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NEW LOCALITY RECORDS AND MORPHOLOGICAL CHARACTERIZATION OF THE INVASIVE CRAB POPULATION *PERCNON GIBBESI* (DECAPODA: GRAPSOIDEA) IN THE EXTREME WEST OF THE GULF OF ANNABA (ALGERIA)

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PERCNON GIBBESI
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ABSTRACT. – This study describes for the first time the presence of the subtropical crab *Percnon gibbesi* (H. Milne Edwards, 1853) on east Algerian coasts. The morphology was studied on 102 individuals (10.2 ≤ length of carapace ≤ 41.05 mm) sampled from Cap de Garde (West of the Gulf of Annaba). The crabs were sampled by free diving (< 2 m), between October 2015 and March 2016. The morphology was characterized using 16 metric descriptors and five meristic descriptors (number of spines on the anterior margin of the five pairs of pereiopods). The different parts of the body were expressed as a function of the length and width of the carapace. Measurements on the left and right chela were based on the length and width of the left and right chela. Possible variations of these dimensions were sought using linear regression with the method of the least rectangle (reduced major axis). The mean numbers, modes and extreme values of each meristic descriptor were calculated and the means were statistically compared between the two sides of the crabs.

INTRODUCTION

The Mediterranean Sea is one of the most affected by exotic invasions (Streftaris *et al*. 2005, Zenetos *et al*. 2009, Quignard 2011). Indeed, there are 78 non-indigenous decapod species in the Mediterranean, including 20 in the Western basin (Zenetos *et al*. 2010). Among these are four decapods on the Algerian coasts (Grimes *et al*. 2016), which include the crab *Percnon gibbesi* (H. Milne Edwards, 1853). This subtropical brachyura is frequent in the rocky coasts of the subtidal zone (Félix-Hackradt *et al*. 2018). It belongs to the superfamily Grapsoidea and the family Percnidae (WoRMS 2019) and is considered to be one of the most invasive decapods in the Mediterranean (Cannicci *et al*. 2008).

Percnon gibbesi is native of the African and American inter-tropical Atlantic coasts as well as the American Pacific (Kerstitch 1989). It has been reported from Cape San Lucas on the California coast to Chile (Relini *et al*. 2000, Galil *et al*. 2002, GBIF 2015). On the West Atlantic coast, this species is found from North Carolina to Brazil (Marine species identification portal 2015, Williams 1965, 1984), whereas on the east Atlantic coast, its presence ranges from Portugal (Bouvier 1940) till the South African coasts (Barnard 1950).

In the Mediterranean, this species was reported for the first time in the Siculo-Tunisian strait, specifically on Linosa Island in 1999 (Andaloro 2000, Pipitone *et al*. 2001, Puccio *et al*. 2003), where it is considered to be exotic and invasive (Relini *et al*. 2000, Galil *et al*. 2002, Deudero *et al*. 2005, Cannicci *et al*. 2008, Katsanevakis *et al*. 2011, Otero *et al*. 2013, Stasolla *et al*. 2016, Suaria *et al*. 2017). Since its invasion, this species has colonized the entire Mediterranean basin where natural populations of *P. gibbesi* thrived rapidly (Cannicci *et al*. 2004, Deudero *et al*. 2005).

On the Algerian coast, the species was reported by Katsanevakis *et al*. (2011), following a point observation on the coast of Skikda in 2010, and in the western part of Algiers in the localities of Rais Hamidou and Sidi Fredj by Lamouti & Bachari (2011). In the extreme eastern region, the species was observed in 2012 for the first time on the coast of Annaba within 50 cm depth (Derbal pers obs).

This study aims to report the presence of *P. gibbesi* on the coasts of the extreme east of Algeria and provides the first data on the relative growth of this exotic species. It focuses on the morphological characterization of a fraction of the population of the Gulf of Annaba. Thus, this information is considered crucial to bring a better understanding of the species intrusion and expansion along the southern Mediterranean coasts.

