ZooNotes 105: 1-4 (2017)
www.zoonotes.bio.uni-plovdiv.bg
ISSN 1313-9916

Shell size and population density of *Cerastoderma glaucum* Poiret 1789 (Mollusca: Bivalvia) in "Pomorie Lake" (Black Sea coast, Bulgaria)

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Abstract. The seasonal population density and population size structure of *Cerastoderma glaucum* of Pomorie Lake (Bulgaria) has been studied. The length of the shells ranged between 2.00 and 27.00 mm. The highest population density was estimated during spring and was 2062 individuals per m^2.

Key words: *Cerastoderma glaucum*, population, lagoon.

Introduction

Cockles are an important component of the salt water ecosystems and a major food source for many species. Bivalves are frequently used to assess the environmental contamination and often considered as a good sentinel and/or bioindicator. The cockle may also be substantial for the monitoring of the macrozoobenthos in the seas (Obolewski *et al.* 2007).

The Lagoon Cockle *Cerastoderma glaucum* (Poiret 1789) is euryhaline bivalve with a wide distribution across the European coasts, ranging from the northern Baltic Sea to the Black Sea and the Caspian Sea, which tolerates salinity between 15 and 35 ppt (Boyden & Russell 1972). According to Hubenov (2015) all *Cerastoderma* at the Black Sea coast of Bulgaria belong to the species *C. glaucum*. This species occurs in non-tidal areas such as lagoons and salt marshes which means it is exposed to a higher salinity while *C. edule* usually occurs in open coasts and estuaries where the salinity has higher daily variations (Reise 2003, Malham *et al.* 2012).

The previous studies on the species in the lake were based on short-term hydrobiological investigations conducted mainly in the 60s. The lack of any present-day malacological studies on *C. glaucum* there motivated the present work.

Materials and Methods

The Pomorie Lake is hyper-saline lagoon of natural origin, located close to the Black Sea and the town of Pomorie. It is relatively shallow water basin with a maximum depth of 1.4 m. It is a part of the Burgas Lakes-complex, which is one of the three most significant wetland complexes along the Bulgarian Black Sea coast for congregations of waterbirds. The Pomorie Lake and the adjacent territories are designated as a protected site according to the Bulgarian legislation and a Ramsar site.

Accepted: 18 April 2017
Published: 29 April 2017
Университетско издателство "Паисий Хилендарски"
Plovdiv University Press "Paisii Hilendarski"

Seasonal samples have been collected from five different sites in the lagoon (Fig. 1). Every site is characterized with different geographic location, degree of urbanization, pollution and human activity. They have different substrates and hydrochemical conditions:

Site1 is located in the northern part of the lake, near the saltpans where salinity exceeds 30‰. The basic substrates there are muddy sand, covered in some areas with seaweed;

Site 2 is the channel that connects the lake with the sea. It is located near the main road in the town of Pomorie. The substrate is artificial - concrete and rocks;

Site 3 is located in the southern part of the lake. It is an urbanized area visited by many tourists during the warm months. The area is used also for extraction of healing mud;

Site 4 is probably the most urbanized area, with many hotels and resorts. The substrate is mainly sandy;

Site 5 is located in the sand spit that separates the lake from the sea.

Seasonal samples (04/2015, 05/2015, 07/2015, 08/2015 and 10/2015) were collected from different sites in the lagoon in 2015 using a hydrobiological sieve. Samples were taken from the littoral zone of the shore at a depth of 10 cm, using a frame with size 50x50 cm. The material was collected into plastic bottles, preserved in 70% alcohol and transported to the laboratory. Then the samples have been sorted and washed in order to remove the adhering organisms and the other debris. The dead specimens have been separated from the living ones. The cockle specimens have been identified, counted and measured. The length of the shells was measured with accuracy of 0.1 mm.

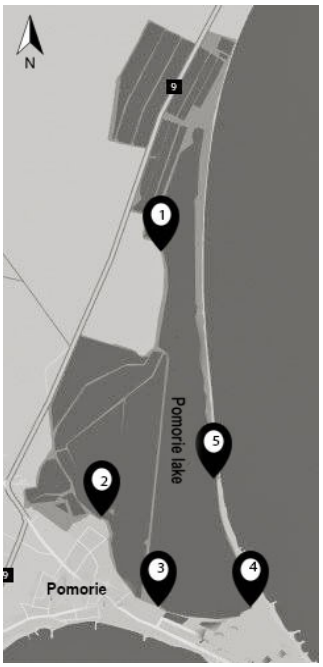

Fig. 1. Map of the studied area (the location of the sampling sites is indicated with numbers).

