# COPPER AND ZINC CONTAMINATIONS IN THE COASTAL SEDIMENTS AND *POSIDONIA OCEANICA*

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**Abstract**
We investigated fish farm impacts on *Posidonia oceanica* by comparing meadows in polluted and unpolluted sites. The density of *Posidonia oceanica,* total organic matter in sediment, copper and zinc concentrations in sediments and plant tissues were examined. The results confirm that the *Posidonia oceanica* meadows and sediment characteristics were strongly affected by the activity.
*Keywords : Aegean Sea, Aquaculture, Metals, Posidonia, Sediments.*

Introduction
The environmental impacts of fish farming activities in coastal waters were documented widely. However, studies of marine aquaculture on seagrass meadows are scarce in Mediterranean [1-3]. The impacts of organic waste derived from the various types of human activities, the development of aquaculture would appear a main cause for a strong regression of *Posidonia oceanica* which is key-stone macrophytes of coastal ecosystems in the Mediterranean Sea. Environmental changes were investigated by using various parameters such as density of meadows, total organic matter (TOM) of sediments, nutrient concentrations of water column and heavy metal concentrations (copper and zinc) in sediments, leaves and rhizomes.

Material and Method
The study area in the Engeceli Bay (Aegean Sea) is characterized by the presence of sandy-muddy sediments. The samples of sediments (0-5 cm) and *P. oceanica* from different depth range (0-5m; 5-10m; 10-15m) were collected by scuba diving in September 2004. At two selected sites include three replicates for each depth range. The impacted site (stations I1, I2 and I3) by fish farming activity is 300 m far from the cages and the other selected site (stations C1, C2 and C3) as a control is near the shore.
Shoot density at each site and each depth range was measured by counting the shoots present in five replicate quadrates of 400 cm$^2$. The amount of organic matter (TOM) was determined spectrophotometrically in sediment samples following the sulfochromic oxidation method [4]. Temperature, salinity and pH values were measured in situ. Nutrient analysis was carried out using autoanalyzer and the colorimetric methods adopted were similar to those described by Strickland and Parsons [5]. Heavy metal concentrations in sediment and leaves, rhizomes of *P. oceanica* were determined by flame atomic absorption spectrometry.
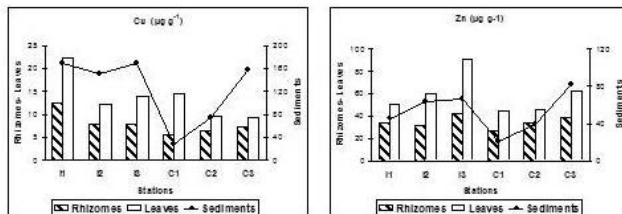


Fig. 1. Mean concentration of Cu and Zn in rhizomes and leaves of *P. Oceanica* and sediments.

Result and Discussion
Density of *P. oceanica* meadow (number of shoots per m$^2$) is higher at control stations than impacted site. The highest value was recorded at C1 (545±89). However, at two sites, shoot density decreased with increasing depth. This may be explained with changes in light intensity [6]. The organic matter contents in the sediment at impacted site range from 7.6 to 10.7%. The highest values measured at station I1 was close to the values recorded under the cages. Only the ammonium values show differences between sites. Samples collected from control sites represented with low ammonium values (0.6-0.9 $\mu$M). However total phosphate and nitrate concentration did not show remarkable changes at two selected sites. Correlation coefficients were calculated among TOM, Zn and Cu in sediments, rhizomes and leaves. The level of TOM was significantly correlated with Cu and Zn in sediment ($p<0.05$, r=0.91 and r=0.55; in respectively). There were significant relationship between Cu and Zn in sediment ($p<0.05$, r=0.81). TOM in sediment was correlated with Cu in

rhizomes but not correlated in leaves. However, the Cu and Zn concentration in rhizomes was correlated with Cu and Zn levels in leaves ($p<0.05$, r=0.70). Rhizomes and sediments contain the highest amounts of Cu (8.5-14.7$\mu$g g$^{-1}$; 152-170 $\mu$g g$^{-1}$) at station I1. This metal was recorded at lower levels both sediments and rhizomes in French coast impacted by aquaculture [2]. In fact, these results are similar to the data obtained from highly contaminated regions in Gulf of Naples [7]. Zinc shows considerable concentration peak in leaves (79-102 $\mu$g g$^{-1}$). Zn levels in rhizomes and sediments ranged between 24.4 and 82.7 $\mu$g g$^{-1}$ dry wt (Fig. 1).

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