MATERIALS & METHODS

The prospected area is located at Cap de Garde, at the west of the Gulf of Annaba, about 10 km north of the city (36°58'03.29"N 7°47'28.93"E) (Fig. 1).

The sampling area is shallow (–5 m), easy to access and protected from prevailing winds (Northwest) and hydrodynamic action by two small islands. The area is rocky and presents rug-

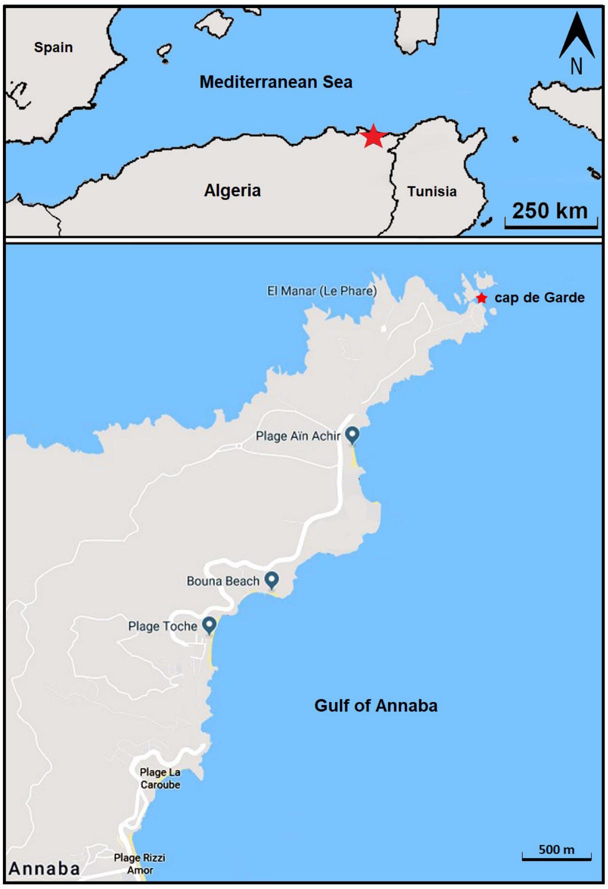

Fig. 1. – Geographic location and sampling location of *Percnon gibbesi* crabs.

Fig. 2. – Photo showing a group of *Percnon gibbesi* moving under a rock (Photo: A.A. Menail).

ged undersea features with blocks of varying sizes (scree, anfractuosities, and crevasses) (Fig. 2), partially covered with Chlorophyceae and Rhodophyceae. The rocks are often interspersed with tufts of very sparse *Posidonia oceanica* sea grass beds. The site explored is home to a classical Mediterranean biodiversity: echinoids (*Arbacia lixula* and *Paracentrotus lividus*), anthozoa (*Anemonia viridis*) and Teleostei fish (Sparidae, Scorpaenidae,

Fig. 3. – Different measurements taken on *Percnon gibbesi*. 1: LC (length of the carapace); 2: WC (width of the carapace); 3: LPLD (left postero-lateral distance); 4: LALD (left antero-lateral distance); 5: LLP (length of the left propodus); 6: LLD (length of the left dactyl); 7: LLc (length of the left chela); 8: WLc (width of the left chela); 9: TLc (thickness of the left chela). 10: number of spines (counted on each pereiopod). Measures 3 to 10 were also done on the right side of the crab.

Labridae, Blennidae, Gobiidae). The average temperature in the sampling area is estimated at 15 °C (Ayada *et al*. 2018).

Sampling was carried out during the day (daytime/daylight), by free diving, between October 2015 and March 2016, on an approximate coastline of 200 m, between 0 and –2 m. The duration of each dive varies between 1 h 30' and 3 h depending on the diver's physical condition and the state of the sea. Three techniques were used according to their leakage reaction to the diver: (i) manual capture when the crab evolves freely on the rock; (ii) pin with a thin metal rod when sheltered or (iii) trapped in a dip net when the animal attempts to conceal itself in an anfractuosity. All captured specimens were placed in a hermetically sealed, wide-necked plastic bottle and then transported before being stored in a –18 °C freezer.

