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Some ecological aspects of the land hermit crab *Coenobita scaevola* (Coenobitidae) at Wadi El-Gemal protected area, Red Sea

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ABSTRACT

Gastropod shells can be a limiting factor in allowing hermit crab populations to increase. The impact of this factor on population size of the land crab *Coenobita scaevola* (Forskäl, 1775) was examined. Extensive and intensive works were conducted on a sandy beach of Wadi El-Gemal island and the protected area coast (35°04’0”E, 24°42’0”N). Activity, spatial and temporal distribution, food foraging, and impact of human tourism activities for this hermit crab were discussed. A total of 365 crab individuals were collected from the sandy beach of Wadi El-Gemal island during August 2007 to July 2008, among these 137 were used for frequency measurements of occupied shells by the land hermit crabs. The hermit crabs were found occupying seventeen species of gastropod shells. A significant regression and correlation were recorded between the shell aperture and chelae. However, our data showing no significant regression values between total body weight of crabs and for each of the shell weight and internal volume. From the other angle, the correlation relationship recorded high significant value for the same relationships. This may reflect that some smaller crabs tend to occupy larger shells than the preferred ones. Moreover, the shell species occupation as a function of chelar hermit crabs size. While the negative results between body weight of crab and both shell internal volume and weight it may be due to the variations behavior of some land hermit crab individuals within population. It is logical that fit the size of chelae with aperture of shell to achieve protection from predators while some members of the population that occupied shell is greater than the size of his body to the unavailability of appropriate shells.

Keywords: Coenobitidae, population, shell occupation, Wadi El-Gemal Island, protected area, Red Sea Coast.

INTRODUCTION

About 800 species of hermit crabs carry empty snail shells as their shelter (Hazlett, 1981; Kuhlmann, 1992; Angel, 2000; and Rotjan *et al.*, 2004). To grow the body size larger, the individual must change the shell to another larger shell (Sato and Seno, 2006). The terrestrial hermit crabs (Family Coenobitidae) include 15 species of *Coenobita* and a single species of another genus, *Birgus latro*. The family is of marine origin and whilst its members have effectively colonised supra-littoral and terrestrial habitats, they continue to carry and live in mollusc shells (Harms, 1938).

Hermit crabs are decapod crustaceans most of which have noncalcified abdomens requiring protection from predation and desiccation. (McLaughlin, 1983 and 2003). Hermit crabs are best known from intertidal areas where they are conspicuous and ecologically important scavengers and predators (Whitman *et al.*, 2001). When a predator comes near, the hermit crab pulls its body into the shell and covers the shell with its claw (Hazlett, 1981; Kuhlmann, 1992; Angel, 2000; and Rotjan *et al.*, 2004). On other hand, Shells are also a limiting resource for these crabs and may regulate their fecundity (Childress, 1972 and Bertness, 1981).

Hermit crabs represent an important part of the many intertidal and moderately deep benthic marine communities worldwide, where they play an important role in the food chain (Fransozo and Mantelatto, 1998). This semi-terrestrial species is very abundant above the sea level on the beaches of the Red Sea and the highly arid shores of Sinai Peninsula, but is totally dependent on the sea for water and consequently limited to the nearshore area (Achituv and Ziskind, 1985). *Coenobita scaevola* is the only species representing the family Coenobitidae inhabiting the Red Sea (Sallam *et al.*, 2008).

One of the major goals in the field of ecology is to determine what limits or regulates the size of a population. Research investigating aspects available worldwide on coenobitid hermits has focused on reproductive aspects (Tudge and Lemaitre, 2006) the mechanism of migration (Barnes, 2003; and Nives-Rivera and Williams, 2003). The shells utilization (Sallam *et al.*, 2008). Since movement is particularly costly in the terrestrial environment, the crabs must carry their shells all the time and sometimes inadequate ones in function of their size and weight. Little information is available to our knowledge about the pattern of ecological limiting factors on hermit crabs of the Red Sea.

The purpose of the present study is to provide a review of field observations to understand ecological limiting factors affecting population of *C. scaevola* inhabiting a sandy beach in the island of Wadi El-Gemal protected area, Red Sea. As an important step to evaluate the ecological limiting factors affecting population of land hermit crabs, is to analyze the relationship between hermit crabs and gastropod shells.

MATERIALS AND METHODS

***Study site*:** The Wadi El-Gemal protected area is located at 50 km South Marsa Alam City on the Egyptian Red Sea coast (35°04'0"E, 24°42'0"N) (Fig. 1). Extensive and intensive works were conducted on a sandy beach of Wadi El-Gemal island and the protected area coast. Four sites namely, office of Wadi El-Gemal protectorate area at south of Shams Alam hotel, south of Ras Bogdady or Torfet El Mashayekh, Ras Hankorab and Marsa Wadi Umm El-abass were chosen to study the negative impact of human activities on the abundance of land hermit crab. Wadi El-Gemal within the hyper arid region characterized by an arid climate and dominated by hot, rainless summers and mild winters.

The monthly mean temperature varies between 24-38°C during summer and 12-26°C during winter. The coastal regions present a wide variety of habitats, including: muddy, sandy, boulder and rocky shores and mangrove forests.

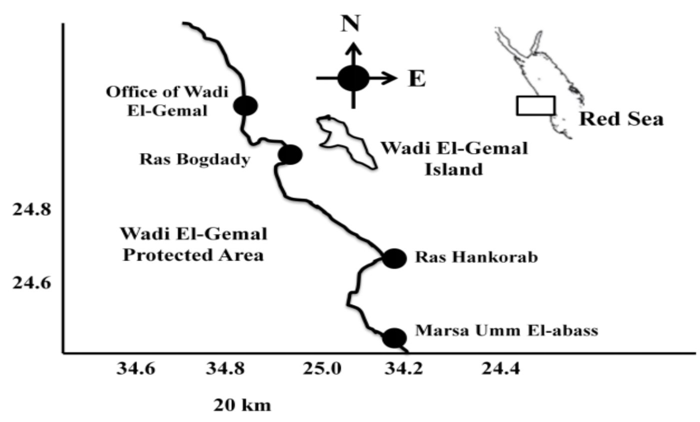


Fig.1: Diagram map indicating the area of sampling at Wadi El-Gemal, Marsa Alam, Red Sea, Egypt.