Results and Discussion

Totally 1000 specimens of *Cerastoderma glaucum* have been collected and measured from the 50 samples, 516 specimens have been obtained in the spring, 415 in the summer and respectively 69 in the autumn. The specimens have been found in all types of substrate. The length of the shell has ranged between 2.00 and 27.00 mm.

The cockles have been wide spread all over the explored sites. Specimens have been found in different types of substrate from muddy-sand to gravel-sand.

Population density

The dynamics of the *C. glaucum* population were studied during three of the seasons. The population density has been calculated per 1m^2. The data shows that recruitment has been observed throughout the year which suggests that the reproductive activity continues during the year. However, the recruitment happens mainly in the spring when population density reached 2064 ind. per m^2 (Fig.2). During summer population density reduced to 1660 ind. per m^2 and mainly adult individuals were collected. According to Labourg & Lasserre, 1980 the adult and juvenile individuals have different distribution. Juveniles (0.5-10 mm) usually attached to filamentous algae by byssus threads. When they reach certain age, they migrate to the adult free-living sediment population. During the autumn population density is significantly reduced (276 ind. per m^2) but still a few recruitments were also recorded in the autumn which indicates again a prolonged reproductive activity.

Population size structure

Three different size groups have been reported during seasons but just two of them dominated through the year (Fig. 2). During the spring the group of small specimens with 0-10 mm shell length (possible juveniles) accounted for 70% of all collected specimens while 29% were in the 11-20 mm class and less than 1% belonged to the 21-30 mm class. During the summer the 11-20mm class (possible adults) was 60% of all collected specimens, 38% were in the 0-10 mm class and 2% were in 21-30mm class. In autumn these ratio was 25% for 0-10mm class; 72% for 11–20mm class and 3% for the 21-30mm class.

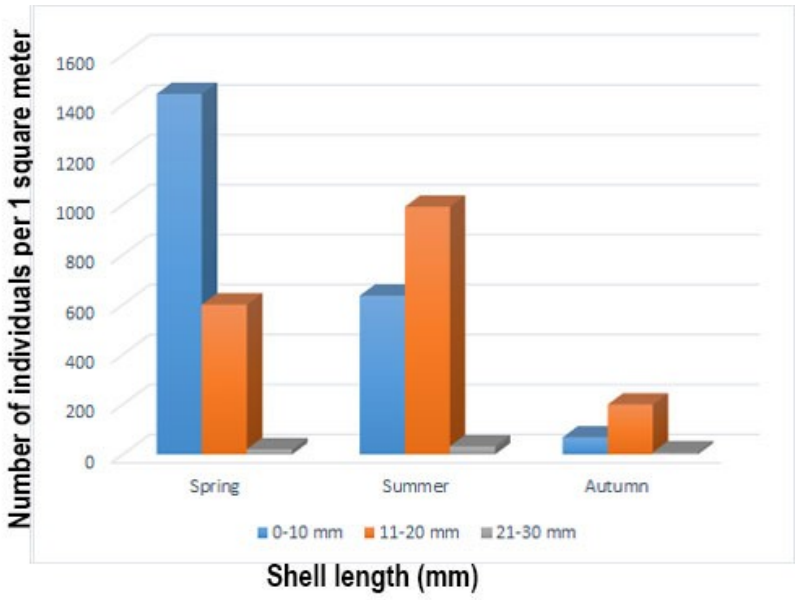

Fig. 2. Population density of *Cerastoderma glaucum* per 1 m^2 of each size group during seasons.

Acknowledgments. I would like to express my gratitude to the Municipality of Pomorie, the Regional Inspectorate of Environment and Water in Burgas and the Info Center of the NGO "Green Balkans" in the town of Pomorie. Special thanks to Assoc. Prof. Dian Georgiev and Assoc. Prof. Dilian Georgiev for their practical assistance during the sampling and the laboratory analysis, for their suggestions and constructive comments, which have improved the quality of the manuscript.

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