ABUNDANCE, SIZE COMPOSITION AND BENTHIC ASSEMBLAGES OF TWO MEDITERRANEAN ECHINOIDS OFF THE EGYPTIAN COASTS: *PARACENTROTUS LIVIDUS* AND *ARBACIA LIXULA*

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Abstract
This study is concerned with the abundance, size composition and benthic assemblages of two echinoid species, the *P. lividus* and *A. lixula* in the Southeastern Mediterranean along the coast of Alexandria, Egypt. Four seasonal trips were made covering 55 km of the shore with depths ranging between 3-9 m. The sea urchin species composition, density and size were compared. Other associated fauna and flora with prominent presence and biomass were observed. The present results showed that *P. lividus* was more abundant (91%) than *A. lixula*. The dominant size class was the medium to large-sized classes for *P. lividus*. The commercial size for the edible *P. lividus* represented 33% of the sampled population. The most dominant macrobenthic assemblages beside the echinoid population were primarily oysters and sea cucumbers.

Keywords: Echinodermata, Levantine Basin, Zoobenthos, Density

Introduction
Studies are scarce on the status of echinoid populations of the southeastern Mediterranean basin off Egypt (Eissa, 1989; Elmasry et al., 2013). Soliman et al. (2015) made a genetic analysis in order to identify the five color morphs of the echinoid population that were found in the current study sites. The last authors confirmed that the echinoid population comprised only two species, the edible commercial urchin *Paracentrotus lividus* (Lamarck, 1816) and the non-edible black urchin *Arbacia lixula* (Linnaeus, 1758).

Materials and Methods
At all stations, sea urchin density , number of individuals per meter square (ind./m2),and size (without spines) were assessed. A 1 m × 1 m quadrat in size was used at each station. The quadrats were used along a 100 m × 100 m transect at the sampling points at depths between 3 and 9 m. Samples were collected taking into consideration individuals under rocks, on vertical walls and from crevices. The collection was seasonal and the specimens were kept in plastic containers filled with sea water from the sampling location. These sea urchins were transported to laboratory and processed live within 24 h from collection. All individuals were counted and test diameters (TD) were measured by means of a Vernier Caliper (0.05 mm accuracy). Sea urchin sizes were grouped in intervals of 0.5 cm (Figure 1). After measurements, sea urchins were kept in laboratory's tanks for further analysis (not published data)

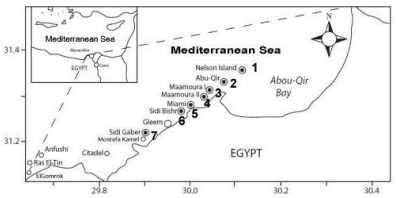

Fig. 1. Map showing the sampling sites, 1- Nelson Island, 2- Abu Qir, 3- Maamoura I, 4- Maamoura II, 5- Miami, 6- Sidi Bishr and 7- Sidi Gaber.

Results & Discussion
The present results showed that *P. lividus* was the dominant echinoid spatially and temporally (91% of the total sea urchin population). *A. lixula* showed frequent occurrence in sites 6 and 7 in the spring season. The most dominant size class was the medium to large-sized classes for *P. lividus* (30-45mm) and large sized classes for *A. lixula* (40-60mm). The commercial size for the edible *P. lividus* represented 33% of the sampled population. Furthermore, the most dominant macrobenthic assemblages beside the echinoid population (49%) were primarily oysters (40%) and sea cucumbers (11%). Beside these, assemblages of seaweeds (red, green and brown macroalgae), Porifera, Cnidaria, Crustacea, other Echinodermata, Bivalvia, Gastropoda, Tunicata, Bryozoa and Annelida were found. The sizes of *P. lividus* ranged between 15 mm to 65 mm in test diameter (TD). As for *A. lixula*, the sizes ranged from 15 mm to 60 mm in test diameter (TD), in the different study sites. The commercial size for the edible *P. lividus* (i.e. >40 mm) amounted for 33% of the collected sample. The peak of densities recorded for *P. lividus* was observed between size classes ranging between (25-45 mm) test diameter. Site (4) showed the highest density of *P. lividus* of the size class 35-40 mm. As for *A. lixula*, the different size classes, from 15-60 mm test diameter, are represented with variable occurrence in all sites with much lower densities than that of *P. lividus*. The present study shows that the highest density of the echinoid population aggregated mainly in the east side of Alexandria city between depths 3 and 9 m. The density of the echinoid population ranged between 2-63 ind./m^2 along the study sites. In the present study the highest densities recorded for *P. lividus* were during autumn, spring and summer seasons (54-59 ind./m^2). Such high densities might be attributed to many factors such as the availability of many types of fleshy algae, which are the preferred food for *P. lividus*, shelter, water temperature and photoperiod. Furthermore, in the occasional low densities of *P. lividus*, in some of the study sites between different seasons, might be attributed to predation (such as some fish, crabs and octopus) or to immigration of *P. lividus* in long foraging trips to different locations in the process for searching either for food or shelter. Hence, more investigations are needed to study the extent of the action of predation and possible immigration of the echinoid population to different suitable or deeper locations along the coast of Alexandria. In Israel, a neighboring coast, Yeruham et al., (2015) reported that in past surveys, conducted in the seventies, the number of *P. lividus* individuals on their coasts ranged between (2 and 10 ind./m^2). Recently, between the years 2010-2014, they made other extensive survey over 80 km along the coast of Israel. Their results showed a drastic decrease in the abundance of *P. lividus* recording only a total number of 19 individuals. The results of the present study suggests interspecific competition between both echinoid species *P. lividus* and *A. lixula* favoring the dominance of *P. lividus* and thus suggesting its higher ecological adaptive plasticity than the black *A. lixula*. It appears that the study sites are well-structured habitat for the presence and recruitment of the edible *P. lividus*. The low presence of *A. lixula* is not currently of major concern as its co-occurrence appears not to inflict any threats on the edible population of *P. lividus*. Finally, it is recommended that this study should be extended to all the Egyptian coasts on the Mediterranean and Red Seas to know the status of the Egyptian sea urchin population in order to maintain such valuable wild resource.

References
1 - Eissa, S.H., 1989. Studies on sea urchins in Egyptian water. PhD thesis. Zoology Department, Tanta University. pp 153.
2 - Elmasry, E., Omar, H.A., Abdel Razek, F.A., El-Magd, M.A., 2013. Preliminary studies on habitat and diversity of some sea urchin species (Echinodermata: Echinoidea) on the southern Levantine basin of Egypt. Egypt. J. Aquat. Res. 39, 303–311.
3 - Soliman, T., Omar, H.A., Abdelrazek, F.A., El-Sayed, A.-F.M., Elmasry, E., Reimer, J.D., 2015. Phylogenetic characterization of two echinoid species of the southeastern Mediterranean, off Egypt. Egyptian Journal of Aquatic Research, 41, 359-365.
4 - Yeruham, E., Rilov, G., Shpigel, M., Abelson, A., 2015. Collapse of the echinoid *Paracentrotus lividus* populations in the Eastern Mediterranean - result of climate change? Nature, Scientific Reports, 5, 13479.