Once the crabs were thawed, 16 different measures were taken on each intact crab; LC: length of the carapace, WC: width of the carapace, LLD: length of the left dactyl, LLP: length of the left propodus, LLc: length of the left chela, WLc: width of the left chela, TLc: thickness of the left chela, LPLD: left postero-lateral distance, LALD: left antero-lateral distance, LRD: length of the right dactyl, LRP: length of the right propodus, LRc: length of the right chela, WRc: width of the right chela, TRc: thickness of the right chela, RPLD: right postero-lateral distance, RALD: right antero-lateral distance (Fig. 3).

Then the number of spines on the anterior margin of the merus of the five pairs of pereiopods were counted with a stereomicroscope (× 30). Due to the presence of small individuals in the fraction of the population sampled, two different measurement methods were used: (i) the INGCO digital caliper (accuracy: ± 0.01 mm) for large individuals (LC > 13 mm), and (ii) macrophotography for small individuals (LC ≤ 13 mm). The principle of this method consists of making the necessary measurements using Leica LAS EZ software (version 2.0.0) from a previously calibrated photograph.

The different measured parts of the body were expressed as a function of the length (LC) and the width of the carapace (WC). The measurements made on the left and right chela were, respectively, expressed as a function of the length and the width of the left and right chela. In order to demonstrate possible changes in these dimensions, the method of least rectangles (reduced major axis) recommended by Teissier (1948) was used, the relationship between variables is linear. It is written as follows:

$$Y = b X + a$$

where b: slope of reduced major axis forced through the origin; a: constant and equal to "0" (because the equation is forced through the origin); X and Y: dimensions measured on the same individual.

The value of coefficient b is compared statistically with $b_o = 1$ at the threshold $\alpha = 0.05$ using Student's t-test (Dagnelie 1975).

Before performing the statistical analysis, normality of distribution were checked using Kolmogorov-Smirnov test supported by Shapiro-Wilk test ($\alpha > 0.05$).

The mean numbers, modes and extremes of each considered meristic variable were calculated. The means were statistically compared between the two sides of the crabs using the paired student t-test (Minitab version 13.2).

RESULTS

In total, we collected 114 crabs (74 males and 40 females) for a sampling effort of 12 hours, with an average of about 10 crabs per hour of free diving. To minimize sampling bias and assure the reliability of the results, individuals with amputated pereiopods were not counted in this present study. We performed metric measurements on 102 individuals (65 males and 37 females valid on the right and left side), of which 40 individuals (22 males and 18 females) were reserved for meristic characteristics. We also observed in the sample the presence of 7 berried females, representing 17.5 % of the female population.

Metric characters

Table I illustrates means, modes and extreme values of the metric characters in the total population of males and females of *P. gibbesi* of Cap de Garde. The length of carapace (LC) varied between 10.2 and 41.05 mm for total population, when it was between 10.81 and 41.05 mm for males and between 10.2 and 39.22 mm for females. The width of carapace (WC) of total population varied between 9.1 and 37.16 mm, in males it was between 9.39 and 37.16, and in females between 9.1 and 35.9 mm.

Table I. – Metric descriptors in the total population, males and females of *Percnon gibbesi*. Acronyms: L: left; R: right; Min: minimum; Max: maximum.

