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Distribution, abundance and biological parameters of *Cerastoderma glaucum* (Mollusca: Bivalvia) along the Gabes coasts (Tunisia, Central Mediterranean)

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The cockle Cerastoderma glaucum *(Poiret, 1789) represents one of the most common marine mollusc species present in soft bottom infralittoral assemblages in Tunisian waters. The status of the species is still poorly known and there is a knowledge gap about its distribution, abundance and biological parameters. The significant ecological role of* C. glaucum *in the ecosystem and its possible future commercial interest requires a better knowledge of its stock. This study aimed to investigate the distribution, abundance and biology of these cockles along the Gabes coast. Cockles were collected, treated and data were analysed. In terms of geographical occupation, maps of the population distribution were drawn. The results showed a scattered distribution pattern of the species according to location ranging between 0 and 270 individuals per square meter. The consequence was a remarkable biomass which represented 1290±326 tons of total fresh weight and high abundance levels reaching over 403±104 million individuals estimated in the area of 3723 hectares. The distribution of the species has also been investigated in consideration with the size which varied markedly according to location, while the shell length ranged between 5 and 37 mm. Samples presented a balanced sex ratio, with males dominating among smaller individuals and females predominating in larger size-classes contrary to previous findings on this species. The size at which 50% of the population reached maturity was 14.29 and 16.59 mm SL for males and females, respectively. Findings of the current study suggest that* C. glaucum *well proliferates in southern Tunisian waters.*

Key words: *Cerastoderma glaucum*, abundance, distribution, size structure, sex ratio, size at first maturity, Tunisian southern waters

INTRODUCTION

The cockle *Cerastoderma glaucum* (Poiret, 1789) is a common bivalve living along the European coasts from the Baltic (WOLOWICZ, 1984) to the Mediterranean Sea (ZAOUALI, 1975; LABOURG & LASSERRE, 1980; BROCK & CHRISTIANSEN, 1989), as well as in the North African saline lakes (LEVY, 1985) and lagoons (ZAOUALI, 1977; DERBALI *et al*., 2009a). It preferentially dwells on muddy bottoms of lagoons and estuaries. It also occurs in areas where the environmental conditions fluctuate at the extremes. Cockles may play an important ecological role in reducing the particulate organic load with a wide range type of salinity and thermal characteristics. This makes *C. glaucum* an interesting subject for cultivation.

From the published literature available, extensive studies have been produced on *C. glaucum* focusing mainly on species distribution (BROCK, 1980 & 1991; WOLOWICZ, 1984, 1987; GONTIKAKI *et al*., 2003), biology and physiology (BOYDEN, 1971; LABOURG & LASSERRE, 1980; BROCK, 1979 & 1982; KOBINA, 1986; MATOZZO & MARIN, 2007, TARNOWSKA *et al*. 2009, 2010; DAVID & TIGAN, 2011) and ecological conditions (KINGSTON, 1974; ZAOUALI, 1975; MCARTHUR, 1996, 1998; TROTTA & CORDISCO, 1998). Nevertheless, available information on *C. glaucum* is scarce in Tunisia. What is known about this species is limited to few studies on ecotoxicology (MACHREKI-AJMI & HAMZA-CHAFFAI, 2006; MACHREKI-AJMI *et al*., 2008), genetic diversity (LADHAR CHAABOUNI *et al*., 2010) as well as on reproductive and ecological aspects (ZAOUALI, 1974, 1980; DERBALI *et al*., 2009b). The principal drawback in the study of *C. glaucum* is the poor knowledge of both the relative abundance and the population distribution in south Tunisia, where the species is one of the most important components of benthic fauna. Studies concerning the stock distribution and densities of the species underpin the basic knowledge in different fields of environmental research. These studies constitute the first step for any future work and can be useful as a reference for studies in marine invertebrates and cultivation.

Apart from some recent records on *C. glaucum* in the Boughrara lagoon (DERBALI *et al*., 2009a), no studies have targeted the current distribution and abundance of the species from southern Tunisian waters. Accordingly, the aim of this study was to assess the current status of the populations of cockles along the Gabes coast depending upon the species distribution, abundance and some biological parameters. The purpose was to give an outline of the status of *C. glaucum* along the Gabes coastal part as a background of southern Tunisia waters poorly known from this point of view.