These types of habitats provide a variety of ecological niches for a large number of crustaceans including the hermit crabs.

Field trips: A total of 365 individuals of land hermit crab (*Coenobita scaevola*) were hand-collected, it is occupying seventeen gastropod shell species. The collections were made monthly from August 2007 to July 2008 during diurnal low tides at different habitats of sandy shore of the study area. Crab specimens were fixed in 10 % formalin in sea water and transported to the marine biology laboratory, Department of zoology, Faculty of Sciences Al-Azhar University.

Quantitative sample: Twenty quadrates covering different microhabitat through each season were investigated to measure abundance of *Coenobita scaevola* inhabiting the study area. The area of each quadrate is (1 m x 1 m) one m^2.

Activity and food foraging of Coenobita scaevola: Active sites were observed for hermit crab activity and food foraging every 30 minutes for a two-hour period starting an hour before sunset.

Shell measures: A total 137 shells occupied by land hermit crabs gastropod shells species were identified weighed and measured for shell internal volume and shell aperture width (SAW) and length (SAL) (Fig. 2). Shell weight was obtained by subtracting crab body weight to the total weight (i.e. the weight of shell plus crab).

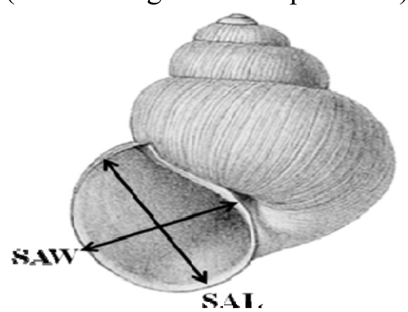


Fig. 2: Diagram of gastropod shell and its aperture

Where:

SAL = shell aperture length and SAW = shell aperture width.

Crab measurements: After, measuring and weighing the occupied shells, crabs were removed from their domiciles by carefully breaking the shells with a vice. Crab specimens were weighed (Wet Weight, WW; TBW), also both length (CL) and width (WL) of crabs chelae were measured (Fig. 3). Measurements were carried out using a 0.1mm venier caliper.

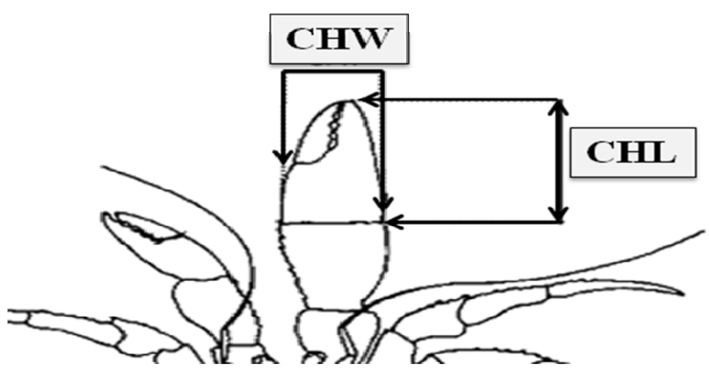


Fig. 3 Diagram of Chelae hermit crab dimensions

Where:

CHL = Chelae length; CHW = Chelae width.

Shell identification: Gastropod shell species were identified according to Sharabti (1984) and Rusmore- Villaume (2008).

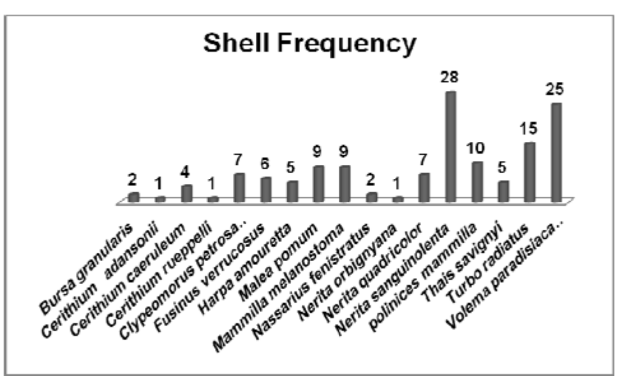
***Data analysis*:** statistical analysis of the data and its corresponding graph were performed using *Statistic* ver.7 program software. To determine correlations between the dimensions of hermit crabs and occupied shells, regression analyses were performed (Spearman test) and by correlation coefficients using the power function equation (Y=a.X b)

RESULTS

A total of 365 individuals hermit crab of *Coenobita scaevola* were obtained for all measurements for each of the land hermit crab and shells occupied by the same (total body weight of hermit crabs, length and width of chelae as well as shell weight, length and width of shell aperture, and volume of internal shells) (Table 1), among these 137 were used for frequency measurements of occupied shells by the land hermit crabs. The hermit crabs were found occupying seventeen species of gastropod shells (Plates 1, 2, and 3) in different frequency and relative frequency respectively (Fig. 4 a & b). Data showed that, *Nerita sanguinolenta* was clearly the most occupied (28 shell, being 20%), followed by *Volema paradisiaca nodosa* (25 shell, being 18%), and *Turbo radiates* (15 shell, being 11 %) respectively. On the other hand, *Nerita orbignyana*, *Cerithium rueppelli* and *C. adansonii* were occupied only by lower percentage values (only one shell, being 1%).

Table 1: Variations of measurements for both land hermit crab (*Coenobita scaevola*) and the occupied shell species.