Pereiopods		Total population		Male		Female	
		L	R	L	R	L	R
LC	Mean	25.69		24.89		27.51	
	Mode	29.69		29.69		–	
	Min-Max	10.2-41.05		10.81-41.05		10.2-39.22	
WC	Mean	23.27		22.39		24.80	
	Mode	31.83		31.83		–	
	Min-Max	9.1-37.16		9.39-37.16		9.1-35.9	
LD	Mean	5.27	5.31	5.54	5.55	4.80	4.88
	Mode	6.26	5.27	1.72	6.83	5.85	5.27
	Min-Max	1.34-12.06	1.7-10.9	1.72-12.06	1.71-10.9	1.34-6.84	1.7-6.88
LP	Mean	5.62	5.62	6.40	6.35	4.24	4.33
	Mode	3.69	4.43	1.94	7.71	6.02	4.43
	Min-Max	1.4-17.34	1.45-13.64	1.47-17.34	1.45-13.64	1.4-6.21	1.49-6.94
Lc	Mean	9.87	9.90	10.70	10.65	8.41	8.57
	Mode	9.17	3	3.76	3.75	9.17	–
	Min-Max	2.88-25.91	3-22.31	2.88-25.91	3-22.31	2.88-12.33	3-11.98
Wc	Mean	5.7	5.81	6.41	6.50	4.43	4.57
	Mode	2.02	1.46	2.02	1.97	4.65	4.61
	Min-Max	1.4-15.07	1.46-13.75	1.4-15.07	1.46-13.75	1.4-6.47	1.46-7.19
Tc	Mean	3.26	3.24	3.54	3.52	2.77	2.74
	Mode	3.25	5.96	1.14	5.96	3.25	–
	Min-Max	1.09-7.53	1.02-7.46	1.14-7.53	1.08-7.46	1.09-3.85	1.02-3.86
PLD	Mean	10.41	10.36	10.24	10.19	10.69	10.66
	Mode	14.66	14.35	12.56	12.83	–	–
	Min-Max	3.62-17.78	3.51-16.99	3.67-17.78	3.81-16.99	3.62-15.21	3.51-14.9
ALD	Mean	14.2	14.83	13.83	14.33	14.83	15.69
	Mode	16.67	19.09	17.18	19.09	–	–
	Min-Max	5.79-22.68	5.72-23.09	5.79-22.68	5.8-23.09	5.81-21.69	5.72-22.4

Measurements correlated to the length and width of carapace (LC, WC)

In the total population (N = 102), the morphometric study revealed a significant correlation for all the measured descriptors (right and left) as a function of the length of the carapace LC and its width WC (L: $0.783 \leq r \leq 0.997$; R: $0.823 \leq r \leq 0.997$; $p \leq 0.05$). We recorded that all measured descriptors grew

Table II. – Allometric types and allometric coefficients in the total population, male and female of *Percnon gibessi* of the Cap de Garde, determined as a function of LC, WC, Lc and Wc. Acronyms: -: negative allometry; +: positive allometry, =: isometry.