MATERIAL AND METHODS

Study area

The Gabes region is located in southern Tunisia and in southern Mediterranean Sea. It extends along 750 km from Hicha 34° 17'N to Mareth 33° 62'N latitude (Fig. 1). Both wide and shallow continental shelves are topographically regular. The bottom slightly declines towards the sea and 60 m depth occurs at 110 km from the coast (BEN OTHMAN, 1973). The area is locally the most important fishing area and comprises most of the Tunisian fishing fleet. The salinity remains fairly stable throughout the year. It was recorded with high concentrations in summer (47-48‰) and often in winter (40-42‰). Temperature of the seawater recorded in the whole study area showed an annual fluctuation between 12°C (winter) and 27°C (summer) (DERBALI, 2011). The main characteristics of substrates are: muddy sand, being covered in some areas with the seagrasses *Cymodocea nodosa* and *Zostera noltii*.

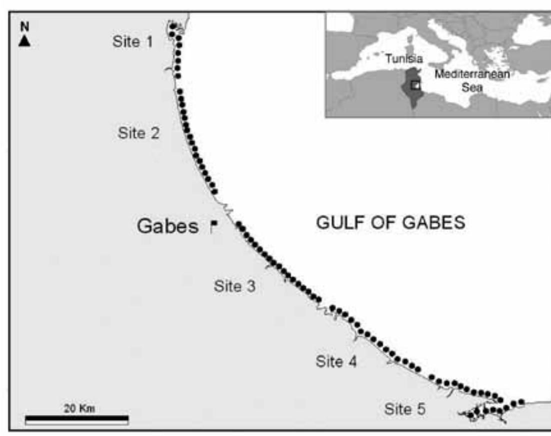

Fig. 1. Map of the study area. The position of transects is indicated

Field sampling and analysis

In the present study, systematic surveys were carried out from August 2007 to April 2009 within the 80 km Gabes coastal part located in south Tunisia. *Cerastoderma glaucum* was well known in five sites: Site 1 (Hicha), Site 2 (Akarit), Site 3 (Kattana), Site 4 (Zarrat) and Site 5 (Mareth) (Fig. 1). Transects were systematically performed along Gabes coast during low tides. Cockles were collected every 50 m along transect line from extreme high water tide to the extreme low water tide. Along transects, 4 to 10 stations were sampled. In each one, two replicates were taken from quadrats (0.25 m^2) using a shovel. Large specimens were collected by hand and small ones were taken using a 2 mm mesh size sieve. This technique has the advantage of not shaping individuals and so avoids the underestimation of the stock.

The materials were put in labelled plastic bags, subsequently preserved in a 7% formaldehyde solution and then transported to the laboratory. In the laboratory, the samples were sorted and washed to remove all adhering organisms and other debris. Cockle individuals were identified, counted and measured for shell length (SL); shell height (SH) and shell thickness (ST) with a digital caliper to the nearest 0.01 mm and weighed for total weight (TW) on a top-loading digital balance (precision of 0.001 g). The obtained data set was registered and maps of population distribution were drawn.

After identification to species level, data were pooled within each station to obtain a mean density (ind. m^{-2}) and mean biomass (g m^{-2}) per site, and subsequently pooled across stations to assess stocks. Obtained data were exploited also for the cartography based on the method of kriging using Arc View v. 3.2 software and to evaluate the population densities and biomass by the method of GULLAND (1969):

$$\mathrm{Bi} = \mathrm{Ni}\frac{\mathrm{Ai}}{\mathrm{ai}} \times \frac{1}{\mathrm{Xe}}$$

where Bi - represents the total biomass of cockles; Ni - the mean abundance in the sample; Ai - the whole study area; ai - the swept area and Xe - is the proportion retained.

For statistical analysis, the effect of site on SL and on abundance was investigated using one-way ANOVA. Similarities between sites in terms of cockle abundances and biomasses were investigated using Cluster analysis (group average). In addition, the harmonic Spearman correlation coefficient was also applied to identify any significant correlation between density and biomass of cockles in each site. The results are presented as a mean ± 95% CI and the significance level used for the tests was $p<0.05$. The relationship between SL and TW was described using the exponential regression ($TW = aSL^b$).

