INTERACTIONS BETWEEN FISH CAGE FARMING AND THE MARINE ENVIRONMENT IN GERA BAY (AEGEAN SEA, EASTERN MEDITERRANEAN)

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Abstract
Interactions between aquaculture and the marine environment were investigated in an enclosed coastal area in the NE Aegean (Lesvos Island). Moderate disturbance of the marine environment was detected, restricted however to a small area in the vicinity of the fish cages.

Key Words: aquaculture, marine environment, coastal area

Introduction

During the last 20 years aquaculture activity has rapidly expanded in coastal marine areas, often resulting in increasing concern over its potential effects in the marine environment [1,2]. The high enrichment of nutrient load in the water column deriving from fish farms could potentially be related to eutrophication in the coastal zone [1,3] and consequently to increased organic load in the sediment that might have a strong impact on the structure of the macrobenthic communities [2]. The present study attempts to determine the interactions between aquaculture and the marine environment, on a spatio-temporal scale, in an enclosed coastal area in the Eastern Mediterranean, where comparable studies are generally lacking [2].

Materials and Methods

Samples were collected from four stations (Pal1 - 10m; Pal2 - 50m; Pal3 -100m; Palbl - 400m = Control site) in Gera Bay an enclosed coastal area in the NE Aegean (Fig.1). Water column and sediment samples were collected by means of a Van Dorn sampler and a Van Veen grab correspondingly, during July 2002, November 2002 and April 2003. Samples for macrofaunal analysis (3 replicates, total surface area of 0.30m^2) were sieved through a 0.5mm mesh and preserved in 5% neutralized formalin. In the laboratory, the macrofauna were sorted and identified to species level, counted and weighed. Organic content, Chl-a and nutrient concentrations were obtained according to standard procedures [4]. The PRIMER package developed at Plymouth Marine Laboratory was used for data analysis.

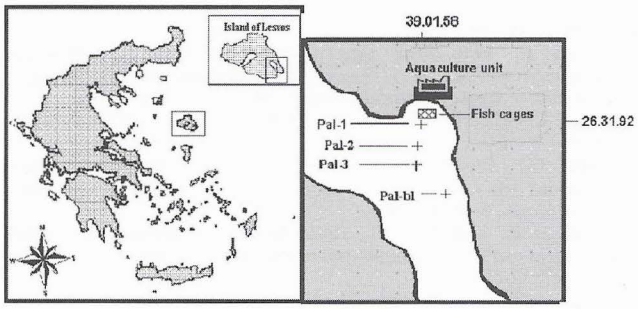

Fig. 1. Map of Gera Bay with indication of study area and sampling stations.

Results and Discussion

Concentrations of NH_4 -N fluctuated between 0.2 (control site) to 5.83 μg-at/l (100m), whereas NO_3-N values reached a peak of 6 μg-at/l near the cages. The NO_2-N, PO_4-P and SiO_2-Si seasonal concentrations (means: 0.4, 0.14, and 3.86 μg-at/l correspondingly) appeared to be similar to those recorded in Gera Bay [5]. Increased Chl-a concentrations were recorded in the proximity of cages (e.g. 1.12mg/l - 10m), but there was a gradual decrease with increasing distance from the cages (0.2μg/l – control site). The Redfield's ratio (N/P) revealed that the study area is a P-limited ecosystem in contrast with the N-limited character of Gera Bay as a whole [5]. The study area has a mesotrophic character even if eutrophication trends were detected close to the cages (10m). Organic material concentrations in the sediment were increased by a factor of 2 to 3 up to a distance of 100m in comparison with the control site (1.11-1.42% *vs* 0.8% correspondingly). Analysis of the molluscan fauna revealed a total of 38 species (17 Gastropods, 18 Bivalves and 2 Scaphopods). Molluscan diversity indices (s, d and H') values were low close to the fish-farm unit and increased along with distance from the cages. Multivariate analyses on the molluscan community revealed a clear difference between the area in the proximity of the cages and that of the rest study area (Fig. 2a). Disturbance techniques applied (ABC curves) indicated also a moderate disturbance effect on molluscan community up to a distance of 50m from the cages (Fig. 2b). As a preliminary result there appears to be a degree of impact of the aquaculture activity in the marine environment in the study area, which, however, is not acute and is detected only in the vicinity of the cages, similar to what has been reported in comparable studies in the Mediterranean [1,2].

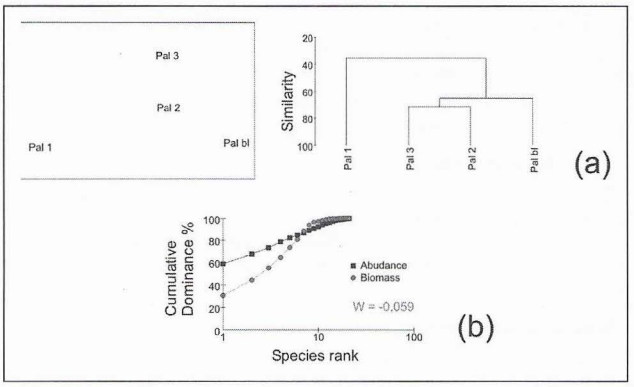

Fig. 2. (a) Similarity dendograms and MDS ordination plots of stations in the study area of Gera Bay based on molluscs species. (b) ABC curve along with W-statistic value for station of 50m in the study area.

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