aquaculture 2015 — Cutting Edge Science in Aquaculture — 23-26 August 2015, Montpellier, France

Effects of stocking densities on gilthead seabream (*Sparus aurata*, L.) juveniles growth performance and content under organic rearing

Domitilla Pulcini[1], Riccardo Aleandri[2], Sergio Rabai[3], Valerio Vitalini[4], Marco Martinoli[5], Fabrizio Capoccioni[1]

[1] Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria (CREA) – Centro per la Produzione delle Carni ed il Miglioramento Genetico (PCM) – Via Salaria 31, 00016, Monterotondo (Italy)
[2] Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria – Dipartimento Produzioni Animali – Via del Caravita 7A, 00100, Roma
[3] NSAqua s.r.l., Ornamental Fish Farm – Via Provinciale Vejanese, 01012 Capranica (Italy)
[4] Piscicoltura del Golfo di Gaeta Società Cooperativa Agricola – Lungomare Giovanni Caboto 55, 04024 Gaeta (Italy)
[5] Università degli Studi di Roma "Tor Vergata" – Laboratorio di Ecologia Sperimentale e Acquacoltura – Via Cracovia 1, 00133, Roma (Italy)

Introduction

Organic agriculture is one of the world's rising food sectors. It is considered a promising sustainable food production model since it aims to contribute to the problem of the increasing of fish demand avoiding further impoverishment of natural fish resources and pollution of the marine ecosystem.
Notwithstanding this there is still a huge gap with respect to traditional aquaculture in terms of quantities and diversity of fish products mainly due to the lack of universally accepted rearing protocols, particularly concerning juveniles rearing phase. Current international legislation provides some rules on organic aquaculture but further implementation is expected by 2017.
Stocking density is a crucial and debated aspect in this sector which requires more scientific data in relation to its effects on fish growth performance and quality during the hatchery juveniles phase. Aquaculture systems efficiency is supposed to be maximized by increasing rearing densities, but other counter-productive effects have been reported.
This preliminary study aims to investigate the potential juveniles growth performance and content (lipids) on gilthead seabream reared a two different stocking density.

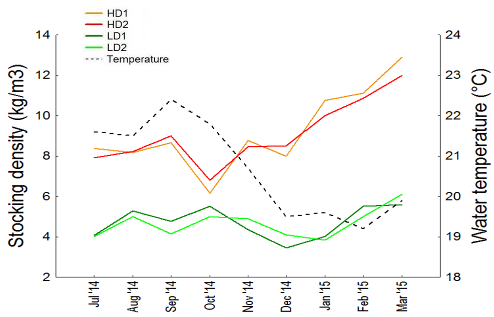

Figure 1. Monthly water temperature and stocking densities in the four tanks of the rearing system

Materials and methods

Sampling design

An experimental rearing system of four PVC tanks was constructed in order to replicate each batch. *Sparus aurata* juveniles randomly chosen from the same hatchery were gradually acclimatized to the tanks water salinity (30 psu) and temperature (Fig. 1) and then stocked at two different densities: 9.1±1.8 (HD1 and HD2) and 4.7±0.7 kg/m³ (LD1 and LD2). Organic feeding rate were adjusted every 4 weeks based on the average weight of fish. In each tank every month an appropriate percentage of individuals were randomly removed in order to maintain stocking density constant through the whole experiment (Fig. 1). At the end of the experiment fishes were harvested and counted, weighted and measured.

Data analysis

Growth performances were determined and feed utilizations were calculated as described by Sveier, Raae and Lied (2000). The relationship between standard length and total weight (LWR) has been calculated from the logarithmic (base 10) equivalent: log W = log a + b·log L.
For each individual, relative condition factor (Krel; Le Cren, 1951) was computed. Such condition factor can be used to indicate whether an individual is in better (Krel>1) or worse (Krel<1) condition than an average individual of the same length. The parameters of the von Bertalanffy theoretical growth curves were estimated both by the standard nonlinear regression model and by an additive effect. Lipids contained in the edible muscle part of a subsample of fishes reared in different stock densities were quantified according to the method of Folch et al. (1957).