Parameters	Total population				Males				Females			
	LC	WC	Lc	Wc	LC	WC	Lc	Wc	LC	WC	Lc	Wc
LC	–	(+) 1.04	–	–	–	(+) 1.04	–	–	–	(+) 1.03	–	–
LLD	(-) 0.48	(-) 0.5	(-) 0.72	(=) 0.99	(-) 0.5	(-) 0.51	(-) 0.71	(-) 0.96	(-) 0.46	(-) 0.47	(-) 0.73	(=) 1.06
LLP	(-) 0.48	(-) 0.5	(-) 0.71	(=) 0.99	(-) 0.51	(-) 0.53	(-) 0.74	(=) 0.99	(-) 0.42	(-) 0.44	(-) 0.67	(=) 0.98
LLc	(-) 0.07	(-) 0.7	–	(+) 1.38	(-) 0.69	(-) 0.72	–	(+) 1. 34	(-) 0.63	(-) 0.65	–	(+) 1.47
WLc	(-) 0.48	(-) 0.5	(-) 0.72	–	(-) 0.52	(-) 0.54	(-) 0.73	–	(-) 0.43	(-) 0.45	(-) 0.68	–
TLc	(-) 0.33	(-) 0.34	(-) 0.49	(-) 0.68	(-) 0.35	(-) 0.36	(-) 0.5	(-) 0.63	(-) 0.3	(-) 0.31	(-) 0.47	(-) 0.69
LPLD	(-) 0.71	(-) 0.73	–	–	(-) 0.71	(-) 0.74	–	–	(-) 0.71	(-) 0.73	–	–
LALD	(-) 0.85	(-) 0.84	–	–	(-) 0.81	(-) 0.84	–	–	(-) 0.81	(-) 0.84	–	–
LRD	(-) 0.4	(-) 0.5	(-) 0.72	(=) 0.98	(-) 0.5	(-) 0.52	(-) 0.72	(=) 0.95	(-) 0.47	(-) 0.48	(-) 0.73	(=) 1.05
LRP	(-) 0.49	(-) 0.5	(-) 0.72	(=) 0.98	(-) 0.51	(-) 0.53	(-) 0.74	(=) 0.98	(-) 0.43	(-) 0.44	(-) 0.67	(=) 0.97
LRc	(-) 0.68	(-) 0.7	–	(+) 1.37	(-) 0.7	(-) 0.72	–	(+) 1.33	(-) 0.64	(-) 0.66	–	(+) 1.44
WRc	(-) 0.49	(-) 0.51	(-) 0.73	–	(-) 0.53	(-) 0.54	(-) 0.75	–	(-) 0.44	(-) 0.46	(-) 0.69	–
TRc	(-) 0.33	(-) 0.34	(-) 0.48	(-) 0.66	(-) 0.35	(-) 0.36	(-) 0.5	(-) 0.66	(-) 0.29	(-) 0.3	(-) 0.46	(-) 0.66
RPLD	(-) 0.71	(-) 0.73	–	–	(-) 0.71	(-) 0.73	–	–	(-) 0.71	(-) 0.73	–	–
RALD	(-) 0.82	(-) 0.85	–	–	(-) 0.82	(-) 0.85	–	–	(-) 0.83	(-) 0.85	–	–

less rapidly than the length (LC) and the width of carapace (WC) (Table II).

In male population (N = 65), the different metric characteristics studied showed a significant correlation between all measured variables (right and left) and the length of the carapace LC and its width WC (L: $0.922 \le r \le 0.998$; R: $0.941 \le r \le 0.99$; $p \le 0.05$). The same type of growth was observed in males as for the total population, with minor allometric growth of all metric characters compared to the length and width of carapace (Table II).

In females (N = 37), the different metric characteristics studied have a significant correlation between all measured descriptors (right and left) and the length of the carapace LC and its width WC (L: $0.914 \le r \le 0.996$; R: $0.945 \le r \le 0.996$; $p \le 0.05$). Just like males and the total population, the minor allometry growth characterized all variables according to the length and width of carapace (15/15) (Table II).

Measurements correlated to the length and width of chela (Lc, Wc)

In the total population (N = 102), we found a significant correlation between all descriptors measured on left and right chela, and the length and width of chela Lc, Wc (L: $0.829 \le r \le 0.99$; R: $0.968 \le r \le 0.986$; $p \le 0.05$). All variables expressed minor growth according to length of chela (Lc), while half of the metric descriptors (4/8) grew at the same speed as the width of chela (LLD, LLP, LRD, LRP), two cases of majorant growth (LLc, LRc) and two others of minor growth (TLc, TRc) (Table II).

The morphometric study of the male chela (N = 65) showed a significant correlation between all variables measured on the right and left chela and the length and width of the chela Lc, Wc (L: $0.986 \le r \le 0.995$; R: $0.967 \le r \le 0.992$; $p \le 0.05$). The growth of different measurements as function of the length of the chela is similar to

Table III. – Statistical comparison (Student's t-test) between right and left side of the measurements taken at *Percnon gibbesi* for the total population, male and female. Acronyms: MC: metric characters; t_{obs}: t observed; p: probability; S: signification; n.s: not significant.

