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VARIATIONS OF BIOFOULING COMMUNITIES IN AN OFF-SHORE FISH CAGE FARM FROM NORTH-WESTERN SARDINIA

VARIAZIONI DEL BIOFOULING IN UN ALLEVAMENTO ITTICO IN GABBIE OFF-SHORE DELLA SARDEGNA NORD-OCCIDENTALE

Abstract *– Biofouling variations were studied in a fish farming facility near Alghero (Italy) between November 2007 and November 2008. Net panels suitable for the settlement of encrusting organisms were immersed in cages in which large and small gilthead seabream specimens were reared. Significant differences in biofouling biomass and coverage were observed between cages containing fish and controls. The results obtained revealed that gilthead seabream can exert a crucial role in controlling biofouling growth, independently from its size.*

Key-words: *fouling organisms, marine aquaculture,* Sparus aurata*, Mediterranean Sea.*

Introduction – Biofouling is a major problem for submerged surfaces (Wahl, 1989), in particularly in aquaculture activities (Porter, 1981). These encrusting organisms can also be considered as an indicator of fish farming impact (Sarà *et al.*, 2007), even if they can be predated (and consequently reduced in biomass and covering percentage) by some grazer species (Lodeiros & García, 2004). The present study, therefore, aimed to describe variations of biofouling on cage nets of an off-shore fish farm by comparing its growth in cages where gilthead seabream (*Sparus aurata*) specimens were reared. We postulated that the grazing activities of different-sized fish could affect the structure of biofouling.

Materials and methods – The study was carried out at a fish farming facility in Alghero Bay (North-western Sardinia, Italy), where custom-made panels (suitable for biofouling settlement) were installed on the nets of floating cages in which gilthead seabreams of different size were reared. The panels were immersed inside 4 fish rearing cages [2 of which containing large (*i.e.* >150 g, LF) and 2 containing small (*i.e.* <50 g, SF) fish], at a depth of 5 m. Two series of control panels (Cs) were also placed at the same depth level in empty cages. Overall, with the aim of sampling 3 panels per group every 3 months for a year (*i.e.* approximately every season), 72 panels (*i.e.* 3 panels × 3 experimental groups × 2 cages × 4 times) were positioned inside the cages using cable ties. Before being positioned *in situ*, each panel was weighed and photographed in its entirety. All the panels were positioned in November 2007, then they were removed from cages in February, May, August and November 2008, respectively. In the laboratory, panels were firstly weighed (to assess biomass increment), subsequently photographed again. Portions of 25′25 cm of digital images were processed with ImageJ software (Abramoff *et al.*, 2004) to estimate the percentage of mesh occluded by biofouling. Analysis of Variance (ANOVA) was used to test for differences in wet weight increment and coverage percentage of biofouling inside the cages containing LF, SF and Cs, and Student-Newman-Keuls (SNK) test was performed for *post-hoc* comparisons (Zar, 2009).

Results – ANOVA evidenced significant differences in wet weight increment of biofouling for ‘Fish size’ and ‘Cage’, as well as for the interaction of both these factors with ‘Time’ (Tab. 1). Furthermore, SNK test detected significant differences ($p<0.05$) between panels in gilthead seabream cages and controls. ANOVA showed significant differences for biofouling coverage percentage also, and, in particular, for ‘Fish size’, ‘Time’ and the interaction between these factors. Again, SNK test detected significant differences ($p<0.05$) among control panels and those positioned inside *Sparus aurata* rearing cages.

Tab. 1 - ANOVA results for wet weight increment and coverage percentage of biofouling.
Risultati dell'ANOVA per percentuali di incremento di peso umido e ricoprimento del biofouling.

		Wet weight increment (%)			Coverage (%)		
Source of variation	df	MS	F	*p*	MS	F	*p*
Fish size, FS	2	47732.34	11.50	**0.039**	1602.58	14.34	**0.029**
Cage, C(FS)	3	4149.76	9.52	**0.000**	111.72	1.91	0.141
Time, T	3	5098.82	3.33	0.070	570.54	8.01	**0.007**
FS ´ T	6	9752.44	6.37	**0.007**	582.73	8.18	**0.003**
T ´ C(FS)	9	1530.47	3.51	**0.002**	71.22	1.22	0.306
Residual	48	435.88			58.46		
SNK test			Cs>SF=LF			Cs>LF=SF	

Conclusions – This study evidenced significant variations of both biomass and coverage percentage of biofouling communities in an off-shore Mediterranean fish farming facility. In particular, the results obtained revealed that gilthead seabream can play a fundamental role in controlling the development of biofouling communities, independently from its size. Therefore, the presence of several specimens of *Sparus aurata* inside the rearing cages of a non-grazer fish species (*e.g. Dicentrachus labrax*) could be useful to mitigate the proliferation of biofouling organisms on the cage nets.

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