Occupied gastropod shell Species	Shell measurements				*Coenobita scaevola* measurements		
	average shell aperture length / cm	average shell aperture width / cm	average shell volume / ml^3	average Shell weight/g	average Chelae length / cm	average Chelae width / cm	average total body weight /g
Bursa granularis	2.2	1.4	5.0	7.0	1.1	0.9	2.0
Cerithium adansonii	1.3	1.1	4.1	11.0	0.9	0.9	2.3
C. caeruleum	1.3	0.8	2.1	3.9	0.8	0.7	1.0
C. rueppelli	1.5	1.1	3.5	12.1	1.1	0.9	2.9
Clypeomorus petrosa isseli	1.5	0.9	2.4	6.0	0.8	0.7	1.9
Fusinus verrucosus	2.2	1.3	6.5	9.7	1.3	1.1	5.8
Harpa amouretta	2.9	1.2	5.7	8.9	1.3	1.0	4.1
Malea pomum	3.0	1.2	7.3	8.5	1.2	1.1	4.4
Mammilla melanostoma	2.7	1.8	5.1	9.5	1.2	1.1	4.2
Nassarius fenistratus	1.0	0.7	1.1	2.6	0.6	0.6	5.3
Nerita orbignyana	1.4	1.0	1.5	1.8	0.8	0.7	1.2
N. quadricolor	1.2	0.9	0.8	4.1	0.5	0.5	0.5
N. sanguinolenta	1.2	1.1	1.9	1.5	0.8	0.7	1.2
polinices mammilla	2.4	1.4	5.4	9.0	1.2	1.1	4.9
Thais savignyi	2.2	1.4	5.2	11.8	1.2	1.1	4.0
Turbo radiatus	2.0	1.8	5.7	10.8	1.2	1.1	5.1
Volema paradisiaca nodosa	3.3	1.3	6.4	8.5	1.3	1.1	5.1



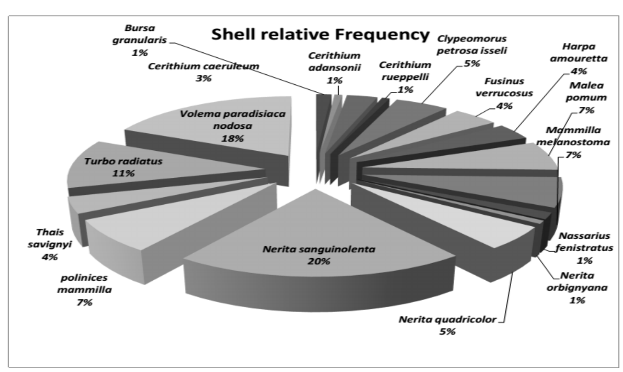


Fig. 4a: Frequency of shells occupied by land hermit crabs. Fig. 4b: Relative frequency of shells occupied by land hermit crabs.

Spatial distribution

Main marine zones, namely: from land to open Sea, shore; supra-littoral; littoral (upper and lower) and sub-littoral are given in Figure (5). Data in Figure (6) show that, the maximum average value of *Coenobita scaevola* abundance was found in supra-littoral zone (14 individuals /m^2) represented by 54 % from all individuals recorded in four zones. Followed second number of individuals recorded in upper-littoral zone (7 individuals/m^2) represented by 27 %, while the minimum average value of abundance recorded in shore (2 individuals/m^2; 8%) and lower-littoral zones (3 individuals/m^2; 11 %) respectively.

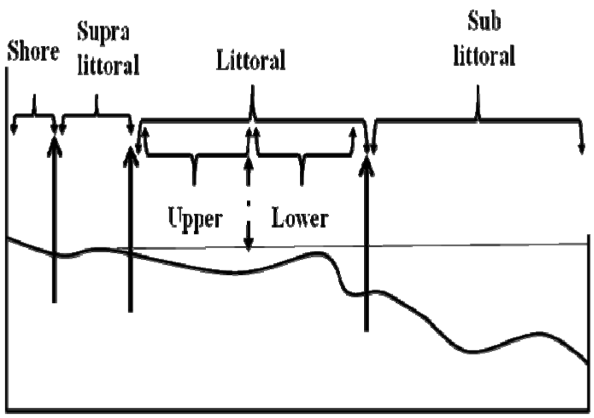


Fig. 5: Diagram showing distribution of *Coenobita scaevola* within marine zones

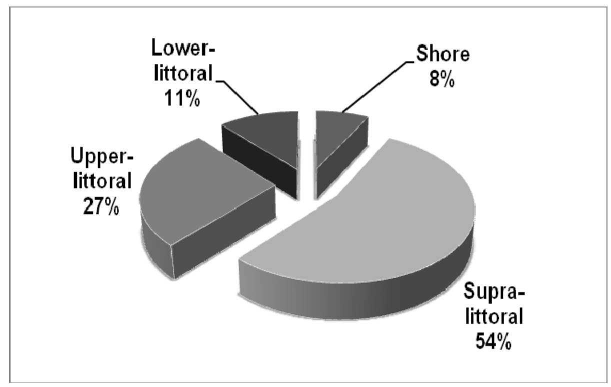


Fig. 6: Population size of *Coenobita scaevola* within marine zones

The present study indicated that, the highest average value of *Coenobita scaevola* abundance was recorded in April (20 individuals / m^2) and the lowest average value of abundance was recorded during December and January months, being 2 individuals / m^2 (Fig. 7). Our data in Figure (8) indicated that, the highest value of *Coenobita scaevola* abundance were slightly different between spring and summer seasons, being 12 individuals / m^2 in the former and 11 individuals / m^2 respectively in the latter. The smaller value was recorded in winter, being 3 individuals / m^2.

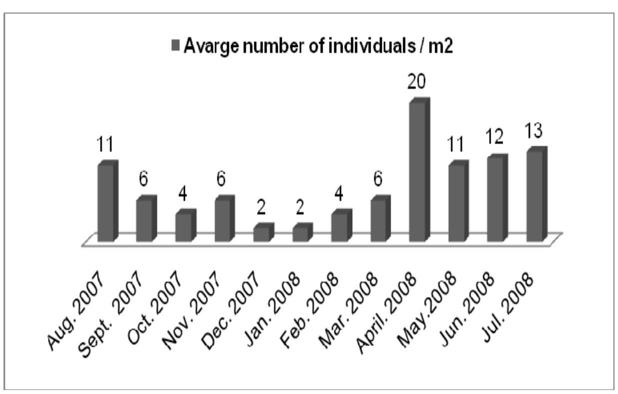


Fig. 7: Monthly variations of abundance (Number of individuals/25m^2) for *Coenobita scaevola*

