Growth of two river crab species of the genus Potamon (Savigny, 1816).

GROWTH OF TWO SPECIES OF RIVER CRABS OF THE GENUS *POTAMON* SAVIGNY, 1816 (BRACHYURA, POTAMIDAE)

BY

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Knowledge of the demography and the regulation of populations is a prerequisite for any action aimed at the sustainable exploitation of endangered species (Kokko & Lindstrom, 1998; Freckleton et al., 2003) or at the biological control of invasive forms (May et al., 1981; Tuyttens et al., 2000; Scalici & Gherardi, 2007). Therefore, it seems surprising that little is available in the literature about growth (i.e., increase of the length and weight) and dynamic potentialities (i.e., Von Bertalanffy parameters) of many decapod taxa, in particular species of river crabs. Growth represents the most useful parameter for providing an estimate of the fitness of a population and of its adaptation to a given habitat. In fact, the size of an individual is always correlated to its main biological processes, such as nutrition, predation, and fecundity (e.g., Sparre & Venema, 1996). Understanding crab population structure and dynamics, therefore, is of interest to both managers of freshwater resources and scholars of population dynamics.

This study aimed at improving our knowledge about the growth of two species of river crabs, *Potamon fluviatile fluviatile* (Herbst, 1785) and *P. potamios palaestinensis* (Bott, 1967), by applying the principles of fish stock assessment. In spite of many ecological and morphological studies on these two species (e.g., Vannini et al., 1983; Gherardi et al., 1987; Gherardi & Micheli, 1989; Micheli et al., 1990; Barbaresi et al., 2007), the lack of information in the literature about their growth potentialities is apparent. In this study, we applied the Length-Based Fish Stock Assessment (LFSA) approach (see Gayanilo & Pauly, 1997), based on an estimate of the growth parameters by modal progression analysis of length compositions

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(MPA, i.e., sequential plotting of size-frequency samples: for details see Gayanilo et al., 1989), to describe the population dynamics of the two species analysed. We also compared their growth rates in order to pin-point possible differences effectuated by environmental parameters.

We collected 265 individuals (103 females and 162 males) of *P. fluviatile fluviatile* in the Regional Reserve Monterano (Rome) in the summer of 2004 and analysed 300 individuals (143 females and 157 males) of *P. potamios palaestinensis* collected earlier from the Dead Sea area by Gherardi & Micheli (1989). The carapace length (CL) of each crab was measured using an eyepiece micrometer in order to generate polymodal frequency distributions. These were analysed by the Bhattacharya (1967) method, a routine of the FiSAT (FAO-ICLARM Stock Assessment Tools) computer program (Gayanilo et al., 1996). This method can decompose size-frequency distributions (here obtained using 2 mm CL range classes, fig. 1) into normal components, the latter being identified as cohorts. The program provides means (ME), standard deviations (SD), numbers of individuals per size class (N), and regression lines (and the respective R^2) for each Gaussian component. At the end of the separation process, the program also provides χ^2-test values.

The results obtained with the Bhattacharya method have been used to evaluate growth rate by a nonlinear regression analysis according to the Von Bertalanffy (1938) formula: $CL(t) = CL_\infty\{1 - \exp[-k(t - t_0)]\}$, where CL(t) is the carapace length at age t, CL_∞ the asymptotic carapace length, k the curvature parameter, and t_0 the initial condition parameter. Once the growth parameters were obtained, other population properties were evaluated, such as the growth performance index computed by applying the following equation: $Ø' = \mathrm{Log}\,k + 2\,\mathrm{Log}\,CL_\infty$, and the expected longevity computed by the equation: $t_{max} = 3/k$ (cf. Gayanilo & Pauly, 1997).

The two species significantly differed for their population structure (after the χ^2-test, *P* was always <0.05) (table I). Specifically, we obtained 5 age classes in *P. fluviatile fluviatile* (from 0+ to 4+) and 4 in *P. potamios palaestinensis* (from 1+ to 4+). In the latter species we did not observe the 0+ class due to the low number of small individuals. In both species, the two sexes shared the same number of age classes. We always observed a separation index $\geqslant 2$ between each pair of adjacent classes. In particular, $SI \geqslant 2$ denotes that two adjacent Gaussian components can be separated (Hasselblad, 1966; McNew & Summerfelt, 1978; Clark, 1981). Mean size values obtained from the program allowed us to compute the following Von Bertalanffy parameters: (1) $k = 0.32$, $CL_\infty = 44.70$, $Ø' = 2.81$, $t_{max} = 9.40$ for *P. f. fluviatile* females; (2) $k = 0.32$, $CL_\infty = 47.40$, $Ø' = 2.86$, $t_{max} = 9.40$ for *P. f. fluviatile* males; (3) $k = 0.62$, $CL_\infty = 48.42$, $Ø' = 3.16$, $t_{max} = 4.84$ for *P. p.*

