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Cartography and spatial distribution of natural deposit of sea urchin *Paracentrotus Lividus* Lamarck, 1816 (Echinodermata Echinoidea) in the region between El Jadida and Safi

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Abstract
A companion assessment of natural accumulation of sea urchin *Paracentrotus lividus* realized in June 2009 in the region of El Jadida-Safi. This assessment has revealed the existence of a coast-wide gradient of density and size that proportionate inversely with 80% of individuals covering the first 10 m while individuals of intermediate size and large live in medium to large depths. In contrast this study clearly reveals the interrelationship urchin / algae on one hand and the nutritional aggregation on the other hand. It notes that young individuals whose size <30 mm are generally fed of *Ulva lactuca*, *Halopitys incurvus*, *Cystoseira baccata* and *Bifurcaria bifurcata*. While *Gracilaria multipartita*, *Laminaria digitata*, *Plocamium cartilagineum* and *Geliduim sesquipedale* are feeding individuals of average size. *Plocamium cartilagineum* and *Geliduim sesquipedalen* which persist in the great depths feed bigger echinoids.

Keys words: Paracentrotus lividus- Population dynamics – Density- algae.

Introduction
The sea urchin *Paracentrotus lividus* has a wide distribution including the Mediterranean Sea, Adriatic Sea and the Atlantic coast of SW Ireland to Morocco and the Canary Islands. It is encountered at the lower intertidal zone and subtidal and also in rocky basins still submerged (Bayed et al, 2005). Although the maximum depth to which we recorded the species is -150 m in Galicia (Besteiro and Urgorri, 1988), the sea urchin *Paracentrotus lividus* lives mainly between 0 and -80 m; on rocks, in sea grass meadows and also on sandy or coral ?(Fernandez, 1996).

Material and methods
Study area
During the companion two sites were chosen; Sidi Bouzid which is in the south of El Jadida, whose geographic coordinates are 33 ° 14 '.05, and 08 ° 33.37 6'N, 7'W, it consists of a rocky platform and it is characterized by an important exploitation. Ain Zarga is the second site that was chosen as a reference site located at 19 Km in the south of Cape Beddouza. that its geographic coordinates are 32 ° .26 '.24, 7'N and 09 ° .14 '31 .8 W.

Sampling
For this study six radials were chosen in Sidi Bouzid, 30 sampling points, ,whose depths are between 0.5 and 20 m, cover the whole site. The separation distance between points is of 500 m and 1 km between radials. In Ain Zarga 25 radials are separated by 500 m and each one include four radials points separated by 500 m. the area of each sampling point is 0.25 m² with the use of a quadra metal (50 cm x50 cm).

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Figure1: Location of sampling sites of *P. lividus*

Results and discussion

Structure of population

The demographic structure of this population (Fig. 2) reveals the presence of two distinct cohorts. This can be attributed to the impact of the exploitation of sea urchins. Indeed, Sidi Bouzid is one of the two cohorts that is appropriate to young urchins, while the other suit the elder ones. According to Levitan (1988), in *P. lividus* there are an emergence of two distinct cohorts when Individuals become old. Unlike Sidi Bouzid, the demographic structure of the population shows only a single cohort in Ain Zarga (Fig. 3).

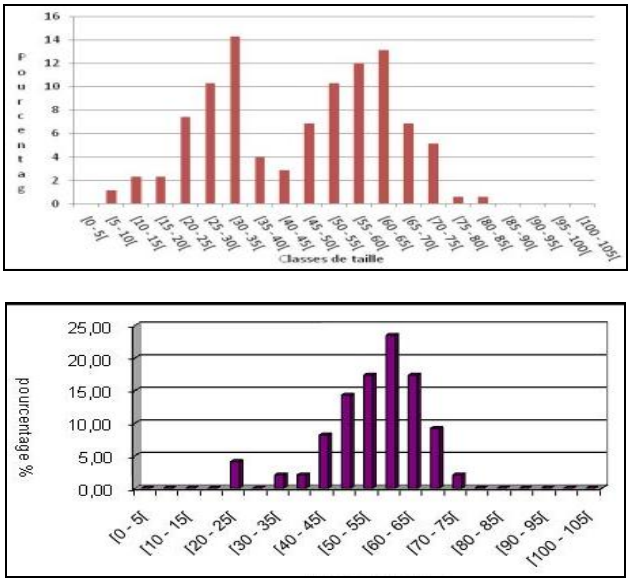

Figure 2 and 3: Frequency distribution of size of P.lividus in Sidi Bouzid and Ain Zarga

Spatial distribution

The results obtained show that, in Sidi Bouzid, the natural deposit is spread between 0 and 20 m depth, while in Ain Zerga, the natural accumulation is limited to shallow depths (0-8 m). This may be related to the nature of the background. Indeed, in Sidi Bouzid, the substrate consists of a wide slab rock while at Ain Zerga, rocky area are limited to very coastal.