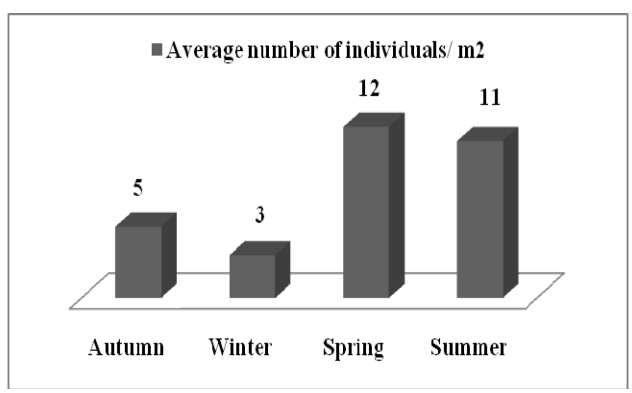


Fig. 8: Seasonal variations of abundance (Number of individuals/25m^2) for *Coenobita scaevola*

Activity of hermit crab observations

Observation data in Figure (9) revealed that, the highest number of individuals active may be for search of food, taking shelter against predators or migrate to suitable microhabitats was recorded at night being 14 individuals/ m^2, followed by early morning period, being 12 individuals/ m^2. The number of active individuals / m^2 decreases gradually during morning and evening periods respectively. Lower number of active individuals was observed at noon and afternoon periods, being 6 individuals/ m^2.

Impact of human tourism activities on *Coenobita scaevola* population size

Comparative analyses of population size of land hermit crab inhabiting four regions are given in Figure (10). It was clear that, the highest abundance was recorded in protected area followed by offshore region, bieng13 individual /m^2 and 10 individual /m^2 respectively, while land hermit crab showed lower individuals within human activities region, both high or low impact on population size that slightly varied from 2 individual /m^2 to 4 individual /m^2 respectively.

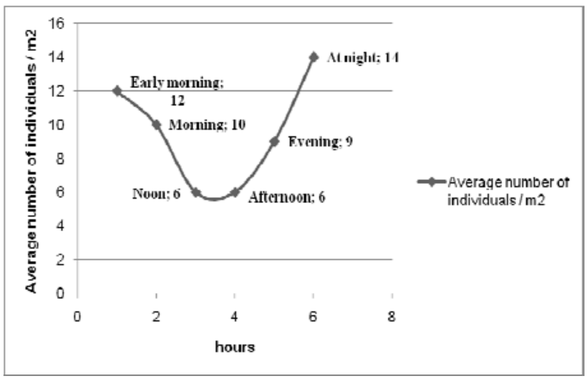


Fig. 9: Daily activity of *Coenobita scaevola*

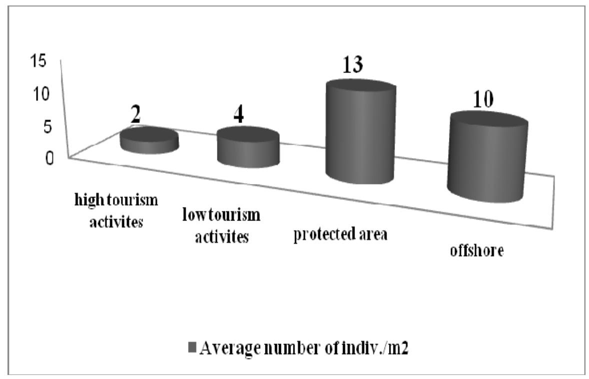


Fig. 10: Impact of human activities on population size of *Coenobita scaevola*

Study on the occupied shells

The present work indicated that, the strong values for regression and correlation coefficient of aperture shell and dimensions chelae of land hermit crab *Coenobita scaevola* are shown in Figure (11) and Figure (12) respectively. It was clear that, the shell species occupation as a function of chelae hermit crab size. Chelae length (CL) and chelae width (CW) of the hermit crabs varied from 0.5 cm to 1.3 cm and 0.5 cm to 1.1 cm, respectively. Aperture of shells occupied by land hermit crabs had an average value of shell aperture length (SAL) that varied from 0.5 cm to 3.3 cm, while the shell aperture width (SAW) ones had an average value from 0.7 cm to 1.8 cm (Table 1).

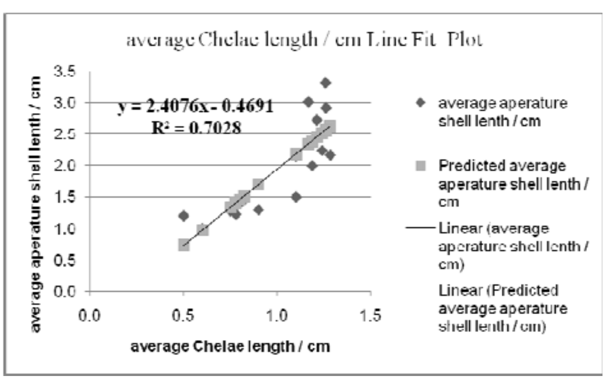


Fig. 11: Regression equation of aperture shell length and chelae length of *Coenobita scaevola*.

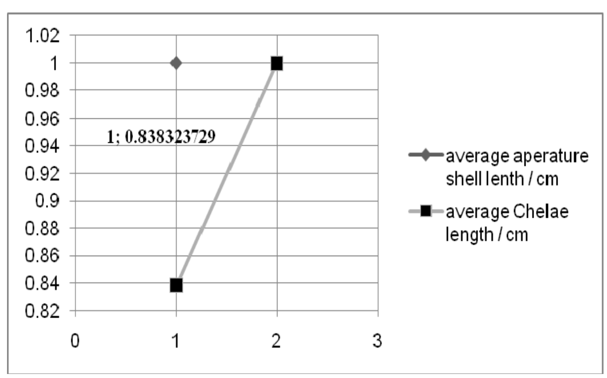


Fig. 12: Correlation relationship of aperture shell length and chelae length of *Coenobita scaevola*.

A significant relationship both regression and correlation were recorded between the shell aperture length and chelae length, SAL x CL (linear function y = 2.4076x - 0.4691, R^2 = 0.7028; and Correlation Coefficient = 0.838323729) shown are Figs. (11 and 12). Similarly, significant relationship both regression and correlation were recorded between the shell aperture width and chelae width SAW x CW (linear function y = 1.0938x + 0.2121, R^2 = 0.5744; and Correlation Coefficient = 0.757889513) (Figs. 13 and 14).