For biological study, approximately 200 cockles were sampled monthly from site 1 (Hicha) throughout the year 2007. Initially, *C. glaucum* specimens were measured for shell length (SL, mm) with a digital caliper (precision of 0.01 mm) and weighed for total weight (TW, g) on a top-loading digital balance (precision of 0.001 g).

The sexuality of the cockles was determined by examination of (1) macroscopic appearance of the gonad and (2) microscopic examination of smears of the sexual products. Since *C. glaucum* lacks external sexual dimorphism, the shell valves were parted and a subjective estimation of gonad volume was made. The visceral mass was then teased apart and smears of the visceral wall with attached gonad were examined at 100x magnification. Specimens were sexed and staged in both male and female groups.

For both sexes, the length at first maturity, defined as the length at which 50% of mature cockles, was estimated by means of a logistic function fitted to the proportion of the mature specimens pooled in 1 mm shell length classes (SL). The quasi-Newton algorithm for non-linear least square estimation of function parameters was applied to data according to the following equation: $P = 1 / (1 + e^{-a\ (SL-SL50)})$, where P - proportion of mature individuals; a - estimated parameter (slope of the curve); SL - Shell length corresponding to the proportion (P); SL50 - total length of 50% mature cockles. The sex ratio (expressed as number of females per males; F:M) was determined. Statistically significant deviations from a balanced sexual proportion of 1:1 were assessed by the χ^2–test, with statistical significance considered at $p<0.05$ (ZAR, 1996). Statistical packages used were SPSS v. 11 and STATISTICA v. 6.0.

RESULTS

Occurrence and abundance

Among all study sites, cockles were well proliferated. Individuals were found in various

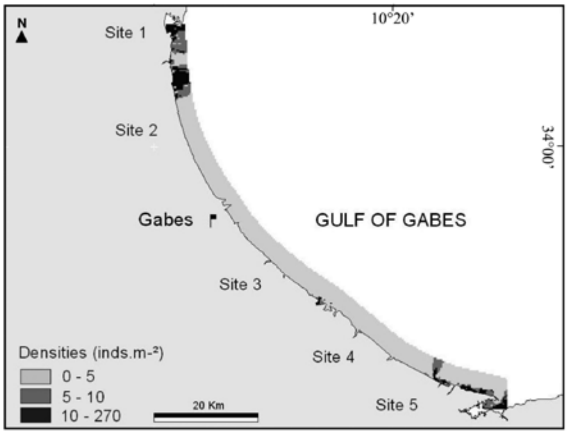

Fig. 2. Spatial distribution of Cerastoderma glaucum along the Gabes coast (Tunisia)

substratum types as on muddy-sand substrate covered in some areas by the marine seagrasses *Zostera noltii* or *Cymodocea nodosa* or by mixed vegetation consisting of these two seagrass. In some localities, *C. glaucum* was encountered loose on the muddy-sand bottom. The species was also found attached to the surface of other macroinvertebrate species such as the pearl oyster *Pinctada radiata*.

During the study, 119 transects were made from extreme high water tide to the extreme low water tide, corresponding to 1600 samples in total (Table 1). Abundance of *C. glaucum* was highly variable according to location (Fig. 2). Two most interesting zones (sites 1 and 2, 796 hectares) showed high abundance with a maximum of 270 ind. m^{-2}. In the remaining sites (site 3, site 4 and site 5) of nearly 2927 hectares (78.6% of the surveyed area) ranged between 10 and 270 ind. m^{-2}. In the remaining study area, the abundance doesn't exceed 10 ind. m^{-2}. In the same way, cockle biomasses were also highly variable (0–800 g m^{-2}). Sites 1 and 2 also had the highest values for biomasses (maximum reached 800 g m^{-2}). Nevertheless, biomass levels exceeding 20 g m^{-2} extended to the whole area of sites 3, 4 and 5.

An extrapolation from observed densities and biomass of the surveyed area provided for the whole population about 1290±326 tons (total fresh weight), with a mean biomass around 26.17 g m^{-2} and a total abundance reaching over 403±104 million individuals. The population was limited to mean densities of 11.03±2.26 ind. m^{-2}.

