# Does the rearing system influence quality and safety of cultured fish?

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## Riassunto

Gli effetti di tre differenti sistemi di allevamento (semintensivo in una laguna costiera, intensivo in vasche in cemento e in gabbie a mare), su alcuni indicatori di qualità e sicurezza dei prodotti ittici, sono stati studiati su orate *(Sparus aurata)* di taglia commerciale. La prova è stata condotta fra maggio e novembre del 2001, in 3 impianti situati nella Regione Puglia (Italia). Tutti gli animali sono stati alimentati con lo stesso mangime commerciale estruso (Biomar, Treviso), ad una razione giornaliera di 1-2% peso corporeo, per 7 giorni alla settimana. Alla fine del periodo sono stati analizzati sul muscolo bianco i seguenti parametri: proteine, lipidi totali, colesterolo, acidi grassi, *Shewanella putrefaciens* e *Pseudomonas spp.*. I risultati sono stati comparati con quelli ottenuti su orate selvatiche (controllo), pescate in una vicina area costiera.
I risultati ottenuti suggeriscono che orate allevate con differenti sistemi, presentano uno stato nutrizionale fisiologico paragonabile a quello di esemplari selvatici.

## Summary

The effects of three different rearing conditions (semi-intensive in a coastal lagoon, intensive in land-based concrete ponds and sea-cages) on several indicators of flesh quality and safety were studied during the rearing of gilthead sea bream *(Sparus aurata)*. The trial was conducted between May and November 2001, at 3 rearing plants in Puglia (Italy). All animals fed the same commercial extruded feed (Biomar, Treviso, Italy) at a feeding rate of 1-2% body weight for 7 days a week. The following parameters were analised in white muscle at the end of the trial: protein, total lipid, cholesterol, fatty acid, *Shewanella putrefaciens* and *Pseudomonas spp.*. The results were compared with those obtained for wild sea breams captured in a coastal area (control). Results obtained suggest that the reared fishes showed (at the and of the trial) a nutritional physiological state comparable to that of wild sea breams.

## INTRODUCTION

Gilthead sea bream is one of the most important finfish species cultured in the Mediterranean region and its production is still in rapid expansion (Basurco and Abellán 1999). Albeit the production of this species has reached a high level of quality and efficiency, the knowledge of the possible influence of the rearing conditions on the quality of the edible product is completely lacking, as it is in general for all reared species. In the present study the effects of three different rearing systems, on several indicators of flesh quality and safety were investigated.

## MATERIAL AND METHODS

The trial was conducted between May and November 2001, in Apulia Region (Italy) and three different sampling were carried out. Fish rearing density was 4, 15 and 25 kg/m$^3$ for semi-intensive, sea cages and land-based intensive system, respectively.
Protein concentration was measured by the Bio-Rad protein kit. Total lipid were extracted according to Bligh and Dyer (1959) and measured by colorimetry as well as cholesterol. Fatty acid composition was screened by gas-chromatography and microbiological analysis was carried out by measuring bacterial growth after incubation in specific culture media. All results are reported as average of 5 determinations with standard error.

## RESULTS

Figure 1

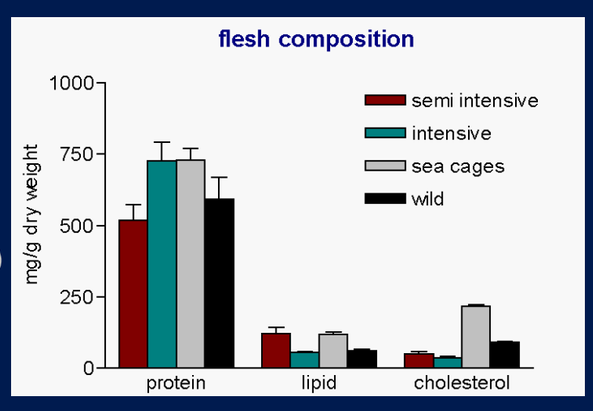
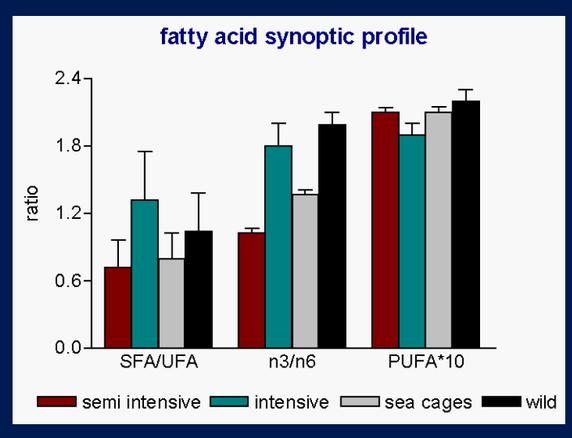