MC	Total population			Male			Female		
	t_{obs}	P	S	t_{obs}	P	S	t_{obs}	p	S
LD	–0.38	0.704	ns	–0.02	0.982	ns	–0.38	0.708	ns
LP	–0.25	0.800	ns	0.08	0.935	ns	–0.48	0.632	ns
Lc	–0.05	0.763	ns	0.06	0.957	ns	–0.44	0.664	ns
Wc	–0.63	0.532	ns	–0.16	0.873	ns	–0.71	0.482	ns
Tc	–0.07	0.944	ns	0.09	0.931	ns	–0.25	0.805	ns
ALD	–0.03	0.978	ns	0.09	0.930	ns	–0.07	0.943	ns
PLD	–1.73	0.087	ns	–0.77	0.446	ns	–1.34	0.189	ns

Table IV. – Meristic characters (number of spines) measured in the total population, males and females of *Percnon gibbesi*. Acronyms: P1-P5: Pereiopod 1-5; L: left; R: right; Min: minimum; Max: maximum.

Pereiopods		Total population		Male		Female	
		L	R	L	R	L	R
P1	Mean	4	4.12	4	4.22	4	4
	Mode	4	4	4	4	4	4
	Min-Max	3-5	4-7	3-5	4-7	4-4	4 – 4
P2	Mean	7.22	7.75	7.22	7.72	7.16	7.77
	Mode	7	7	7	7	7	7
	Min-Max	4-10	7-11	4-10	7-10	6-8	7 – 11
P3	Mean	8.88	9.1	8.90	9.13	8.83	9.05
	Mode	9	9	9	9	9	9
	Min-Max	7-10	9-10	7-10	9-10	8-10	9-10
P4	Mean	9.9	9.82	9.95	9.95	9.83	9.66
	Mode	10	10	10	10	10	10
	Min-Max	8-12	6-12	9-12	9-12	8-11	6-10
P5	Mean	9.67	9.72	9.63	9.72	9.72	9.72
	Mode	10	10	10	10	10	10
	Min-Max	7-11	6-11	7-11	7-10	9-10	6-11

that of total population, with dominance of minor growth (8/8). As function of wide of chela, we recorded 3/8 of cases that presented minor growth (LLD, TLc, TRc), three others expressed isometric growth (LLP, LRD, LRP) and two cases of majorant growth (LLc and LRc) (Table II).

The parameters measured on the female chelipeds (N = 37) right and left are significantly correlated with the length and width of the chela Lc, Wc (L: $0.968 \leq r \leq 0.983$; R: $0.89 \leq r \leq 0.982$; $p \leq 0.05$). All measured parameters (8/8) showed minor growth as function of chela length, just like total population and males (Table II). On the other hand and as function of chela width, we recorded that half of variables (4/8) showed isometric growth, with two cases of minor growth: thickness of left and right chela (TLc and TRc, respectively) and two others of majorant growth: length of left and right chela (LLc and LRc, respectively).

The statistical comparison between left and right side measurements showed no significant difference in the total population as well as in males and females of *P. gibbesi* (Table III).

Meristic characters

The number of spines measured on the 5 pairs of pereiopods of the *P. gibbesi* population in Cap de Garde are presented in Table IV and showed that the mode is identical on the left and right pereiopods of total population, males and females.

The statistical comparison of the number of spines between the 5 pairs of left and right pereiopods for the total population (N = 40), males and females, shows that apart from a very significant difference observed in the 2nd pair of pereiopods in the total population, the pereiopods 1, 3, 4 and 5 show no difference, the first pair of pereiopods in females has exactly 4 spines in both sides (Table V).

Table V. – Statistical comparison (Student'st-test) of the number of spines between the 5 pairs of left and right pereiopods of *Percnon gibbesi*. Acronyms: NC: numeric characters; t_{obs}: t observed; p: probability; S: signification; ns: not significant; **: very significant difference; -: similar number of spines.