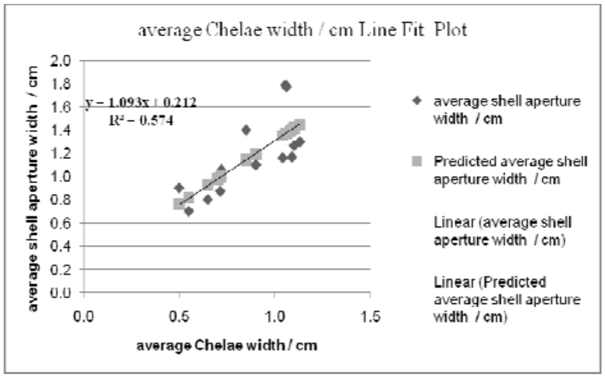


Fig. 13: Regression equation of aperture shell width and chelae width of *Coenobita scaevola*.

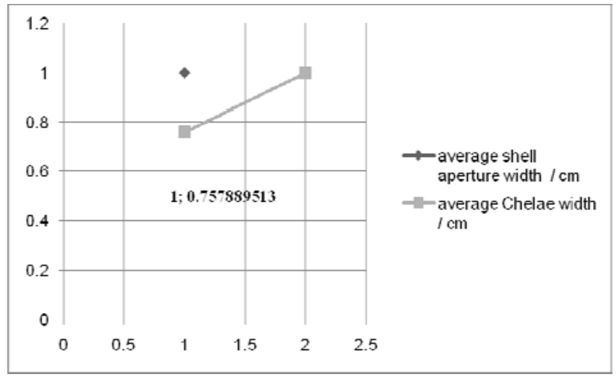


Fig. 14: Correlation relationship of aperture shell width and chelae width of *Coenobita scaevola*.

Data revealed that, not regression significant relationship between the shell weight and crab total body weight, SW x TBW. From the other angle, the correlation relationship was recorded high significant value (linear function y = 0.2629x + 1.3261, R^2 = 0.2819; and Correlation Coefficient = 0.530968678**)** shown are Figures (15 and 16).

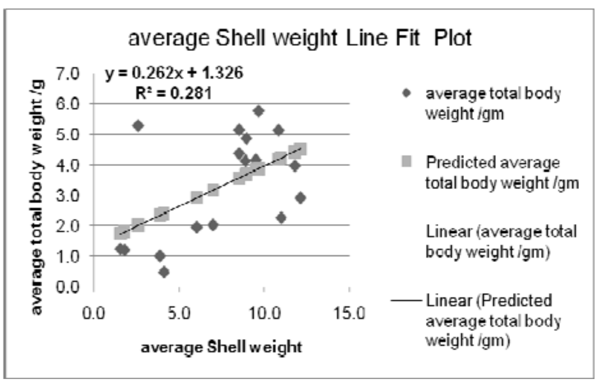


Fig. 15: Regression equation of shell weight and land hermit crab total body weight

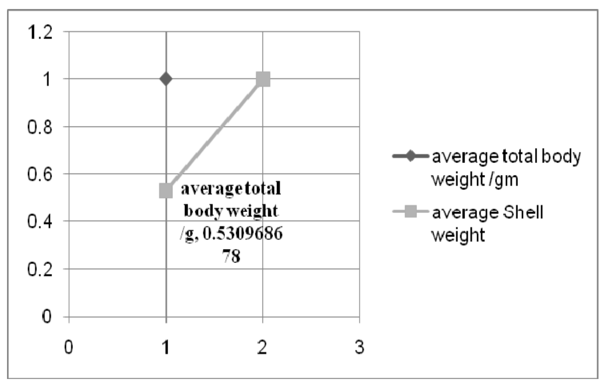


Fig. 16: Correlation relationship of shell weight and land hermit crab total body weight

The equations ranked the relationship between the crab total body weight and internal volume of the occupied shell (SV x TBW) as recognized not regression significant, while the high correlations value was recorded (Linear function y = 0.8316x + 1.371R^2 = 0.486; and correlation coefficient = 0.697114405) (Figs. 17 and 18).

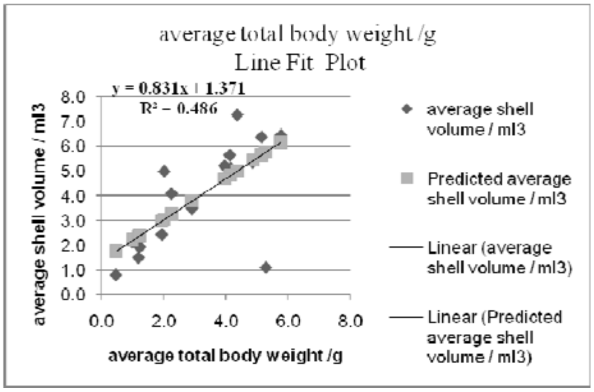


Fig. 17: Regression equation relationship between the crab total body weight and internal volume of the occupied shell

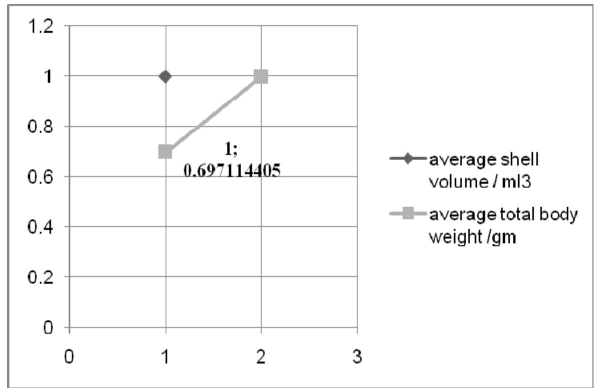


Fig. 18: Correlation relationship between the crab total body weight and internal volume of the occupied shell

Food foraging observations

Data observations show that, the crabs gather in large numbers to search for food. It has wider variety of food types such as dead fishes, jellyfishes, micro-organisms associated with plant roots or seagrass, remains of dead animals and eggs of sea turtles. Observation also showed that *Coenobita scaevola* have intensive ability for feeding during summer, autumn and spring seasons, but winter season the ability for feeding are decrease or limited.