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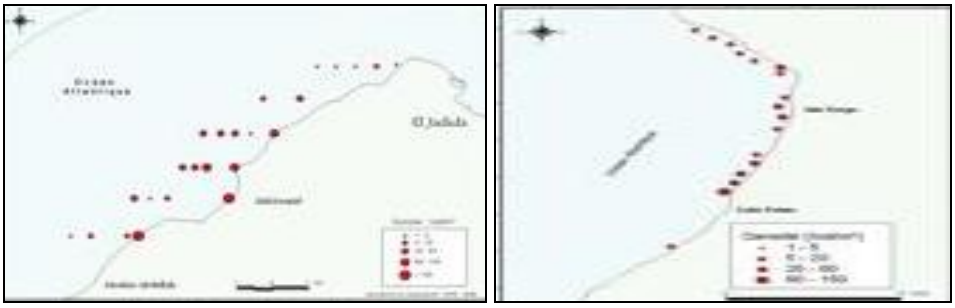
It is also noted the in Sidi Bouzid the results show a density that decreases with depth. Studies prepared by Urgorri et al. (1994) reported the existence of an abundance gradient with depth and that 80% of small individuals are found in the first 10 meters. In addition, results also show that the density decreases towards the north of Sidi Bouzid
(off El Jadida) and the south (off Moulay Abdellah). This can be attributed on one side to the impact of pollution; this case is in the north where two discharge outfalls continuously, and on the other side, to predation and / or competition where in the case of the south where the abalone (other algae grazer) is abundant.

Studies have also shown the existence of a gradient increasing between size and depth. The large individuals (diameter> 50mm) are grouped in areas exceeding 10m., This can be also explained by the growth of sea urchins that is more important at depth. According to Grosjean et al. (1996), *Paracentrotus lividus* is growing with depth which suggests that the growth of small individuals in battered areas is inhibited by intraspecific competition within the population which is likely linked to the high density level of this stratum.



Figures 4and 5: Spatial distribution of densities of *P. lividus* in Sidi Bouzid and Ain Zarga

Interrelation between algae and sea urchins in Sidi Bouzid

This study showed the close relationship between the sea urchin *Paracentrotus lividus* and algae. Spatial dynamics of the field of sea urchins showed segregation on size (Fig 6).

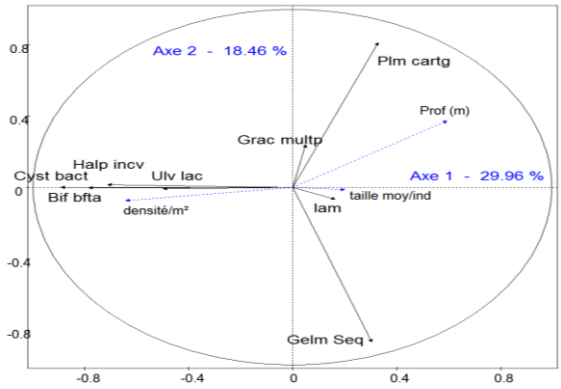


Figure 6: Principal Component Analysis (PCA) with additional variable

Young individuals whose size <30 mm are mainly fed of *Ulva lactuca*, *Halopitys incurvus*, *Cystoseira baccata* and *Bifurcaria bifurcata*. While *Gracilaria multipartita*, *Laminaria digitata*, *Plocamium cartilagineum* and *Geliduim sesquipedale* form algal mat that feed the individuals of medium size. In contrast, the *Plocamium cartilagineum* and *Geliduim sesquipedale* still feed the large individuals of *P.lividus* in the depth. The results recorded show similarly that the algal biomass decreased significantly with high densities in sea urchins (Fig 7and 8).

The relationship between the urchin size and algae can be explained by various factors such as the size of algae, consistency, calcification and resistance of digestion (Hessen and Van Donk, 1993; Van Donk et al, 1997).

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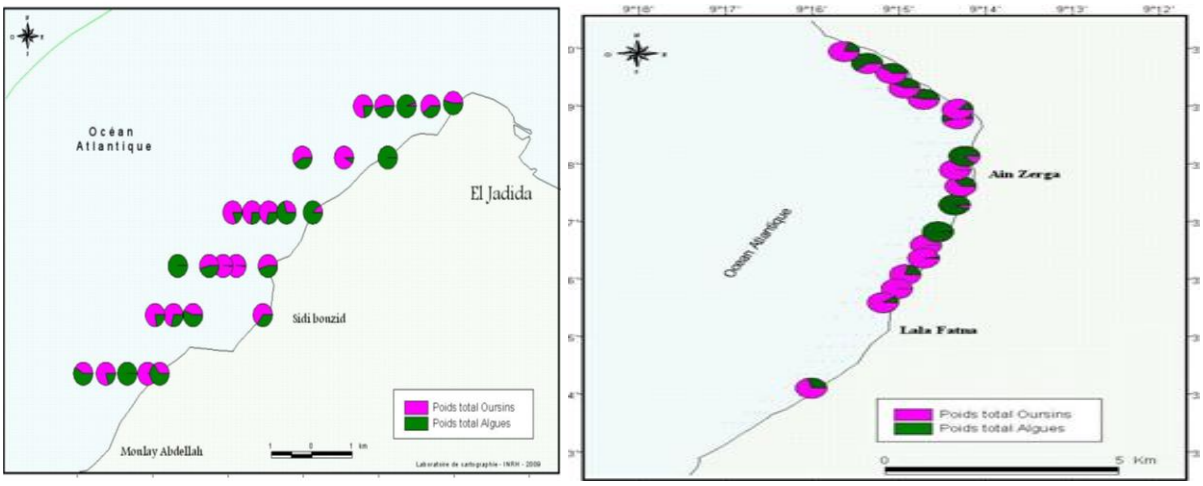

Figures 7 and 8 : Spatial distribution of the total weight of sea urchins and algae in Sidi Bouzid and Ain Zarga

Conclusion

At the end of the sea urchin *P.lividus study* in the maritime area between El Jadida and Safi, the results obtained highlight the different relationships between sea urchin and its natural habitat.

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