerable to aquaculture impact respect marine ones for their limited extension; therefore, the reduction of environmental impact is a mandatory question for the future of aquaculture in Italy and in Europe. Integrated marine aquaculture systems are based on co-production of two or more aquatic edible species, where fish are reared in combination with marine bivalves (such as blue mussels) and edible algae. Freshwater bivalves are optimal candidates for freshwater integrated aquaculture, but are investigated to little extent as they are not considered suitable for human consumption. The department of veterinary sciences of Torino university in 2017 has won an EU project financed (AQUAVAL) about freshwater integrated aquaculture and bioremediation. From May to November 2018, two consecutive experimental trials have been organised, in order to test the bivalve filtration efficiency in artificial conditions, using output water from a productive farm, in order to test the efficiency of bivalves in reducing bacteria concentration. Twelve aquaria have been equipped with 4 bivalve densities (60; 30; 15 and 7.5 kg/mc) and a control (without bivalves), in order to test the optimal density. In the second experimentation, the highest bivalve rearing density (60 kg/mc) was substituted with a lower density of 3.75 kg/mc. Despite some negative aspect have emerged during these experimentations, first results indicate a net bacteria reduction of almost 100% in 7.5 kg/mc density, one order of magnitude lower than the control. In the successive phases of the project, a bivalve meal will be tested as a potential ingredient of fish feeds and bivalve shell will be used as Calcium source in laying hens feeding. Finally, the possibility of bivalve utilisation as living sensors for water monitoring will be tested. This method, currently used in drinking water treatment plants, will be eventually transferred to aquaculture, in order to promote an innovative concept of hybrid integrated aquaculture.

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O105

In vitro evaluation of macroalgae (*Ascophyllum nodosum* and *Lithothamnium calcareum)* and microalgae (*Schizochytrium* spp.) for animal nutrition

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The growth of food demand and the scarcity of lands and water have led to interest in novel sustainable food and feed ingredients. Algal biomass as feedstock or as supplements in animal nutrition can positively improve the food security and environmental impact. Algae can be grown cheaply without arable land, they release oxygen into atmosphere and, if included in the diet of ruminants, are able to reduce methane emissions. Algae are characterised by high content of nutrients, minerals, complex carbohydrates, pigments and poly-unsaturated fatty acids. Although the nutritional profiles of algae vary considerably within species, different studies showed general antioxidant and antibacterial properties.

The aim of this study was to evaluate the antibacterial activity against O138 *E. coli*, a typical enteric pathogen of swine, and the antioxidant proprieties of *Ascophyllum nodosum, Lithothamnium calcareum* and *Schizochytrium* spp. Algal extracts were obtained starting from 5 g of dried algal flour samples, dissolved in 150 mL of acetone, were extracted in a Soxhlet apparatus for 6 h. After the evaporation of solvent under vacuum at 50 °C, the residue was dissolved with 20 mL of water. The overnight cultures of O138 *E. coli* in Luria-Bertani (LB) medium served as the inocula for