DISCUSSION AND CONCLUSION

The land hermit crab is very abundant above the sea levels on the beaches of the Red Sea and the highly arid shores of Sinai Peninsula, but is totally dependent on the sea for water and consequently limited to the near shore area (Achituv and Ziskind, 1985). In the present study the maximum abundance of *Coenobita scaevola* was found in supra-littoral zone among four investigated zones. Second high number of individuals recorded in upper-littoral zone, while the minimum value of abundance was recorded in shore and lower-littoral zones respectively. These data were agreement with that mentioned by Barnes (1999 and 2001) who studied the hermit crab assemblage in the Quirimba Archipelage in northern Mozambique, exhibited a strong tidal zonation pattern. The supra-littoral zone was dominated by the semi-terrestrial *Coenobita* species.

Data showing how free-living terrestrial hermit crabs are learn the locations of their most essential resources, food and shelter. Foods on the beach may be washed away during the next tidal cycle. Thus, the spatial and temporal distributions of their potential foods may prevent land hermit crabs from specializing on any single food type. As generalist foragers, land hermit crabs may have higher fitness when selectively foraging on different food types than when foraging randomly. Crabs have limited abilities to locate resources individually, but as they coalesce on a resource, their aggregation can be noticed by passing foragers, tipping them off about the discovery. All observed species of land hermit crab indicated that the lack any member of hermit crab populations is feeding on a specific type of food. The data obtained from the land hermit crab behavior, indicated that the modes of its feeding are filter feeding, Omnivores and feeding scavenger. Our data support observations by Barnes, (2001) noted that humans provided two important resources for local coenobitid populations: food and shells. Humans provide food in the form of domestic waste and faeces, thereby also promoting population growth. Being highly general scavengers, as well as gregarious feeders, coenobitids will quickly'clean up' organic waste discarded around a site. VINE, (1986) mentioned that, the individuals of *Coenobita scaevola* are scavenge at night to close to high water.

According to some authors, organic matter can be accumulated on or deposited among sediment particles, constituting a food source for benthic organisms. Some species use the sediment like shelters, however, other species can obtain food in the substrate (Fransozo *et al.* 1998); these species are called deposit-feeders, like the studied hermit crab species. Coenobitids will consume rotting plant and animal matter, fungi and faces, as well as other coenobitids on occasion (Thacker, 1996 and Brodie, 1998).

The present results showed that, the abundance of hermit crab in the two regions, where available protection against the negative human activities such as shells collections, while the low abundance was recorded in regions human activities. On other hand, humans provide food in the form of domestic waste to the land hermit crabs. Mather *et al.* (1997) speculated that hermit crabs are sometimes associated with octopus dens as scavengers opportunistically feeding on remains of prey left in middens and dens.

Results of the present study showed that, the increased activity of *Coenobita scaevola* at night was followed by early morning period. Numerous reasons for this activity either search of food, shell or avoid from predators. *Coenobita scaevola* often bury them or retreat to the shade during the heat of the day this leads to decrease in activity rate at noon and the afternoon period. These results were agreements with previous studies. Seurat (1904) and Gross (1964) stated that, hermit crab (*Coenobita perlatus*) utilization of the beach, nearshore, and interior habitats varied with species, time of day, presence of moonlight, amount of wrack on the beach, size, sex, and reproductive condition of mature individuals. The smallest crabs were closest to the beach, while large individuals were present on the beach as well as in the interior. *Coenobita perlatus* lives in burrows or rest in shaded areas among coastal vegetation during daytime and then emerge at night to scavenge close to high water (Vine, 1986). Although coenobitids are well adapted to a life on land, their air sacs require adequate moisture to function and the animal must either be close to water or carry its own supply in its shell. To help avoid desiccation, coenobitids tend to be either crepuscular or nocturnal and often bury themselves or retreat to the shade during the heat of the day (Szabo, 2012).

Although temperature is one of the important factors affecting marine organisms that inhabited intertidal zone. They are subjected to death by desiccation resulted by water loss, which may be hastened by high temperature. Some species have a great resistance to such conditions and they were found all the year around. While others species have low resistance, therefore disappeared through a part of the year. In our results of land hermit crab abundance and temporal distribution indicated that these benthic species had high degree of tolerance against environmental conditions. The land hermit crab (*Coenobita scaevola*) was occurring through all months, but maximum value of abundance was found in April month). The minimum abundance value was recorded during December and January months. On other hand, seasonal variation of abundance recorded in spring, while the minimum abundance recorded in winter.

Although shell utilization by hermit crabs has been examined in other areas of the world (Mantelatto and Garcia, 2000), rare information is available to our knowledge about the impact of limiting factors on *Coenobita scaevola* population at the Red Sea. Volker (1967) reported *Coenobita scaevola* to inhabit 29 shell species in Hurgada, based on a punctual sample. Sallam and Mantelatto (2010) reported information on population dynamics of *Coenobita scaevola* at the Red Sea.

The present study has focused on some limiting factors affecting on abundance or population size of land hermit crab such as human activates, optimal diet, occupied shells and environmental conditions. Numerous studies have focused on other limiting factors are controlling the abundance of land hermit crabs such as diversity and abundance of shells, shell utilization, shell preference and predators (Hazlett, 1970; Vance, 1972; Kelogg, 1976; Conover, 1978; Elwood *et al.*, 1979; Carikker, 1981; Kurta,1982; Mather, 1991; Siu and Lee, 1992; Walker, 1994; Hazlett, 1996; Barnes, 1997; Hahn, 1998; Osorno *et al.*, 1998; Mantelatto and Garcia, 2000; Tirelli *et al.*, 2000; Benvenuto and Gherardi, 2001; Garcia and Mantelatto, 2001a; Mantelatto and Dominciano, 2002 ; Barnes, 2003; Gilchrist, 2003; Meireles *et al.*, 2003; and Mantelatto and Meireles, 2004).