Interestingly, a total of 3709 specimens were harvested from the five aforementioned sites (3723 hectares). Significant variations in abundance and biomass values were recorded among sites (Fig. 3). At site 1, the mean abundance was significantly higher than those at the other sites ($p<0.05$). The same differences were also recorded between site 2 and those from sites 3, 4 and 5 ($p<0.05$). On the other hand, no significant variations were occurred between mean values from sites 3 and 4 ($p>0.05$). As for abundance, mean biomass showed significant variations ($p<0.05$) among sampling sites 3, 4 and 5 respect to sites 1 and 2. Spearman correlation coefficient was performed to compare between densities and biomasses values in each site. Obtained values exceed 0.93 so there is a strong positive correlation between densities and biomasses. Moreover, by means of cluster analysis of sites (group average) applied to sampling period defined two groups; the first composed of sites 3, 4 and 5 whereas the second grouped sites

Table 1. Colonised surface areas, number of transects and replicates in the five sites along the Gabes coast (Tunisia)

Sites	Surface (ha)	% of all surface	Number of transects	Number of replicates
Site 1	338	9.08	19	234
Site 2	458	12.30	36	320
Site 3	590	15.85	18	204
Site 4	547	14.69	19	290
Site 5	1790	48.08	27	552

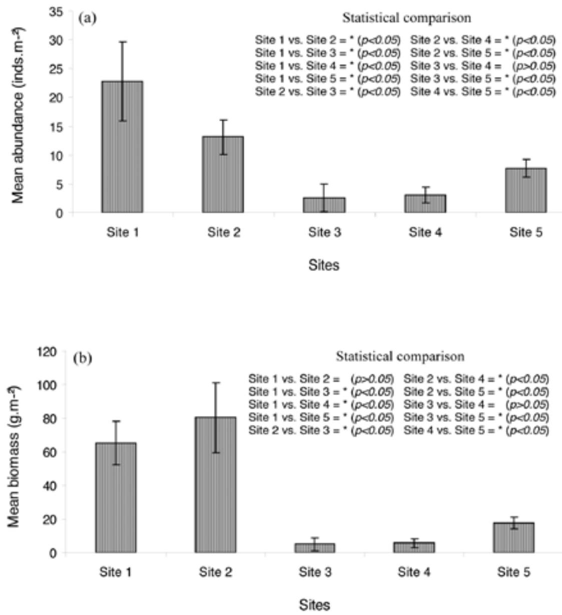

Fig. 3. a) Density and b) biomass levels, expressed as ind. m^{-2} and g m^{-2}, of Cerastoderma glaucum *at five sites. Values are means ± CI. Asterisks: significant results: * $p < 0.05$*

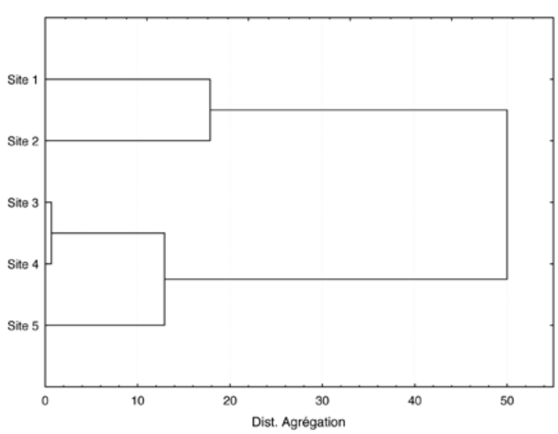

Fig. 4. Similarity dendrograms of sites (average group) for Cerastoderma glaucum *along the Gabes coast (Tunisia)*

1 and 2 (Fig. 4). Differences between the aforementioned groups were due mainly to cockles being most abundant in both site 1 and site 2.

Population structure

The size frequency distribution of *Cerastoderma glaucum* was determined in all sites (Fig. 5 and Table 2). The broad size-range of specimens varied between 5 and 37 mm SL. The mean size of the length distribution was 20.24±0.20 mm SL. The majority of cockle populations were attributed to size classes (5-30 mm) which represented 93.8% of total samples collected in the present study. Large-size individuals (>30 mm) represent only 6.2%. The populations of cockles are not distributed in an even manner: smaller individuals are distributed in a relatively heterogeneous way over the whole study area however larger specimens were more geographically restricted to the northern part (sites 1 and 2).