NC	Total population			Male			Female		
	t_{obs}	p	S	t_{obs}	p	S	t_{obs}	p	S
Spines P1	–1.4	0.16	ns	–1.42	1.17	ns	–	–	–
Spines P2	–2.81	0.008	**	–1.86	0.07	ns	–2.09	0.05	ns
Spines P3	–1.94	0.06	ns	–1.31	0.20	ns	–1.46	0.16	ns
Spines P4	0.55	0.58	ns	0	1	ns	0.82	0.42	ns
Spines P5	–0.31	0.76	ns	–0.57	0.57	ns	0	1	ns

DISCUSSION

Across the western coast, *P. gibbesi* has for a fact gradually established itself and its spread ranges throughout the Gulf of Annaba. It has been reported on shallow rocky habitats throughout the Mediterranean basin (Pipitone *et al*. 2001, Félix-Hackradt *et al*. 2018 and Noe *et al*. 2018). We have also observed it in many other shallow rocky areas in the Gulf of Annaba, but with varying numerical proportion according to the explored sites during free diving (Beaches: Belvedere, La Caroube, Gassiot, Alzon, Draouch, Seraidi and El-Hanaya). At Cap de Garde, where this exotic brachyura thrives actively, we sampled on a linear transect of about 200 m a total of 114 specimens for a total of underwater sampling effort of 12 h, at the range of approximately ten individuals per hour of free diving.

At Cap de Garde, the largest specimen captured was a male with a length and a carapace width of 41.05 mm and 37.16 mm, respectively. The largest female sampled measures 39.22 mm for a width of 35.9 mm. The smallest individual is a female with a carapace measuring 10.2 mm in length and 9.1 mm in width. These metric values are higher than those described in the different populations observed in the Mediterranean basin. In Italy, Relini *et al.* (2000) reported the presence of a male with a length of 25 mm and a width of 23 mm. On the Tunisian coasts, the largest female and male individuals sampled are 25 and 39 mm long, respectively (Sghaier *et al.* 2011). The population of Egypt sampled by Azzuro *et al.* (2010) is of smaller size (LC = 17.5 mm, WC = 17 mm). On the Greek coasts, the carapace lengths measured are between 15 and 35 mm (Thessalou-Legaki *et al.* 2006). These differences in size between the riparian Mediterranean populations and those sampled at Cap de Garde can probably be explained by the favorable conditions in the studied area, such as the limitation of inter-specific competition for food and the diversity of refuges against predation and hydrodynamic action. In fact, the prospected area is shallow with a mixed bottom (rocks and *Posidonia oceanica* seagrass beds) consisting of numerous rocks of variable volumes and shapes (pebbles, faults, blocks, caves) with a strong cover of chlorophyte and rhodophyte algae.

The lack of precise information on the allometric growth of the different populations of *P. gibbesi* to its range does not allow a comparison of our morphometric results in a wider geographical context.

Overall, all observed allometry in the male population is almost always reflected in the total population. This is explained by the fact that males are predominantly represented in the sampled population (63.73 %, compared with 36.27 % of females), whereas other species of Grapsoidea in the Mediterranean have a predominance of females (Cannicci *et al.* 1999). This difference in sex ratio could be attributed to the short sampling period and the crab catching method. In our case, they were all caught manually using free diving.

This study allowed us to describe for the first time the presence of *P. gibbesi* on the east coast of Algeria. This species is very abundant at highly shallow depths. The population sampled by free diving includes different size categories with even the presence of egg-bearing females and very small individuals. All this information indicates the presence of a stable and reproductive population on Annaba coast. This species often evolves in small groups (1-5) in the subtidal zone, sheltering between the rocks and feeding mainly on algae.

In order to gain a better understanding of this exotic and invasive species and its impact on the native biodiversity and possibly on boundary ecosystems, it is important to complete this study across all Algerian East coasts and also on the Algerian coastline using various sampling methods, destructive (traps, manual capture, etc.) and non-destructive (visual counts). All the ecological studies (habitats of predilection, demographic structure, behavior, abundance, frequency, interspecific competition, etc.) and biological studies (growth, reproduction period, feeding habits, etc.), need to be carried out in the near future and are necessary, and even essential, for both the scientific community and the managers, in the perspective of initiating a monitored plan for this species and the other exotics invasive plants and animals species of the Algerian coast.

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