EFFECTS OF ANTIFOULING PAINTS ON FARMED FISH OF THE EASTERN MEDITERRANEAN

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Abstract
In this preliminary study, was examined the accumulation of copper and zinc as basic ingredients of antifouling paints in cultured sea bass and sea bream. Samplings were carried out in four Eastern Mediterranean fish farms. Two of them used nets treated with antifouling paints whereas the other two utilized untreated nets. The results showed that almost in all cases the concentrations of heavy metals were higher in fish collected from cages treated with antifouling paints. Furthermore, statistical analysis revealed significant differences in copper and zinc concentrations among the samples from the farms with different use of treatment. These preliminary results indicate that the use of antifouling paints may exert toxic effects in cultured fish.

Keywords: Aquaculture, Fouling, Metals, Fishes, North-Eastern Mediterranean

Introduction
Marine fouling is a growing global phenomenon and it is widely accepted that in the aquaculture industry is an expensive problem. The main protective method against fouling involves the use of toxic antifouling paints. Nevertheless there is little information regarding pollutant levels in cultured fish [1]. The impact of antifouling on the concentration of heavy metals in cultured fish in the Eastern Mediterranean has been addressed only in one experimental study [2]. Therefore, the specific aim of this preliminary study in four aquaculture sites of the Eastern Mediterranean was to detect whether the concentrations of copper and zinc would be related to the use of antifouling treated nets.

Materials and methods
Cultured sea bass Dicentrarchus labrax and sea bream Sparus aurata were supplied from four fish farms which are located in the Aegean and Ionion Sea (Eastern Mediterranean). Two of them used nets treated with antifouling paints whereas the other two utilized untreated nets. These are henceforth referred to as AF and NAF farms, respectively. A total number of 40 individuals were analyzed (n=10, TW=399.46±109.81 g sea bass & n=10, TW=327.70±88.65 g sea bream at AF farms; n=10, TW=420.80±73.43 g sea bass & n=10, TW=366.98±42.54 g sea bream at NAF farms). Metals were analyzed in muscle, liver and gills separately for each tissue and fish (n=120). Samples (about 0.5 g) were dried at 80°C for 48 h, weighted and wet digested with concentrated HNO3. Quantitative determinations of copper (Cu) were carried out by graphite furnace atomic absorption spectrometer and zinc (Zn) were carried out by flame atomic absorption spectrometer, using standard addition methods. The one-way analysis of variance (ANOVA) was used to determine statistical significant differences between fish exposed to antifouling treated and un-treated nets.

Results and discussion
Heavy metals concentrations in tissues of the two studied species are summarized in Figure 1. These results showed that almost in all cases the concentrations of heavy metals were lower in samples collected from untreated nets. Maximum concentration of copper and zinc was detected in the liver (28.50 and 435.25 mg kg⁻¹ dry wt, respectively) of sea bass at the AF farms. Mean concentration of zinc in liver of sea bass and sea bream was 19 and 14 times higher in AF farms compared to NAF farms. Results generally showed that almost always highest metal concentrations appeared in liver for both studied species, which is in agreement with other studies [2, 3]. In another similar study of the North Europe on farmed salmon, [3] reported lower concentrations of copper in muscle and higher in liver compared to our data. Furthermore, one way ANOVA showed significant differences in heavy metals concentration among the samples of the AF and NAF farms for both studied species (p<0.001). All the above mentioned indicate the negative effect of antifouling coatings on cultured fish. In any case, concentration of copper and zinc in muscle of both studied species did not exceed the maximum limits for food (30 and 100 mg kg⁻¹ dry wt, respectively) [4].

Fig. 1. Mean±SD concentrations of copper and zinc in muscle, liver and gills of cultured sea bass and sea bream (mg kg⁻¹, dry wt)

References
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