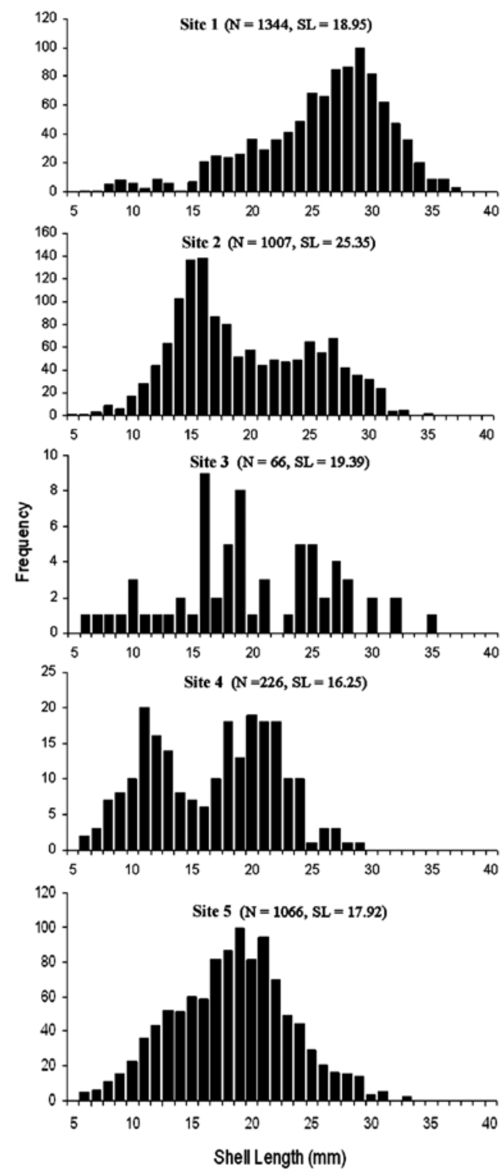

Fig. 5. Distribution of Cerastoderma glaucum *individuals according to shell length (SL - shell length; N - total number of specimens) at the five sites along the Gabes coast (Tunisia)*

Table 2. Minimum (Min), maximum (Max), average, mode and confidence interval (CI) values of shell length (SL) within the five examined populations (N: number of specimens harvested)

Sites	N	Min SL (mm)	Max SL (mm)	Average SL (mm)	CI	Mode
Site 1	1344	5.00	34.70	18.95	0.31	16.00
Site 2	1007	5.55	36.60	25.35	0.35	29.00
Site 3	66	6.00	34.30	19.39	1.59	16.00
Site 4	226	5.10	28.90	16.25	0.68	11.00
Site 5	1066	5.30	32.80	17.92	0.29	19.00

The mean sizes ranged from 16.25±0.68 mm in site 4 to 25.35±0.35 mm in site 2. The coefficient of variation of the size data in the current study area was relatively higher in site 3 due the presence of a few large individuals. Moreover, cockles' sizes appeared greatly influenced by location. Means shell length of individuals sampled in the 5 sites were significantly ($p<0.001$) different, with the exception of the comparison between site 1 (18.95±0.31 mm) and site 3 (19.39±1.59 mm) (Table 2). On other hand, shell length was positively correlated to total weight ($R^2=0.9226$). The relationship was: $W = 0.0006 L^{2.7754}$ ($R^2=0.9226$, N=3709, see Fig. 6).

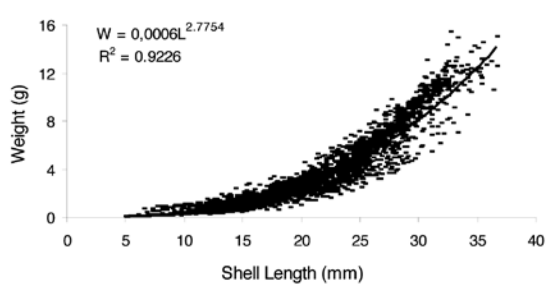

Fig. 6. Relationship between shell length and total weight of Cerastoderma glaucum *at the five sites along the Gabes coast (Tunisia)*

Sex ratio

Biological samples of 2283 cockles (1004 females, 918 males and 361 unsexed) were sampled from site 1 throughout the year 2007. For both sexes, specimens presented a broad size-range, both in term of shell length (10.25-35.30 mm) and total weight (0.34-13.93 g). Individuals with indeterminate sex (N=521, 21.3%) were

