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DETERMINATION OF THE DISTRIBUTION OF PHYTOPLANKTON RELATED TO WATER QUALITY IN SEA BASS (*Dicentrarchus labrax*) FARMING LAND PONDS (Muğla, Turkey)

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Abstract

This study was carried out for determinate the phytoplankton distribution and the water quality of cultured sea bass land ponds, in Muğla province, Turkey. Sea bass (*Dicentrarchus labrax,* L., 1758) is known the most popular species of the Mediterranean region and its production has been multiplying since the 1980s. Water samples were taken from 6 different points, including main drainage, clean water, and 4 land ponds, to identify the phytoplankton composition. Samples were collected on May 2017 from the fish farm when algal blooms were observed. A total of 31 taxa belonging to Bacillariophyta (13), Charophyta (1), Chlorophyta (7), Cryptophyta (2), Cyanobacteria (3) Euglenozoa (4) and Ochrophyta (1) divisions were identified. It is stated that excessive algal blooms may cause massive fish deaths in aquaculture ponds. According to the recorded species of phytoplankton, the ponds are fairly organically polluted. Also, *Microcystis aeuruginosa* and *Merismopedia glauca* of toxin-producing cyanobacteria were recorded often in water samples. Especially when Cyanobacteria members do excessive blooms, this may be a big threat to the fish farm living beings. In conclusion, monitoring and controlling the phytoplankton composition and water quality parameters are required periodically to improve the conditions of aquaculture.

Keywords: Phytoplankton, algal problems, Sea bass farming, land ponds, Turkey

1. INTRODUCTION

It is known that aquaculture in recent years, as well as all over the world shows a rapid increase in Turkey. Because of its dynamics related to environmental changes, aquaculture has high-risk efforts (Plumb and Hanson, 2011). It is stated that natural seafood reserves of our seas have been decreasing day after day due to various reasons (Korkut et al., 2007). According to some researchers estimates, production amount by aquaculture will pass the production by hunting in the coming years. For this reason, with the increased production, it becomes necessary to carry out studies in order to reach higher quality products in aquaculture and make the production more economical. Especially, fish farming in inland ponds are widely used both in the world and in Turkey and have become an important sector particularly in the Aegean and Mediterranean regions. The fact that the fishes grown inland ponds are attracted to buyers at a higher price, the ease of maintenance and feeding makes production in soil ponds more attractive (Özdemir and Dirican, 2006).

Nowadays, in parallel with the increase of the world population, animal food deficit is increasing day by day. Aquaculture is seen as an important source for this deficiency. Sea bass (*Dicentrarchus labrax,* L., 1758) is the most popular species of the Mediterranean aquaculture. Its production started in the 1980s and has come up by multiplying day after day (Oban et al., 2016). The first sea bass hatchery was established in 1990 with an agreement between FAO, Italy, and Turkey and its facility have been activated in 1993. Nowadays, gilthead sea bream and sea bass are accepted as the most intensively cultured marine fish species. Additionally, alternative fish species for aquaculture are turbot, meager, red sea bream, sharp snout sea bream and common dentex. The sea bass production constitutes approximately 70% of the total fish breeding production of Turkey.

Muğla which is located in the south-western part of Turkey has a long sea coast length and it is the first place in Turkey in terms of a number of fish farms and production amount (Özdemir and Dirican, 2006).

Water quality is also a major factor in rearing healthy fish and if it is not suitable, fish will not feed or grow well regardless than disease becomes more prevalent. It is not enough to maintain only the physical and chemical conditions of used water in fish farms for optimal growth of the selected cultured fish species. It is known that fish production is affected by the density and diversity of zooplankton and phytoplankton in aquatic systems. Phytoplankters have a vital role on fish production due to they are primary producers in food chain in aquatic environments (Park and Shin, 2007). Also they are one of the bioindicators of water quality due to they react very fast when changes occur in aquatic systems (Bellinger and Siegee, 2015). Environmental changes like temperature, water movement, light, soil and other biological factors lead to changes in species of phytoplankton and thereby in the food chain. Therefore, the composition and density of phytoplankton species of the pool water have to be determined. Eutrophication one of the environmental problems of waters affects negatively the fish productivity. The major environmental variables temperature, pollution, seasons, area of the ponds determine the fish production. It was stated that undesirable algal blooms lead to deterioration on quality of water in fish breeding ponds like other aquatic environments. The goal of our study is to determine which phytoplankton species cause problems in sea bass fish farms inland ponds and to take attention on this subject.

