MESOSCALE EFFECTS OF FISH FARMING ZONES ON MACROBENTHIC COMMUNITIES IN THE AEGEAN SEA

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Abstract

The effect of fish farming zones on the marine benthic communities over mesoscales (1-10 km) was investigated in three coastal areas of the Aegean Sea. The results showed that there were no significant changes between sites close to and far from the fish farming zones in terms of abundance, biomass and diversity.

Key words: aquaculture, fish farming zones, benthos

Introduction

The benthic effects of fish farming in the vicinity of fish cages have been documented from several parts of the world including the Mediterranean [1,2]. However, the expansion of fish farming has resulted in the development of large zones with considerable production and therefore with significant release of nutrients. Although the dispersive character of the sites selected for fish farming induces rapid water renewal it could be expected that the amount of nutrients and fine particulate material released could directly or indirectly disturb marine biota over larger spatial scales. Even more so in the case of oligotrophic marine systems such as the Mediterranean where the signal of nutrient enrichment should be more readily detectable over larger spatial scales. The present study was designed to test the hypothesis that macrofaunal communities are influenced by fish farming zones at spatial scales of 1-10 km.

Materials and methods

Three areas in the Aegean Sea (Evoia, Chios and Lesvos islands) were sampled during September 2002, during the period of maximal feed supply. In each region, one sub-area near the zone of fish farming activity (thereafter referred to as "fish-farm site") as well as one sub-area far away from these zones (thereafter referred to as "reference site") were investigated. Reference sites had comparable topography, depth and an average distance of 20 nautical miles (nm) from the respective fish-farm sites. At each site 10 random replicates were taken by means of a 0.1 m^2 Smith-McIntyre grab. Specimens were sieved over a 0.5 mm sieve, fixed with formalin 10% and identified into species level. Sediment redox potential (Eh), total organic carbon and nitrogen (TOC, TON), chlorophyll a and phaeopigments were determined for each replicate. Diversity was determined by means of PRIMER software and comparisons between sites, sediment types and proximity to fish farming zones were performed by means of 3-way ANOVA.

Results and discussion

In the 60 samples analyzed, a total of 9077 individuals were found belonging to 334 species. The results of the 3-way ANOVA (Table 1) for abundance and biomass, showed no significant changes in biomass in respect of any of the variables examined, whereas abundance showed significant changes in response to sediment type and area but no significant differences in response to proximity to fish farming zones. All the measures of diversity employed (Table 2) namely Shannon index (H'), evenness (J) and number of species per sample (S) also showed significant changes among areas and types of sediments but again with no significant changes in response to proximity to fish farming zones. Our results indicate that fish farming zones examined under the present levels of production and at the present scheme of site selection procedures do not impose significant changes on macrofaunal community attributes. Although fish farming releases considerable amounts of nutrients in the water column [3] it seems that these do not affect the productivity in a way that could negatively affect the benthic environment beyond the zone at the immediate vicinity of the farms.

Table 1. ANOVA table for total macrofaunal biomass and abundance per area (E:Evia, L: Lesvos, C:Chios), aquaculture presence (Aqua) and substratum type (sed). F: value of F-test, p: the probability value (significant values in bold). Res: results (when significant differences only), N: Near, F: Far, Co: coarse, Fi: Fine sediments.

	Biomass			Abundance		
	F	p	Res	F	p	Res
Sept						
Area	0.02	0.9783		9.90	0.0002	L<E
Aqua	0.15	0.7030		1.74	0.1927	
Sed	0.20	0.6540		10.49	0.0021	F<Co

Table 2. ANOVA table for diversity indices (J, H, S) from abundance data per area (E:Evia, L: Lesvos, C:Chios), aquaculture presence (Aqua) and substratum type (sed). F: value of F-test, p: the probability value (significant values in bold). Res: results (when significant differences only), N: Near, F: Far, Co: coarse, Fi: Fine sediments.

	J			H			S		
	F	p	Res	F	p	Res	F	p	Res
Sept									
Area	16.73	0.0000	L>E,C	6.36	0.0033	L<C	9.24	0.0004	L<E
Aqua	1.41	0.2405		0.05	0.8311		0.13	0.7224	
Sed	3.35	0.0728		40.52	0.0000	F<Co	40.37	0.0000	F<Co

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