Crabs occupying shells large enough that they can withdraw completely and block the shell aperture with the chelipeds are much harder to extract from their shells than crabs which are too large to withdraw completely, and for this reason they would presumably be less vulnerable to predators (Ball, 1972). Volker (1967), that affirm “land hermit crabs seem to have no relation to the shells of a given snail species”, other author found that shell dimension constitutes mainly the determinant for *Coenobita scaevola* shell utilization, adopting in the Red Sea similar strategy developed by some other tropical and subtropical marine hermit crabs (Garcia and Mantelatto, 2001b). The size of the occupied shells is usually quite well correlated with the hermit crab size in the field (Hazlett 1981). Positive correlation between hermit crab size and shell measure was reported. Despite no significant difference in shell type utilization between sexes was observed, significant correlations in all regression analysis were obtained only to males. This may reflect that males choose the shells that best fit (shell size preference) them associated to the type availability in the survey, but laboratory experiments are needed to test this hypothesis (Renata Biagi *et al.*, 2006).

Our data indicated that, the shell species occupation as a function of chelae hermit crab size. A significant regression and correlation were recorded between the shell aperture and chelae. However, our data showing no significant regression values between total body weight of crabs and for each of the shell weight and it internal volume. From the other angle, the correlation relationship was recorded high significant value for the same relationships. These results are explained as follows: the population of *Coenobita scaevola* is strongly related to the gastropod shell utilization. Moreover, the shell species occupation as a function of chelar hermit crabs size, while the negative results between body weight of crab and both shell internal volume and weight it may be due to the variations behavior of some land hermit crab individuals within population. This may reflect that the size of chelae with aperture of shell to achieve protection from predators, while some members of the population that occupied shell is greater than the size of his body to the unavailability of appropriate shells. This hypothesis is confirmed by some field observation to the behavior of some both smaller and female crabs tend to occupy larger shells. Furthermore, the results indicate that the *Nerita sanguinolenta* was the most occupied (20%), followed by *Volema paradisiaca nodosa* (18%), and *Turbo radiates* (11 %) respectively. On the other hand, *Nerita orbignyana*, *Cerithium rueppelli* and *C. adansonii* were occupied only by lower percentage values (1%). Regarding to the correlation results, occupied shell by hermit crab strongly associated with shell internal volume. This means that the presence of crab in 17 kinds of shells get it out of the idea that he chooses a particular type, but this does no prevents the utilized of certain types of among occupied gastropod shell species due to the abundance of the place which is inhabited by land hermit crab.

In conclusion, some environmental conditions and food resources and human activities did not affect the population size of the land hermit crab acting as limiting factors .This may be attributed to the enjoyment of this species a great deal of resistance to harsh environmental conditions, as well as the diversity of its food and take advantage of human waste. The all correlation relationships between hermit crab and shell occupied, show that the shells can be a limiting factor in allowing hermit crab populations to increase. Future ecological studies *(i.e.* shell availability and mechanism selection, competition, predation and limiting factor) are necessary to definitively understand shell utilization phenomena in this important crustacean group.

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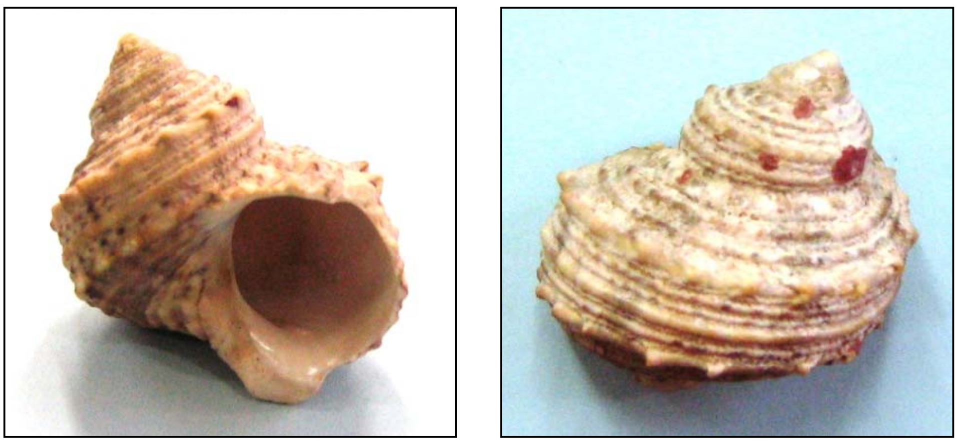
A photograph of land hermit crab *Coenobita scaevola*

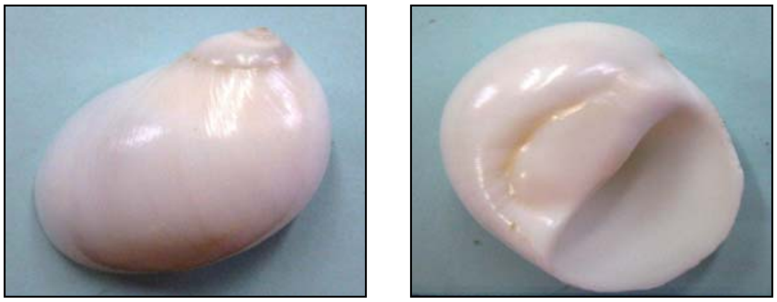


Turbo radiates

Malea pomum

Plate 1: land hermit crab and some occupied gastropod shells

Thais savignyi

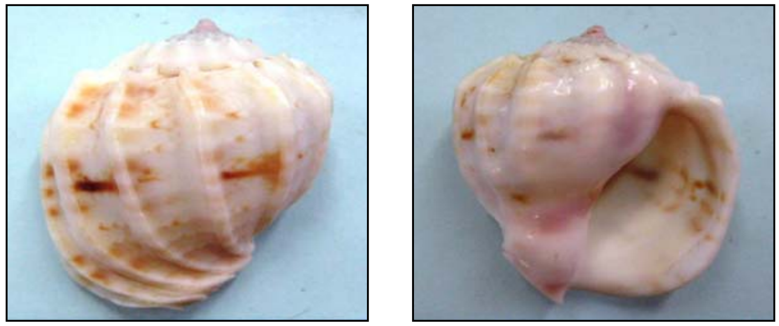


Polinices mammilla

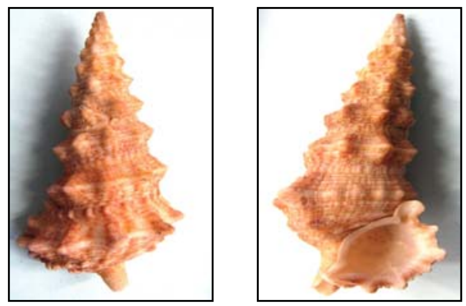
Nerita sanguinolenta

Volema paradisiacal nodosa

Plate 2: Some gastropod shells



Harpa amouretta



Cerithium adansonii

Nassarius fenistratus

Fusinus verrucosus

Plate 3: Some gastropod shells

ARABIC SUMMERY

بعض السمات الإيكولوجية لسرطان الارض الناسك *سونوبيتا إسكيفولا* (عائلة: السنوبيتيدى) فى محمية وادى الجمال، البحر الأحمر