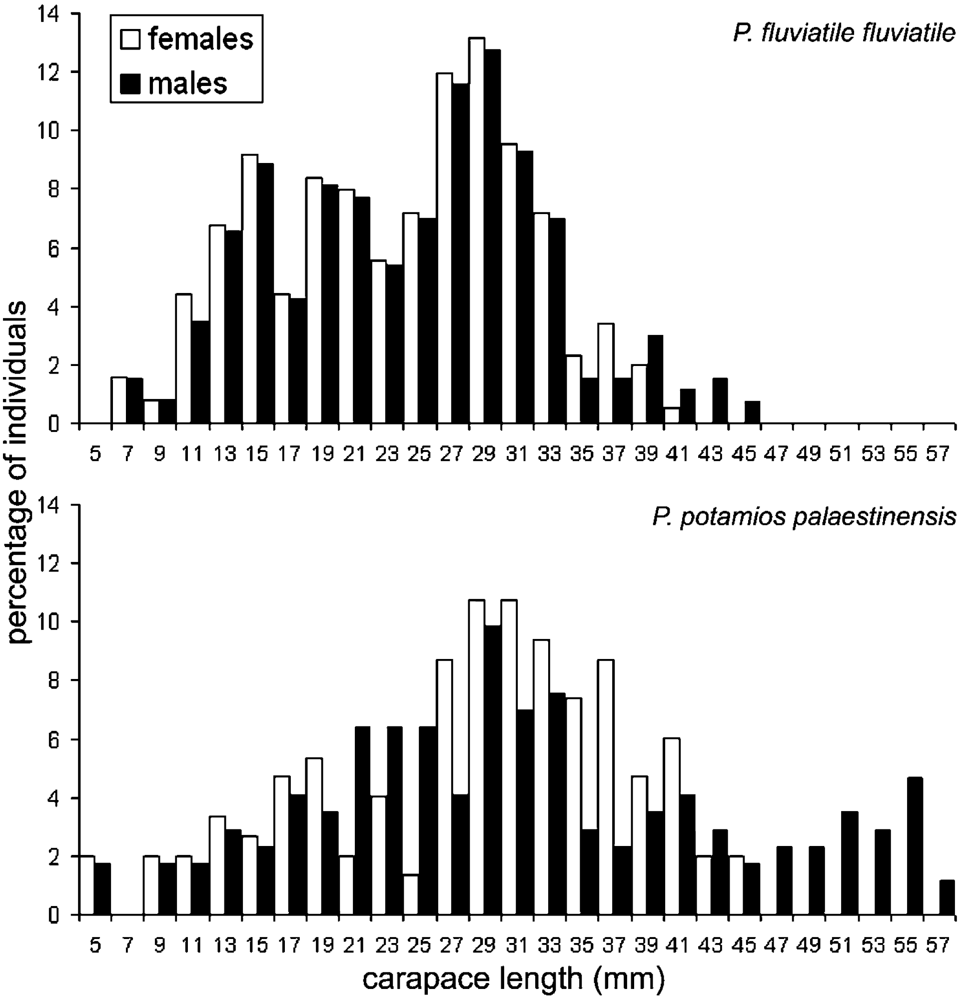

Fig. 1. Size-class frequency distributions of the analysed populations of *Potamon fluviatile fluviatile* (Herbst, 1785) and *Potamon potamios palaestinensis* (Bott, 1967).

palaestinensis females; and (4) $k = 0.60$, $CL_\infty = 60.16$, $Ø' = 3.34$, $t_{max} = 5.00$ *P. p. palaestinensis* males.

The two species also differed for their size-class frequency distributions: *P. p. palaestinensis* individuals reaching significantly larger dimensions than those of *P. f. fluviatile*, whereas both species were sexually dimorphic for their body size, males having a significantly longer CL than females.

Unfortunately, we cannot provide either a good description of the growth pattern of the analysed species or an exact comparison between them, due to the different times and ways of collection. Besides, data on the growth pattern of other river crabs are lacking in the literature. However, an interesting result of our study is

TABLE I

Results of the length-frequency analysis after the application of the Bhattacharya method on *Potamon fluviatile fluviatile* (Herbst), (Pff), and *Potamon potamios palaestinensis* (Bott), (Ppp). S.I. indicates separation index values; R^2 is the statistical output of the FiSAT computer program (always significant after t-test, P is always <0.05)

		Females				Males			
Species	Age class	Mean	St.Dev.	S.I.	R^2	Mean	St.Dev.	S.I.	R^2
Pff	0+	8.50	0.95	–	0.83	8.53	1.08	–	0.81
	1+	13.89	1.98	4.33	0.94	13.50	1.76	4.34	0.94
	2+	22.00	2.94	3.68	0.78	22.37	2.33	3.69	0.77
	3+	28.55	1.20	3.30	0.81	30.48	2.43	3.41	0.71
	4+	33.59	1.13	3.16	0.64	36.59	1.06	3.50	0.53
Ppp	1+	18.99	3.81	–	0.78	21.07	6.25	–	0.84
	2+	31.52	2.99	3.69	0.83	36.09	5.72	2.51	0.93
	3+	39.01	2.52	2.72	0.73	48.37	2.76	2.73	0.80
	4+	42.24	3.11	2.08	0.66	54.66	1.41	2.24	0.63

that *P. f. fluviatile* grows slower than *P. p. palaestinensis*, probably due to its longer intermoult period (in fact, the growing period may be longer in the Middle East). The higher growth rate of *P. p. palaestinensis* affects its longevity: the longevity of *P. f. fluviatile* is approximatively 2 times longer than that of *P. p. palaestinensis*. These differences may be related to the different geographic areas inhabited by the two species, being a possible reflection of the diverse environmental pressures to which they are subjected. Further studies (on fertility and fecundity) are needed to better characterize the ecological strategy (k- or r-selected) adopted by these two species of river crab.

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