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Analysis of the Plankton in the Area around the Cape Maslen Nos, Bulgaria: Possibilities for Cultivation of Mediterranean Mussels (Mytilus galloprovincialis)

Galin Y. Nikolov[1], Alexander P. Atanasov[2], Dian M. Georgiev[3] , Evgeni G. Raichev[3]

1 - National Agency of Fishery and Aquaculture, Sofia, 1606, Bulgaria
2 - Trakia University, Faculty of Veterinary medicine, Stara Zagora, 6000, Bulgaria
3 - Trakia University, Faculty of Agriculture, Stara Zagora, 6000, Bulgaria
E-mail: mihaylov@uni-sz.bg

Abstract. The aim of the study was to establish the species taxonomic composition and the quantitative characteristics of plankton in the Cape Maslen Nos area. Representatives of the Protozoa, Rotatoria, Annelida, Mollusca and Arthropoda predominated in the composition structure of zooplankton whereas members of Bacillariophyta, Chrysophyta, Dinophyta, Cyanophyta, Euglenophyta in that of phytoplankton. The comparative analysis of phytoplankton data shows that the highest mean biomass values were 24.76 – 33.33 g/m^3 and mean biomass values of zooplankton – 51.43 g/m^3.

Key words: plankton, cultivation, Maslen Nos, *Mytilus galloprovincialis,* Bulgaria

Introduction

Plankton is a key factor in the ecological equilibrium of Black Sea ecosystems and therefore, the knowledge of its structuring communities is of utmost importance (GEORGIEVA, 1998). The environmental effects of urbanization of Black Sea coast consist in a steady trend towards alteration of chemical and biological conditions (MAVRODIEVA *et al.,* 2005). Consequently, a misbalance in the successive development of phytoplankton societies has emerged (MAVRODIEVA *et al.,* 2005). The occurring changes could influence the next trophic levels and to change the organization of the whole biotic system at the Bulgarian Black Sea coast. This new cyclicity would have an impact on hydrobiont cultivation technologies.

In a number of European countries, an industrial-scale production of local and introduced mussel, oysters, shrimps and fish species is organized (STAYKOV, 2001). During the last years, there is an increased interest towards cultivation of Mediterranean mussels in Bulgaria. Several farms have been created in Sozopol, Kavarna, Balchik. Regardless of the technological differences in the cultivation of *Mytilus galloprovincialis* in current conditions, the presence of plankton and littoral is essential (KOLAROV *et al.,* 2005). In these zones, the strong tidal currents provoke an intensive ion exchange, which provides optimal

trophic background, saturation of water with oxygen and removal of metabolites (KOLAROV *et al.*, 2005).

The purpose of the study was to investigate the natural nutrient resources and therefore, the potential for cultivation of *Mytilus galloprovincialis* in front of the Cape Maslen Nos aquatory.

Material and methods

The investigations were carried out in 2007 at the Midia Experimental Base of the Faculty of Agriculture, Trakia University, Stara Zagora located at Cape Maslen Nos. The area is within the Black Sea biogeographical region and represents the eastern part of Strandzha that sticks out in the sea (GRUEV & KUZMANOV, 1994). It is located 8 km away from Primorsko (Fig. 1). The average altitude is 16 m, the atmospheric pressure ranges between 712–763 mm. The average annual temperature is 13° C, and the annual temperature amplitude – 20°C. The average temperature in July is 23–24°C, and August is the hottest month (VELEV, 1997).

For determination of the qualitative and the quantitative composition of plankton, samples were collected in April, July and October from various depths (0.5, 1.2 and 5 m from the bottom as per MAVRODIEVA *et al.*, 2005) with a bank bathometer for phytoplankton and at a depth of 5 m with plankton net for zooplankton (KONSULOV, 1994). Samples were conserved with 4% formaldehyde. Phytoplankton was identified to a genus level and zooplankton – to the species level institute of Fishing Resources, Agricultural Academy. Zooplankton samples were processed according to quantitative method of DIMOV (1959).

Fig. 1. A general view of Cape Maslen Nos.

Results and Discussion

The composition of the phytoplankton at Cape Maslen Nos consisted of 84 taxa from the following divisions: *Bacillariophyta* (45); *Dinophyta* (8); *Chrysophyta* (5); *Cyanophyta* (23); *Euglenophyta* (3). In the year of the study, the divisions *Bacillariophyta* and *Cyanophyta* were predominating. A similar trend towards increase of the *Bacillariophyta* share has been reported in 2000-2004 in the Sozopol bay (MAVRODIEVA *et al.*, 2004).

The mean biomass of the phytoplankton ranged between 24.76 –33.33 g/m^3, with highest values in the summer sample. In the area reported similar values (39.7 g/m^3 for *Acartia clausi*) by GEORGIEVA (1998).