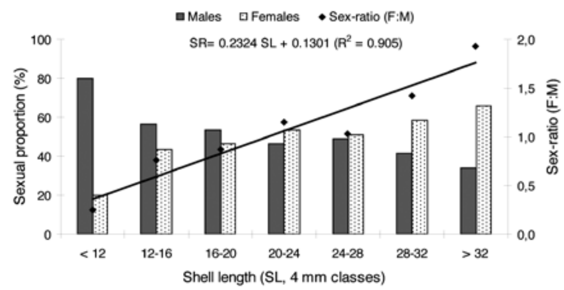

Fig. 7. Variations of sexual proportion and sex ratio (F:M) according to specimen size. The line illustrates unbiased sexual proportion (F:M = 1:1)

found in samples taken in January, February and March (during the resting phase or at the very early stage of gametogenesis).

The overall sex ratio (F:M = 1.09:1) was not significantly divergent from parity (F:M = 1:1, χ^2-test, $p>0.05$). In order to detect variations in the sexual proportion as a function of specimen size, data were grouped into size-classes (4 mm SL). Males dominated the smallest individuals (below 16 mm SL), both sexes were statistically balanced in intermediate size-classes (between 16 and 24 mm SL), while females predominated the largest size-classes (above 24 mm SL) (χ^2-test, $p<0.05$). The strong positive correlation (r=0.905) obtained in the linear regression established between shell length size-classes (SL, 4 mm classes) and the respective sex ratios (F:M) further emphasizes the decreasing proportions of males per females with increasing size-classes (Fig. 7).

Size at first maturity

Relationship between the percentage of mature *C. glaucum* and total shell length for

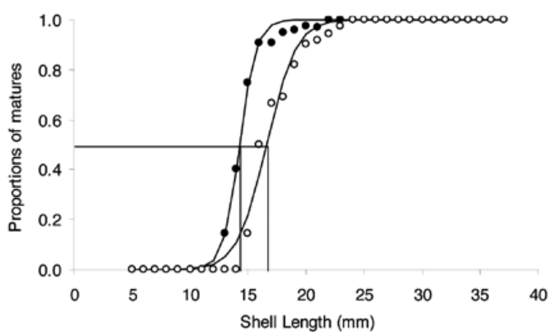

Fig. 8. Relationship between the proportion of mature Cerastoderma glaucum *and total shell length (SL) for males (●) and females (○) along the Gabes coast (Tunisia)*

both sexes are summarized in Figure 8. The smallest mature male was 13 mm SL and the largest immature one was 21 mm SL, whereas $L_{50\%}$ was estimated to be 14.29±0.1 mm SL. The smallest mature female was 15 mm SL and the largest immature one was 23 mm SL, whereas $L_{50\%}$ was estimated as 16.59±0.3 mm SL.

DISCUSSION

The present study area supports an extraordinary abundance and biomass of cockles. The consequence was a remarkable biomass which represented 1290±326 tons of total fresh weight and high abundance levels reaching over 403±104 million individuals (35.4% of total stock in southern Tunisian waters). This stock was much higher than that reported from the Bou Ghrara Lagoon (220 tons of fresh weight and a high abundance levels reaching over 156 million individuals; DERBALI *et al.* 2009a) and from the Bizerte Lagoon located in northern Tunisian part (192 tons; unpublished data). A gradient similar to this could be seen for another clam species (*Ruditapes decussatus*) with about 2405 tons which presented 52.5% of its total biomass in the surveyed area (unpublished data). Maps of spatial distribution densities and biomasses revealed the fluctuation of cockles' habitat in the study area. It seems that the stock of cockles varied substantially form one locality to another. It appears that this population has been influenced by strong impacts of various levels (e.g. physicochemical, edaphic and hydrological factors of the present study area). STERGIOU *et al.* (1997) clarified that temperature and food potentials are the most important factors affecting phenotypic differences in growth patterns and maximum sizes in a variety of marine organisms. Elevated water temperatures and phytoplankton levels occurring in the current study area may promote rapid growth rates in many local bivalve species. Due to high water temperature levels (12-27°C) and shallowness, the salinity remains fairly stable throughout the year. It was recorded with high concentrations in summer (47-48‰) and often in winter (40-42‰) (DERBALI, 2011). This result indicating that salinities still high throughout the year and showing that *C. glaucum* tolerates elevated salinities. The maximum value recorded here (48‰) is much larger than that recorded in Vouliagmeni Lagoon where the salinity ranged between 17 and 18 psu (CHINTIROGLOU *et al*., 2000). BAMBER (2004) demonstrated that this species tolerated a hypo- to hyperhaline salinity range. It preferred salinities ranging between 10 and 40 psu and tolerated salinity values over 60 psu.

