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Biochemical and nutritional traits of sea bass (*Dicentrachus labrax*) from different rearing systems.

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ABSTRACT - Farmed European sea bass (*Dicentrarchus labrax)*, sampled from three different culture systems (intensive in sea-cages, intensive in land-based basins and extensive in lagoon and storage basins of salt-work), of the Northern, Central and Southern Italy, were analyzed with the aim to employ nutritional trait to describe and to distinguish the "origin" of the product. Lipid and fatty acid profile, strongly affected by the feeding history and environmental factors, responsible of the nutritional and perceived quality of fish product, are proposed as marker of origin.

Key words: Aquaculture, Sea bass, Quality, Fatty acids.

Introduction - Due to the expansion of the aquaculture market and to the strong competition from extra-EU nations, the interest of Italian producers, to increase and distinguish the value of the local aquaculture production and of Italian consumers, to have the guarantee of the origin, rapidly grown. Thus, the interest of the research is to find and to adopt useful marker to monitor and describe fish quality and to certify the origin (Moretti *et al.,* 2003; Caswell, 2006). In this study a multiple study approach was adopted to evaluate and characterize quality of farmed European sea bass, sampled from three different culture systems: intensive in sea-cage (G), intensive in land-based basins (I) and extensive (E) in lagoon and in storage basins of salt-work, from aquaculture plants localized in the North, in the Center and in the South of Italy. Fish were analyzed to study the effect of the rearing system on some quality markers, such as biometrics and morphometrics (Tulli *et al*., 2009), merchantables and chemicals (Majolini *et al*., 2009), nutritional and sensorial. To describe the "origin" of the product, we focus on lipid and fatty acid profile of the fillet. These parameters are strongly affected by the feeding history and environmental factors (Cordier *et al.,* 2002) and are responsible of the nutritional and perceived quality of fish product (Grigorakis, 2007).

Material and methods - Specimens of European sea bass (n=337), having a body weight ranging from 270 to 600 g (small S) and from 600 to 1000 g (large L), were sampled, from November 2007 to February 2008, from eleven aquaculture plants (three extensive in lagoons and storage basins of salt-work, five intensive in land-based basins and sea cages) in the North (Friuli, Veneto), Centre (Tuscany) and South (Apulia and Sicily) of Italy. Fish were killed by immersion in ice slurry and dissected within 24 hours after catch. The fillets were separated and analysed for different physical and chemical characteristics (Majolini *et al.,* 2009*;* Tulli *et al*., 2009). For each fish, one fillet was homogenized and utilized for the evaluation of percentage of total lipids (Folch *et al*., 1957), fatty acid profile by derivatization (Lepage

Figure 1.   Correlation circle of eight fatty acid classes (a) according to principal compo-
nents 1 and 2 obtained from the PCA which used 18 cases (b). Cases repre-
sent mean of 337 different determination of fatty acids composition of sea
bass (E: extensive lagoons; I: intensive in land-based basins; G: intensive in
sea cages; S small, L large).
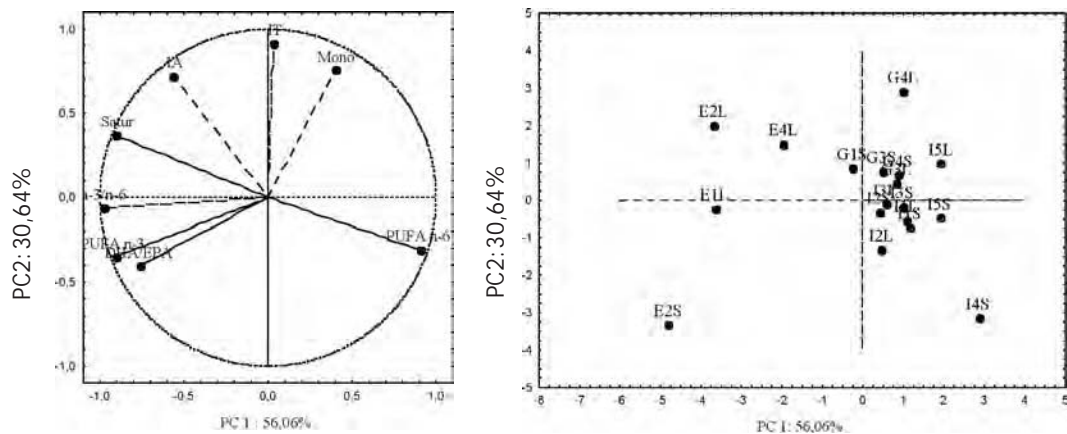
and Roy, 1995) and separation by FID gas-chromatography. **Data were processed for one-way analysis of**
variance (ANOVA) and **Principal Component Analysis (PCA) by STATISTICA version 6.0.**

Results and discussions - Among the muscle component, lipids affect the nutritional value of
the edible part, the merchantable traits and the sensorial properties (Sargent *et al.*, 2002, Grigorakis,
2007) and represent the principal component determining the differences between wild and reared
fish (Ackman, 1995; Cordier *et al.,* 2002; Sargent *et al.*, 2002). The quality of cultured sea bass, was
recently reviewed by Grigorakis (2007), who reported high variability, in relation to multiple factors.

Il our work, as expected, a significant influence of the rearing system on total lipid content was ob-
served. **Specimens reared in intensive (I and G), in fact, showed the higher total lipid content in muscle**
$(7.76\pm2.67$ and $8.69\pm1.6\%$), respect to those reared in extensive $(3.9\pm0.82\%)$ $(P<0.05)$.

To verify the effect of the rearing system on fatty acid profile (Sargent *et al.*, 2002), we applied multi-
variate analyses to fatty acids of analyzed sea bass (Figure 1). The percentage composition of fatty acid
classes and lipid quality indexes was entered into the model (figure 1a). PCA analysis examined eighteen
cases, representing the number of sampling carried on specimens of S and L size of each rearing system,
for a total number of 337 fish. This analysis explains 87% of the variability in the original data (Figure
1a, 1b). The first principal component (PC1) explains 56.06% of the combined variance, the second com-
ponent (PC2) 30.64% (figure 1a, 1b). A correlation circle was plotted using PC1 and PC2 axes in order
to separate the individual data according to origin and size of specimens. This representation shows
that the considered variables are well explained (87%) by these combined variables, resulting useful
for comparison of fatty acid profile among specimens of different origin (Barrado *et al.* 2003, Grigorakis,
2007). By this representation, reared sea bass are well differentiated in relation to the rearing system
and also in relation to size (Figure 1a, 1b). **Extensively-reared sea bass (E) are completely separated from**
intensively-reared fish **(I and G) and within the extensive system, farms were differentiated along the**
second PC (E1 and E4 separated from E2) **(Figure 1a, 1b). The same results were obtained, from analyses**
carried on the same samples, by biometry and morphometry (Tulli *et al.,* 2009) and by NIRS (Majolini *et
al.,* 2009). Our study, moreover, shows that also within the intensive system, sea bass reared in sea cages
(G) can be differentiated from sea bass reared in land-based basins (I), being the differences in fatty acid

composition reflected by the first PC (Figure 1a, 1b) suggesting fatty acid profile as a tool to certify the quality and origin of farmed sea bass. Previous study, carried on sea bass collected from the same extensive **storage basins of salt-work located in Trapani (Southern Italy), showed that this niche product, very** appreciated by the consumers, presented a lower lipid content and a different fatty acid profile respect to fish reared in intensive (Santulli and Messina, 2008). Analyses in progress will clarify the chemical basis of the different flavour, responsible of the different perceived quality.

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