2 MATERIAL AND METHOD

Water samples were taken from 6 different points, including main drainage, clean water, and 4 land ponds from the fish farm (Muğla, Turkey) when algal blooms were observed in May 2017. Location of the fish farm was shown in Figure 1 and views of the land ponds was shown in Figure 2. Water temperature, dissolved oxygen, pH and salinity of each sampling points were measured with the WTW Multi 340i/set multiparameter in the study area. Identification of phytoplankton species were done in the laboratory by using a microscope at a magnification of 400, in reference to the literature, including several comprehensive reviews on the subject (Hustedt,1930; Desikachary, 1959; Prescott, 1961, Prescott, 1964, Patrick and Reimer, 1966; Patrick and Reimer, 1975, Huber-Pestalozzi, 1975; Hustedt, 1985; Krammer & Lange-Bertalot, 1986; John et al., 2003). Phytoplankton counting wasn't possible due to the intense particulate matter in the water samples.

Figure 1. Location of the fish farm

Figure 2. View of the aquaculture land ponds

3 RESULTS AND DISCUSSION

In a total of 31 species belonging to 7 divisions, Bacillariophyta (13), Charophyta (1), Chlorophyta (7), Cryptophyta (2), Cyanobacteria (3) Euglenozoa (4) and Ochrophyta (1) were recorded. The list of recorded phytoplankton species was given in Table 1 and the percentage distribution of phytoplankton groups was shown in Figure 3. All the recorded species were checked in algabase cite (Guiry and Guiry, 2017).

In general, water samples except for shallow ponds, have high turbidity and contain a large amount of particulate matter. Phytoplankton composition of sampling ponds is mainly composed of Bacillariophyta, Chlorophyta, and Euglenozoa members. *Cyclotella meneghiniana* of diatoms, *Scenedesmus* spp. of green algae, *Cryptomonas ovata* of cryptomonads, *Euglena gracilis* and *E. viridis* of euglenoids were detected almost in all sampling pools. Euglenozoa members were not recorded in shallow ponds while *Chroococcus limneticus* and *Merismopedia glauca* of Cyanobacteria were recorded. Also, *Plagioselmis nannoplanctonica* from

Crytophyta was found only in shallow ponds. Especially, *Microcystis aeuruginosa* and *Merismopedia glauca* of toxin-producing cyanobacteria, and species of *Euglena* genus which are accepted organic pollution indicators were found quite often in water samples of the fish farm ponds (Yilmaz et al., 2018). It is reported that, when Cyanobacteria members do excessive blooms, this may be a big threat to the fish farm living beings. Especially filamentous algae are ending asphyxia in the fish and may cause acute stress response or mass mortality. According to the recorded species of phytoplankton, the ponds found to be contaminated organically.

In this study, blue-green algae were found often but in low numbers.

The water temperature varies from 7 ºC to 8 ºC in winter, depending on the weather temperature**.** The pH changes from 7.0 to 7.5 and salinity vary between 8‰ and 11‰ of artesian well water. The salinity concentration of where the aquaculture activities will be done is a factor affecting the development of the fish species (Yıldırım and Alpbaz, 2005). Dissolved oxygen of the water is very low as 5 mg/ L and it is tried to be kept around 8 mg/ L by using mechanical methods especially in the night. When algae increase over, algae cover the surface of the water and may block the air from entering the water from the atmosphere and cause a sudden drop in the oxygen concentration of the water. Decreases in the oxygen concentration of the pool water may cause a negative effect for aquaculture. The environmental conditions of the area where the fish farms are producing or are planning to do are well known. For this purpose, water temperature, dissolved oxygen concentrations, flow rate and direction of the fish farms should be monitored in daily periods (Yıldırım and Alpbaz, 2005). Also dissolved oxygen concentrations indicate the pollution level of water (Park and Shin, 2007).

Table 1. Recorded taxa of phytoplankton of the aquaculture land ponds.