Other mechanisms structuring the cockle population include soft bottoms and organic matter content. The high diversity of shellfish species is particularly interesting when the depth of the organic matter layer (<1 m) and the muddy sand bottom are considered. In fact, these factors can provide ecological conditions that are able to maintain highly diverse reef communities in the current study area. The five sites maintain high diversity if compared to other areas in southern Tunisian waters where only a few species (*Gibbula ardens, Cerithium vulgatum*, *Cerithium scabridium* and *Bittium reticulatum*) were found on rock and hard substrates. It seems that this low diversity is primarily attributed to bottom characteristics. This hypothesis can be supported by the relationship between the sedentary nature of some shellfish species such as *C. glaucum* and substrates.

As regards faunal diversity and substrate types, this species was more frequent and abundant in areas sheltered by seagrass *Cymodocea nodosa* and *Zostera noltii*, covering more than

70% of the mud sandy bottoms. Indeed, the heterogeneity of geographical distribution of C. *glaucum* was found to be significantly correlated to the distribution of seagrass. This positive correlation was probably related to the main organic source offered by *C. nodosa*. This detritus was the richest in organic carbon and was the predominant source of primary organic matter. As such, SARÀ (2007) indicated that among the dominant organic sources in the diet of cockles, potentially available for suspension feeders via POM and SOM, was the seagrass *C. nodosa*. The other benthic organic sources considered in the study area were the macroalga *Ulva lactuca*. Although, the most dominant seagrass was *C. nodosa* in the studied area, the least two species dealt mainly with optimal labile organic sources for cockle diet. Size of *C. glaucum* recovered in the study area ranged between 5 and 37 mm SL. The maximum length observed was 37 mm, which is higher to those recorded in the Boughrara Lagoon (29 mm; DERBALI, 2006; DERBALI *et al.*, 2009a) and in the Vouliagmeni Lagoon population (30.78 mm; GONTIKAKI *et al.*, 2003). However, this size is much smaller than that reported from northern areas of its distribution in Irish waters (50 mm; BOYDEN, 1971). The majority of the cockle populations consisted of smaller individuals from 10 to 24 mm SL. Unfortunately, cockle populations are not exploited in Tunisia waters, so one can assume that the small number of the adult individuals can be attributed mainly to natural mortality caused by the pollution and increased temperature in summer, a fact that caused the cockles to die. Besides, the distribution of the length-frequencies was approximately normal in sites 1, 3 and 5 and bimodal in sites 2 and 4, implying a small number of young individuals or recruits (Fig. 5). This is to be expected for a species with a continuous reproduction strategy, recruiting few individuals continuously throughout the year (DERBALI, 2011). Similar trends were found in populations of the Berre lagoon (Marseille French), however differences events can be observed within other populations from the Baltic and North sea (TANROWSKA *et al.*, 2009).

In the current study, the overall sex ratio of cockles (F:M = 1.09:1) was not significantly divergent from parity (F:M = 1:1, χ^2-test, $p>0.05$). Males dominated the smallest individuals (below 16 mm SL), both sexes were statistically balanced in intermediate size-classes (between 16 and 24 mm SL), while females predominated the largest size-classes (above 24 mm SL) (χ^2-test, $p<0.05$). Similarly, the same sequences of events were reported in populations of cockles caught from northern coast of Sfax (DERBALI *et al.*, 2009b). Changes in the sex ratio of *C. glaucum* were compared among other geographic areas. WOLOWICZ (1984) mentioned that sex ratio in *C. glaucum* population does not vary with age. This could be explained by the genetic isolations between populations. TARNOWSKA *et al.* (2009) and LADHAR CHAABOUNI *et al.* (2010) reported that Tunisian cockles are particular population compared to European ones. It is genetically more diverse, and there may be genetic isolation between Tunisia and European populations. Anyway our finding is interesting in that it is distinct from previous findings. Similar trends were found in another mollusc species such as *Hexaplex trunculus* from Spain (TIRADO *et al.*, 2002) and Portugal (VASCONCELOS *et al.*, 2008). Males dominated among smaller individuals, while females predominated in the larger sizes classes. Moreover, a muricid species (*Bolinus brandaris*) from Spain presented a females-biased population, but the size structure was similar for both sexes (RAMON & AMOR, 2002). Generally, females are more common in older populations of gonochoristic molluscs (FRETTER & GRAHAM, 1964), and this increasing proportion of females with larger size is probably explained by differential growth rates between sexes, with females allocating higher energy expenditure towards growth than for reproduction.

