EFFECTS OF A BLUEFIN TUNA FARM ON WATER QUALITY IN THE EASTERN AEGEAN SEA, TURKEY

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Abstract
Fattening of Bluefin tuna at net cages has been expanding in the Mediterranean but there are few studies dealing with environmental impacts of this new sector. To detect possible negative effects, four samplings were carried out between July 2011 and May 2012. Some physico-chemical variables and chlorophyll a values were investigated. Although some increases in nutrients were observed at farm station, these were not significant due to high water depth, good farm management and periodic farming in the area.

Keywords: Aquaculture, Aegean Sea, Nutrients, Chlorophyll-A

Introduction
The Tuna farming is based on capture from the wild and fattening at cages for 4 to 8 months. Tuna fattening is an intensive aquaculture and bait fish used for food demand. Hence, high organic loads may be observed around the cages [1]. Unconsumed bait fish and feces are the main concern. The aim of the study is assessment of the effects of tuna fattening on the water quality in the SE Aegean Sea.

Materials and methods
The study was accomplished in the Gerence Bay, Eastern Aegean Sea. Four stations were chosen for sampling. Farm station (FS) was in the center of the cage system, while control stations were located 200 (C200) and 1000 m (C1000) Northwest, 300 m (C-300) Northeast of the cages (Fig.1). Depths at the sampling stations are between 48 and 58 m. Samplings were done in July 2011, October 2011, March 2012 and May 2012. Surface and bottom water samples were collected by Nansen bottle.

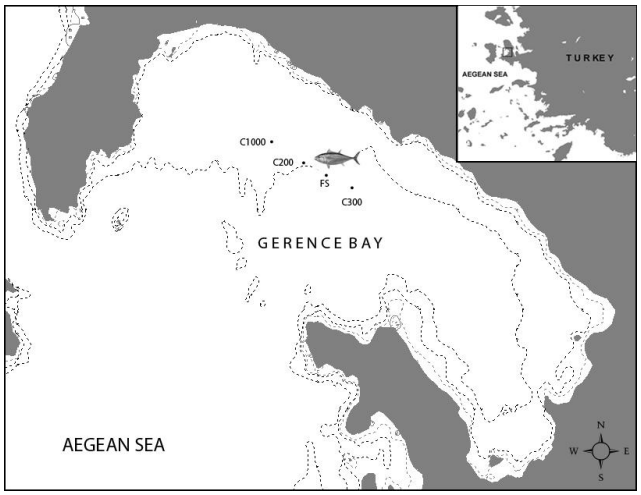

Fig. 1. Map showing the studied area and stations.

Temperature, salinity (SCT meter) and dissolved oxygen (DO) measurements (Oxygen meter) were carried out on site, pH was measured by pH meter, chlorophyll a and nutrients (nitrate–nitrogen, ammonium–nitrogen, and phosphate–phosphorus) were determined spectrophotometrically at the laboratory [2].

Results and discussion
Range of some physico-chemical parameters of the four stations are presented in table 1. Temperature, pH and salinity values varied in relation to seasonal changes.

Tab. 1. Range of physico-chemical variables at the sampling stations.

Parameters	C -300	FS	C 200	C 1000
Temperature (oC)	15.0-22.2	15.1-22.7	15.1-22.6	14.7-22.7
pH	7.9-8.2	7.9-8.2	7.8-8.30	7.8-8.30
DO (mg/L)	6.40-8.23	6.56-8.01	6.50-8.17	6.48-8.30
Salinity (‰)	35.1-37.8	35.0-36.9	35.2-37.1	35.5-37.2
Nitrate+nitrite (µM)	0.01-0.61	0.02-0.51	0.01-1.04	0.04-0.44
Ammonium (µM)	0.12-0.97	0.51-1.39	0.21-1.69	0.21-2.78
Phosphate (µM)	0.61-4.59	0.31-6.12	0.31-3.06	0.31-3.67
Chl-a (µM)	0.63-4.27	0.63-4.64	2.85-4.60	3.80-4.27

DO values varied with weathering and no significant differences were detected between the farm and control stations. DO never dropped below the healthy fish farm value of 5.6 mg/L [3]. Nitrite+nitrate values showed no detectable differences between the stations. However, highest mean values for ammonium and phosphate were observed at FS. Highest phosphate concentrations were also measured at farm station in July 2011. Nevertheless, these differences were not found statistically significant. Similar results were also reported at the same farm [4] and at the other tuna farm [5]. Mean chlorophyll a concentrations were calculated as 1.76±0.72 µg/L at farm station and this value is way lower than the standard values of 10 µg/L recommended for the Northern European waters [6]. In addition, no significant differences were found between the stations for chl a.

Although some increases in nutrients were observed at farm station compared to the controls, these increases were not significant due to high water depth, sound farm management and periodic farming activity in the area.

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