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تتميز العائلة السنوبيتيدى (سرطانات البحر الارضية) بإمتلاكها لعدد من الغرف الخيشومية التى تمكنها من الاستفادة بأكسجين الغلاف الجوي كما يمكن لها أن تبقى خارج مياه البحر لفترات طويلة. وهي تعيش في جحور تحفرها بنفسها، أو بين الصخور أو في المناطق الظليلة بين النباتات الساحلية خلال النهار ثم تخرج ليلا للتغذية على مقربة من مياه المنطقة المدية. وتمثل هذه العائلة في البحر الأحمر بنوع واحد هو سونوبيتا إسكيفولا الذى يتواجد بوفرة كبيرة على شواطئ ساحل البحر الاحمر والجزر المترامية بعيدا عن الشواطىء.

وتعد اصداف البطنقدميات هى الملاذ للسرطان الناسك فهى بمثابة بيته الذى يلازمه بكل مكان، حيث يوفر له الحماية من الاعداء والمفترسات، كونه لا يستطيع تكون صدفة بذاته. وأثناء نمو السرطانات الناسكة، فإنها تستبدل بأصدافها أصدافًا أكبر .وقد تناولت الدراسة حصر الوفرة (حجم العشيرة: عدد الافراد/ المتر المربع)، وكذلك مجموعة من القياسات (طول وعرض فتحة الاصداف التى يقطنها السرطان، وزن الاصداف ، الحجم الداخلى الاصداف، طول وعرض ملقطيى السرطان، بالاضافة لوزنة) بهدف ايجاد قيم علاقات الاعتماد والارتباط بين الاصداف والسرطان). علاوة على ذلك : تم دراسة اوقات النشاط، افضلية الغذاء، التوزيع الزمنى عبر الاشهر والمواسم، تأثير الانشطة البشرية على وفرة العشيرة .

وقد استخدم رصد موسع ومكثف على الشاطئ الرملي للسهل الساحلى وجزيرة محمية وادي الجمال بالبحر الاحمر. تم جمع ٣٦٥ من أفراد السرطان الناسك خلال شهر أغسطس ٢٠٠٧ الى يوليو ٢٠٠٨، واستخدم منهم ١٣٧ فردا لقياسات تكرار الصدفة التى يشغلها السرطان الناسك. تم رصد سبع عشرة نوعا من البطنقدميات يشغلها السرطان الناسك ، وقد سجلت اصداف نوع *نيرتا سانجينولينتا* اعلى نسبة من بين الاعداد الاصداف التى تم فحصها.

أوضحت النتائج الإحصائية وجود قيم عالية موجبة لعلاقات طردية بين فتحة الاصداف و ابعاد ملاقيط السرطان المستخدمة لغلق الصدفة عند تعرضه لهجوم ما (فإنه يسحب جسمه بكامله إلى الداخل ويسد فتحة قوقعة الرخوي بأحد ملقطيه أو بكليهما) في حين أنه تم تسجيل نتائج ضعيفة بين وزن جسم السرطان وكل من وزن وحجم الصدفة من الداخل على حد سواء. غير ان جميع قيم علاقات الارتباط سجلت معدلات معنوية ايجابية عالية تقترب من الواحد الصحيح . ويمكن تفسير ذلك فى ضوء المشاهدات الميدانية ونتائج دراسات سابقة لعدد من العلماء : ان المنطقى ان تتناسب فتحة الصدفة مع حجم ملاقيط السرطان ، وذلك لتحقيق الحماية من المفترسات (بمعنى ان السرطان يستخدم صدفة ذات فتحة يمكنه غلقها بملاقيطة ، لذا يبحث عن غيرها ذات فتحة اوسع عندما يزداد حجمه : علاقة طردية)، مغايراً لذلك قد تسلك بعض افراد عشيرة السرطان الناسك اختيار اصداف تفوق اوزانها، ربما يعزى ذلك لزيادة سمك الاصداف المستخدمة مثلاً، ايضاً قد يختار صدفة بها مساحات خالية من الداخل تفوق حجمه، ويعزى هذا لعملية التبيوض مستقبلاً بالنسبة للإناث، وهذا الانحراف فى السلوك بين الافراد هو ما يضعف العلاقة الطردية بين كل من : وزن الصدفة وحجمها الداخلى وبين السرطان على حد سواء. وربما يكون اختيار اصداف اكبر وزن وحجم عن وزن الجسم لعدم توافر الاصداف المناسبة بمكان المعيشة. و يدعم هذه الفرضية مشاهدات ميدانية لنزعة بعض صغار واناث السرطانات الناسكة لإختيار اصداف كبيرة الحجم نسبياً.

واخيراً فإن نتائج هذا العمل تشير الى عدم تأثير العوامل التى تم فحصها على حجم عشيرة السرطان الناسك القاطن لمحمية وادى الجمال (حيث اظهرت نتائج رصد وجود السرطان انه تواجد بكافة مواسم العام، مما يدل على تمتعه بمقاومة عالية للتغيرات البيئية القاسية مثل درجة الحرارة ، كما انه متنوع الغذاء فهو غير مقيد بنوع معين، اضافة لإستفادته من الضغوط السلبية الناجمة عن الانشطة البشرية فى تغذيته على النفايات المتخلفة عنهم)، لذا فقد اشارت النتائج ان العامل المقيد والمؤثر بقوة على زيادة او نقص حجم العشيرة لسرطان الارض الناسك تمثل فى توافر الاصداف المناسبة كماً وحجماً.