Sexual maturity of bivalves is classified according to microscopic properties, such as the presence of gametes in gonads and the degree of their development (KINGSTON, 1974; KECK *et al.*, 1975), though sometimes it can be determined from macroscopic properties, i.e. from the appearance and colour of foot tissue. In Pectenidae, Mytilidae and Limidae, both the sex and degree of gonad development can be determined from the colour of gonads (LUBET, 1959). Accordingingly, investigations on the size at sexual maturity revealed that males matured at a smaller SL than females and reached a smaller maximum SL, which was in agreement with results of studies made in other geographical area differing by its bottoms characteristics, vegetation cover and physicochemical factors (DERBALI *et al*., 2009b). Unfortunately, no data are available elsewhere for a comparison in *C. glaucum*. However, for another morphological similar species *Cerastoderma edule* from French coasts, the first maturity recorded was at about 20 mm (DABOUINEAU & PONSERO, 2004) which is slightly larger than in our data.

Finally, the present paper is the first report of an extraordinary abundance of *Cerastoderma glaucum* in the coastal part of Gabes. It will be a crucial baseline study useful for the future as a reference for studies in marine invertebrates and cultivation in time when this species constitute an interesting candidate for farming. Besides, the data may help to determine future quantitative changes indicating trends in the southern Tunisian waters that are exposed to various factors of environmental conditions and human activities.

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Raspodjela, brojnost i biološki parametri vrste *Cerastoderma glaucum* (Mollusca: Bivalvia) duž obale zaljeva Gabes (Tunis, središnji Mediteran)

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SAŽETAK

Srčanka *Cerastoderma glaucum* (Poiret, 1789) predstavlja jednu od najčešćih vrsta morskih mekušaca prisutnih u infralitoralnim zajednicama mekog dna u vodama Tunisa. Status ove vrste je još uvijek nedovoljno poznat te postoje praznine u znanju o njenoj raspodjeli, brojnosti i biološkim parametrima. Značajna ekološka uloga vrste *C. glaucum* u ekosustavu i mogući budući komercijalni interes zahtijevaju bolje znanje o njenom stoku. Ova studija je usmjerena na istraživanje raspodjele, brojnosti i biologije srčanki duž obale zaljeva Gabes. Srčanke su sakupljane, obrađene i analizirani su podatci. U pogledu geografske rasprostranjenosti, nacrtane su karte raspodjele populacije. Rezultati su pokazali raspršeni uzorak raspodjele vrste prema lokaciji u rasponu od 0 do 270 jedinki po kvadratnom metru. Posljedica je bila izvanredna biomasa koja je predstavljala 1290±326 tone ukupne svježe mase i visoke razine brojnosti koje dosežu preko 403±104 milijuna jedinki procijenjenih na području od 3723 hektara. Raspodjela vrste također je bila istraživana s obzirom na veličinu koja značajno koleba ovisno o lokaciji, dok je dužina ljušture bila u rasponu između 5 i 37 mm. Primjerci su predstavili uravnotežen omjer spolova, sa mužjacima koji prevladavaju među manjim jedinkama i ženkama koje prevladavaju u razredima veće veličine, suprotno prijašnjim saznanjima za ovu vrstu. Veličina kod koje 50% populacije doseže zrelost bila je između 14,29 i 16,59 mm SL (shell length - dužine ljušture) za mužjake i ženke. Saznanja ove studije navode na to da se vrsta *C. glaucum* uspješno razmnožava u vodama južnog Tunisa.

Ključne riječi: *Cerastoderma glaucum*, brojnost, raspodjela, veličinska struktura, omjer spolova, spolna zrelost, južne vode Tunisa