Figure 2




White muscle protein content was higher in fish from land-based intensive rearing and sea cages, with semi-intensively reared fish showing the lowest value. Lipid content was higher in fish from the semi-intensive plant and sea cages. Fish reared in sea cages showed the highest cholesterol content, followed by wild specimens and, with lower values, by fish reared in semi-intensive and land-based intensive conditions (Fig. 1). Fatty acid profile of the white muscle showed that semi-intensively and sea cages reared fish were those with the highest levels of unsaturated and monounsaturated fatty acid. Saturated/unsaturated fatty acid ratios resulted quite balanced for wild specimens, the highest for land-based intensively reared fish and the lowest in fish reared in semi-intensive conditions (Fig. 2). As expected, wild specimens presented the highest n3/n6 ratio, with the lowest one showed by the semi-intensively reared fish. Wild fish exhibited also the highest percent content of polyunsaturated fatty acid, but the lowest of monounsaturated fatty acid. Regarding the durability of the flesh, an index of its safety for consumers, fishes from the semi-intensive rearing system exhibited the highest microbiological stability, with the initial concentration of the specific markers *Shewanella putrefaciens* (Fig. 3) and *Pseudomonas spp.* (Fig. 4) remaining constant up to 4 days, after harvest, when stored at 4 °C.

Figure 3

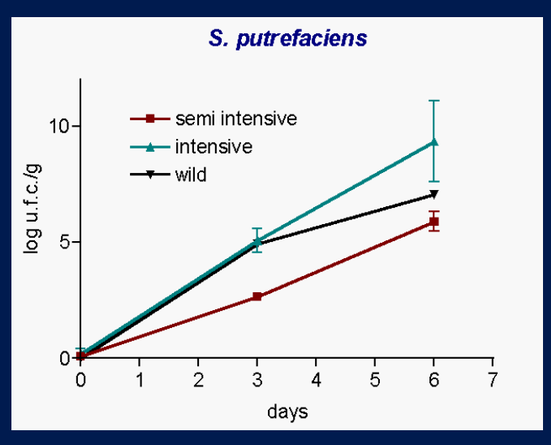
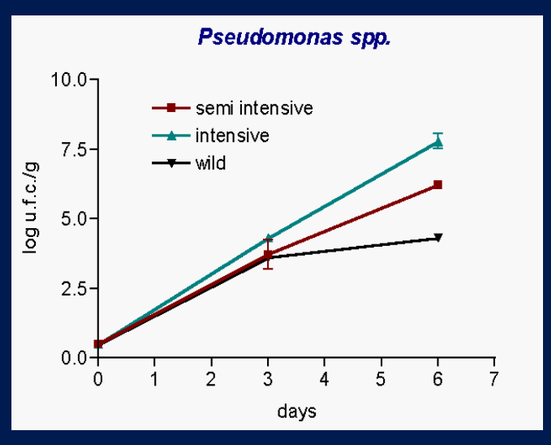



Figure 4




## CONCLUSIONS

The results obtained in this work show that, at least for some of the parameters examined, fish reared with different culture systems can compete with wild specimens in terms of flesh quality and safety for food consumption.

## REFERENCES

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Project carried out in collaboration with **Panittica Pugliese** (Torre Canne-Brindisi) (Dr. Massimo Caggiano) and **Nereidi** (Mola di Bari) (Dr. Gaspare Barbera).

## ACKNOWLEDGEMENTS

A special thanks goes to the personnel of Hydra Coop – ICR Mare (Lecce) and in particular to Dr. Roberta De Mitri, Dr. Maria Anna Bianco and Mr. Luigi Riso for their excellent technical support.

Project co-financed by EC and MIPAF (Italian Ministry for Agriculture Politics) under the EU PESCA Initiative (project 66/IP).

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Design and realisation: ACQUA.TE.A.M.
Acquacoltura e Tecnologie Applicate al Mare - Lecce

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