Phytoplankton was mainly represented by diatom algae (*Bacillariophyta*), comprising more than 50% of phytoplankton biomass, with their share increasing during the autumn (Table 1). Co-dominant diatom genera were *Skeletonema, Cyclotella, Nitschia.*

The next group by biomass was dinoflagellates (Dinophyta) with predominating species *Prorocentrum* and *Peridinium.*

Table 1. Dynamics of phytoplankton (biomass in g/m^3) in front of the Cape Maslen Nos aquatory

Division	April	July	October
Bacillariophyta	56,61	58,76	69,41
Dinophyta	41,72	42,03	30,37
Euglenophyta	0,52	0,05	-
Chrysophyta	0,20	0,06	-
Cyanophyta	-	-	0,22
Overall biomass	99,05	100,9	100,0

The *Euglenophyta* and *Chrysophyta* genera were very poorly represented and during the autumn, they were not detected in samples. The group of blue-green algae *Cyanophyta* was found out only in the autumn sample. The observed tendency for domination of *Bacillariophyta* over *Dinophyta* was most probably due to the effect of ecological factors that were not identified in the present study. The causes for the abundance of diatom algae should be searched in the ratio of biogenic elements and silica (not subject of this study) that has a key role in the dynamics of plankton societies in the Bulgarian Black Sea area (MONCHEVA & KRASHEV, 1997 cited by MAVRODIEVA, 2005).

In the region of the mussel farm, the zooplankton was included representatives of *Protozoa*, *Rotatoria*, *Annelida*, *Mollusca* and *Arthropoda*.

From Protozoa, the dinoflagellate *Noctiluca scintillans* was extensively developed. *Rotatoria* was represented with the species *Synchaeta vorax*, while *Annelida* was represented with larvae of annelid worms. From molluscs (*Mollusca*) larvae of Mediterranean mussel, other mussels and snails. The *Arthropoda* type included lower crustaceans from subclass *Branchiopoda,* order *Cladocera* and representatives of subclass *Copepoda* – *Pseudocalanus elongatus*, *Centropages kroyeri* and *Oithona minuta*. According to KOVALEV *et al.* (1998, cited by STEFANOVA *et al.,* 2005) *Centropages kroyeri* is a rare species that in the early 1990-ties was almost not present in the Black Sea basin. In the view of authors, this was due to the increased anthropogenic eutrophication.

The average zooplankton biomass in the Cape Maslen Nos area was 51.43 g/m^3. During the spring it was 35.39 g/m^3, in the summer – 102.15 g/m^3 and in the autumn – 16.76 g/m^3. Because of the high counts of *Noctiluca scintillans*, it was included in the calculation of the total zooplankton biomass.

Table 2. Dynamics of quantitative structure of zooplankton (specimens/m^3) in the Cape Maslen Nos aquatory

Species	April	July	October
Noctiluca scintillans	42442	46920	22631
Synchaeta vorax	198	96	49
Pleopis polyphemoides	294	175	106
Podon leucarti	146	487	69
Acartia clausi	510	981	238
Acartia sp.	586	843	341
Acartia nauplii	488	765	674
Pseudocalanus elongatus	286	-	116
Paracalanus parvus	232	487	126
Oithona minuta	348	596	316
Copepoda nauplius	193	215	27
Polychaeta larvae	154	199	72
Lamellibranchia veliger	366	361	148
Gastropoda (veriger stage)	112	149	117
Penilia avirostris	-	487	117
Centropages kroyeri	-	291	-
Evadne tergestina	-	-	136

Among the represented zooplankton species, the dinoflagellate *Noctiluca scintillans* was extremely numerous, followed by the crustacean *A. clausi* and its larvae (naupilus and copepod). *N. scintillans* dominated with massive bloom. This event was specific for the

80-90-ties of the last century, when the Black Sea was subjected to strong eutrophication due to anthropogenic press (STEFANOVA *et al.*, 2005).

The analysis of phyto- and zooplankton in the Cape Maslen Nos area showed increased biomass during the summer months. We support the belief of STEFANOVA *et al.* (2005), that the extensive development of zooplankton and particularly of *N. scintillans* is consecutive to the spring development of phytoplankton. Our data about *N. scintillans* counts (46920 organisms/m^3) exceeded the average annual values for this species in Bulgaria. According to STEFANOVA *et al.* (2005) this is a specific process for Black Sea coastal zones (up to the beginning of the 1990-ties) when high amounts of phyto-and zooplankton have been detected.

Conclusions

The observed trends in the dynamics of plankton in the Maslen Nos region were similar to characteristic fluctuations for the Bulgarian Black Sea area. Regardless of the fact that after the mid 1990-ties the zooplankton structure was restored, there is still a possibility for competition between *M. galloprovincialis* and *Mnemiopsis leidyi* for food. The successful cultivation (intensive production) of *M. galloprovincialis* in the studied aquatory during the spring and summer months could rely upon the biomass of the observed groups of *Protozoa*, *Rotatoria*, *Annelida*, *Mollusca* and *Arthropoda*.

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