Results and Discussion

Fishes from replicated batches of each stocking density were cumulated (HD1+HD2 and LD1+LD2) since no significant differences were found in all results. The different growth parameters of fishes reared at different stocking densities are shown in Table 1.

	HD	LD
	Mean ± SD	
Mean weight of initial stock (g)	2,5 ± 1,5	
Mean weight of final harvest (g)	34,2 ± 11,0*	39,2 ± 10,6*
Mean length of initial stock (cm)	5 ± 0,3	
Mean length of final harvest (cm)	11,6 ± 1,1	11,8 ± 1,0
Food conversion ratio (FCR)	0,004 ± 0,012*	0,024 ± 0,023*
Specific growth rate (% day^{-1})	1,0 ± 0,7	1,1 ± 0,6
Mean daily growth rate (g)	0,1 ± 0,1	0,1 ± 0,1

Table 1. Growth parameters, the food conversion ratio & mean daily growth rate the two stocking densities during the experiment period

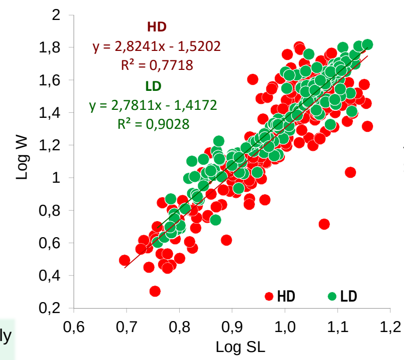

Figure 2. Plot of the length-weight relationships of fishes reared at high and low stocking densities

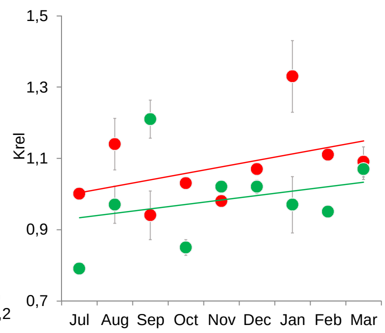

Figure 3. Changes in relative condition factor of fishes reared in high and low stocking density

- Mean individual weight of final harvest and food conversion ratio are significantly higher (ANOVA; p<0,05) in low density reared fish (Tab. 1).
- The linear log-transformed LWRs have been statistically compared (ANCOVA). Slopes and intercepts between LWRs of HD and LD sea breams are not significantly different (Fig. 2).
- Monthly changes in the mean values of sea bream Krel show (Fig. 3) a slight increase during rearing period at both stocking densities; test for equality of slopes (ANCOVA; p=0.74) is positive.
- Comparisons of the mean estimates of the VBGF parameters (Brody growth coefficient and asymptotic length, L_∞) were either not significantly different (ANCOVA; p=0.14)(Fig. 4).
- Lipid levels in muscle of sea bream reared at different stocking densities (median values for HD and LD group are 4.1 and 4.2 % w.w. respectively) don't vary significantly (Mann-Whitney test; p=0.79)(Fig. 5).

In conclusion no significant differences were found in almost all indicators selected in order to test differences in seabream juvenile growth performance reared under organic rules at different stocking densities. Further studies at higher densities and comparison with wild juveniles are planned in order to obtain more decisive results.

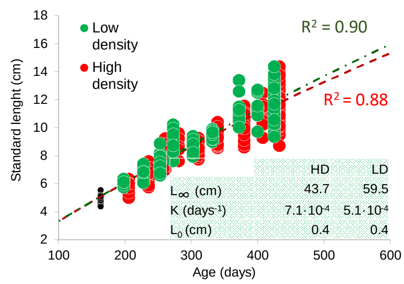

Figure 4. Von Bertalanffy growth parameters and curves

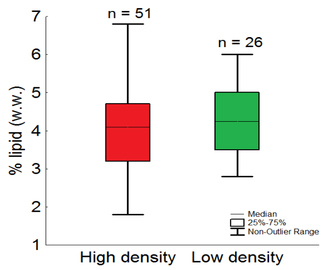

Figure 5. Percentage of lipids contained in the edible muscle part

Acknowledgments

This work was carried out within the research project "SANPEI II", financed to CREA-PCM by the Italian Ministero delle Politiche agricole e Forestali (MIPAAF), Direzione Generale per la Promozione della Qualità Agroalimentare, Ippiche e della Pesca.