DIVISIO: BACILLARIOPHYTA	**DIVISIO: CHAROPHYTA**
Order: Bacillariales	**Order: Desmidiales**
Nitzschia acicularis (Kützing) W.Smith	*Cosmarium formosulum* Hoff
Order: Cocconeidales	
Cocconeis placentula Ehrenberg	
Order: Cymbellales	**DIVISIO: CRYPTOPHYTA**
Cymbella affinis Kützing	**Order: Cryptomonadales**
Order: Licmophorales	*Cryptomonas ovata* Ehrenberg
Ulnaria acus (Kützing) Aboal	*Plagioselmis nannoplanctonica* (Skuja) G.Novarino, I.A.N.Lucas & Morrall
Ulnaria ulna (Nitzsch) Compère	
Order: Mastogloiales	
Achnanthes lanceolata (Breb. ex Kütz.) Grunow	**DIVISIO: CYANOBACTERIA**
Order: Naviculales	**Order: Chroococcales**
Navicula cryptocephala Kützing	*Chroococcus limneticus* Lemmermann
Pleurosigma sp.	*Microcystis aeruginosa* (Kützing) Kützing
Order: Stephanodiscales	**Order: Synechococccales**
Cyclotella meneghiniana Kützing	*Merismopedia glauca* (Ehrenberg) Kützing
Stephanodiscus astrea (Kützing) Grunow	
Order: Tabellariales	
Diatoma vulgaris Bory	**DIVISIO: EUGLENOZOA**
Meridion circulare (Greville) C.Agardh	**Order: Euglenales**
Order: Thalassiophysales	*Euglena acus* (O.Müller) Ehrenberg
Amphora ovalis (Kützing) Kützing	*Euglena gracilis* G.A. Klebs
	Euglena viridis (O.Müller) Ehrenberg
DIVISIO:CHLOROPHYTA	*Trachelomonas hispida* (Perty) F. Stein
Order:Clamydomonadales	
Pandorina morum (O.F.Müller) Bory	
Order: Sphaeropleales	**DIVISIO: OCHROPHYTA**
Coelastrum microporum Nägeli	**Order: Chromulinales**
Kirchneriella sp.	*Dinobryon sertularia* Ehrenberg
Scenedesmus ecornis (Ehrenberg) Chodat	
Scenedesmus quadricauda (Turpin) Brebisson	
Scenedesmus sp.	
Sphaerocystis sp	

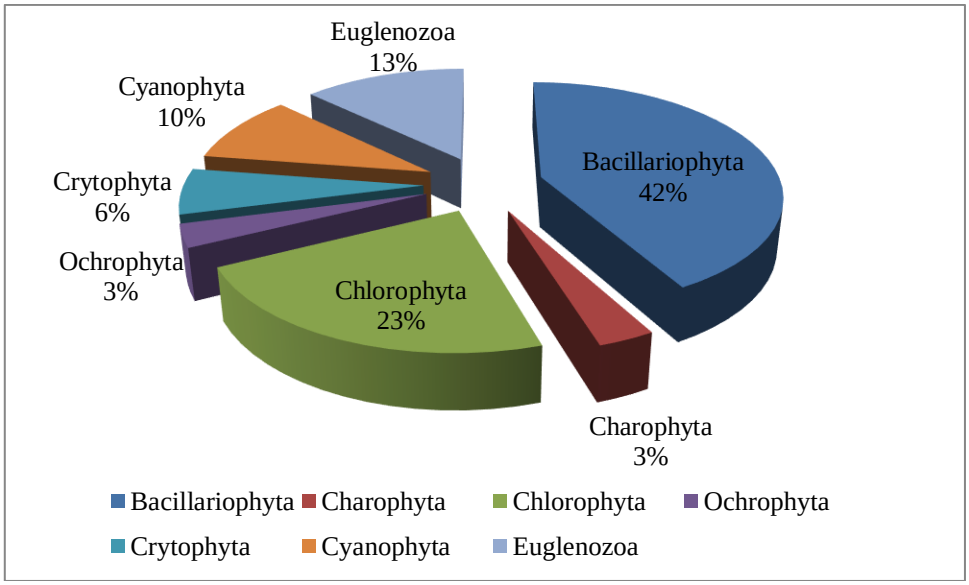

Figure 3. The percentage distribution of phytoplankton groups.

4. CONCLUSION

Determining the phytoplankton composition and density takes an important place in successful fish farming strategy. In conclusion, it is necessary to constantly monitor and controlling the phytoplankton composition as well as the physical and chemical variables of the water used in aquaculture, for obtaining maximum and high-quality yield. Also, periodically monitoring of phytoplankton will serve as a measure to prevent sudden mass mortality, which can be caused by excessive algal increases.

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