Some biological characteristics of the marbled crab, *Pachygrapsus marmoratus* in the southern Black Sea (Sinop, Turkey)

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Abstract— The aim of the present study was to determine some biological characteristics of *Pachygrapsus marmoratus* in Sinop harbor, Black Sea, between July 2013 and June 2014. A total of 237 crabs, ranging from 20.12 to 50.92 mm in carapace width (CW) and 14.18 to 45.98 mm carapace length (CL) were collected monthly. Male:female ratio was found 1:0.1. The mean CW, CL, and weight (W) were determined as 39.70±0.42 mm, 35.43±0.35 mm, 28.72±0.74 g for males and 35.09±1.50 mm, 31.56±1.28 mm, 19.65±1.65 g for females, respectively. Correlation analyses were also conducted to reveal some size parameters relationships between males and females. The b values of CW and W for males and females were found 2.28 and 2.08, respectively. Negative allometric growth (Pauly's t-test, P < 0.05) was observed males and females of *P. marmoratus*.
The condition factor (CF) varied 30.94-72.31 with a mean 45.66±0.48. The highest mean condition factor (48.03) was recorded in March and the lowest (41.50) in August.

Keywords— *Pachygrapsus marmoratus, some biological characteristics, Sinop, Black Sea.*

I. INTRODUCTION

THE marbled crab, *Pachygrapsus marmoratus* (Fabricius, 1787) is a semi terrestrial crab in the intertidal belt of rocky shores, on breakwaters, pier piles and similar habitats throughout the Mediterranean Sea, Black Sea and northeastern Atlantic from Brittany to Morocco including the Canary Islands, the Azores and Madeira [1]-[2]-[3].
The intertidal species are active during aerial phases, while they shelter themselves in refuges during high tide or avoid submersion by migrating away from the water's edge. Most of these species rely on internal clocks as well as on external stimuli to synchronize their periods of activity and their migrations with the tidal phases [4]-[5]-[6]-[7]. *P. marmoratus* has a flexible omnivorous diet with prey intake mainly being hard-shelled organisms such as limpets, barnacles and mussels, as well as algae [7]-[8].
P. marmoratus is dominant intertidal brachyuran on the rocky Black Sea shore of Turkey, and its habitat includes the whole intertidal zone [9]-[10]. There are limited biological information about the species in this region [11]-[12]. In the

present study, we described the size composition, sex rates, length-weight relationships as carapace length and carapace weight of *P. marmoratus* on the Black Sea coasts of Sinop, Turkey.

II. MATERIALS AND METHODS

The marbled crabs were collected from Sinop harbor southern Black Sea between between July 2013 and June 2014. Marbled crabs were caught monthly by trammel nets (mesh sizes, 50-56-60-64 mm), from the depths raging 2 to 6 m. Distinction of sex was made based on typical characteristics of the abdomen [13]. The carapace width (CW) was measured from the tip of the left dorsal spine to the tip of the right dorsal spine and carapace length (CL) was measured with a vernier caliper from the edge of the frontal region near the eye to the base of the carapace back wall [14].

The length-weight relationship $W=a L^b$ was applied female and male marbled crabs, where W is the weight (g), L is the total length (mm) (CW and CL), and a, b are constants [15]. The Pauly's t-test was used to test of the calculated b values for females and males [16]. The significance of the regression (r) for the carapace width-weight data pairs was assessed by ANOVA, analyzed using ordinary least squares regression (95% confidence). Sex ratio was analyzed using Chi-square test ($\chi 2$). The condition factor (CF) was calculated as CF = (W/L^3) x 100 [17].

III. RESULT AND DISCUSSION

During the study, a total of 237 marbled crabs were collected, ranging between 20.12 to 50.92 mm in CW for males and 21.59 to 45.92 mm in CW for females, 14.18 to 45.98 mm CL for males and 20.34 to 40.32 mm CL for females. The mean CW and CL was found 39.70±0.42 mm, 35.43±0.35 mm for males and 35.09±1.50 mm, 31.56±1.28 mm for females, respectively. The total weights of marbled crabs were changed 3.92-52.22 g with a mean of 28.72±0.74 g for males and 5.45-36.19 g with a mean of 19.65±1.65 g for females. The mean CW and CL was significantly different for among males and males (P<0.05).

The sex ratio was estimated in favor of males 1:0.10 and the difference between the sexes was highly significant ($\chi 2$= 153.93; d.f.= 1; P<0.05). Other studies gave to the sex ratio (Females:males) 1:1.27 in Trabzon coasts of Turkey [11] and 1:1 in Ordu coasts of Turkey [12].

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The length-weight equation with CW was calculated $W=0.0066\,CW^{2.2817}$ ($r^2 =0.85$) for males and $W=0.0116\,CW^{2.0818}$ ($r^2 =0.91$) for females (Fig. 1). Negative allometric growth (Pauly's t-test, $P < 0.05$) was observed for each of the sexes marbled crabs with CW. The length-weight equation with CL was calculated $W=0.0068\,CL^{2.3373}$ ($r^2 =0.85$) for males and $W=0.0054\,CL^{2.3717}$ ($r^2 =0.96$) for females (Fig. 1). Negative allometric growth (Pauly's t-test, $P < 0.05$) was observed for each of the sexes marbled crabs with CL. Other studies gave also the similar results for b values as females (2.63) and males (2.87) with CW in Trabzon coasts of Turkey [11] and for females individuals 2.963 with CL in Ordu coasts of Turkey [12]. Also positive allometric growth was gave for males (b= 3.035) with CL and females (b=3.103), males (b= 3.065) individuals with CW [12]. The parameters of length-weight relationship may be affected by various factors, such as period, temperature, food, environmental conditions, stomach fullness, differences in age, stage of maturity and sex [16].
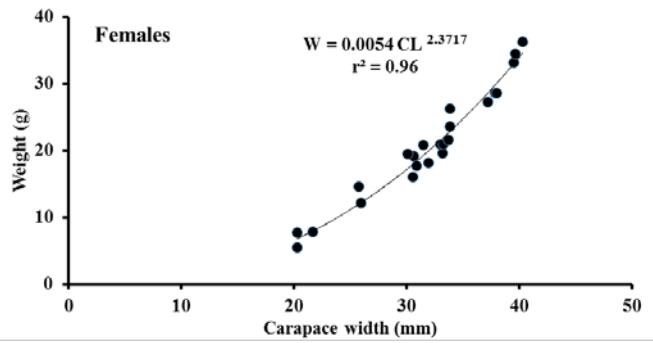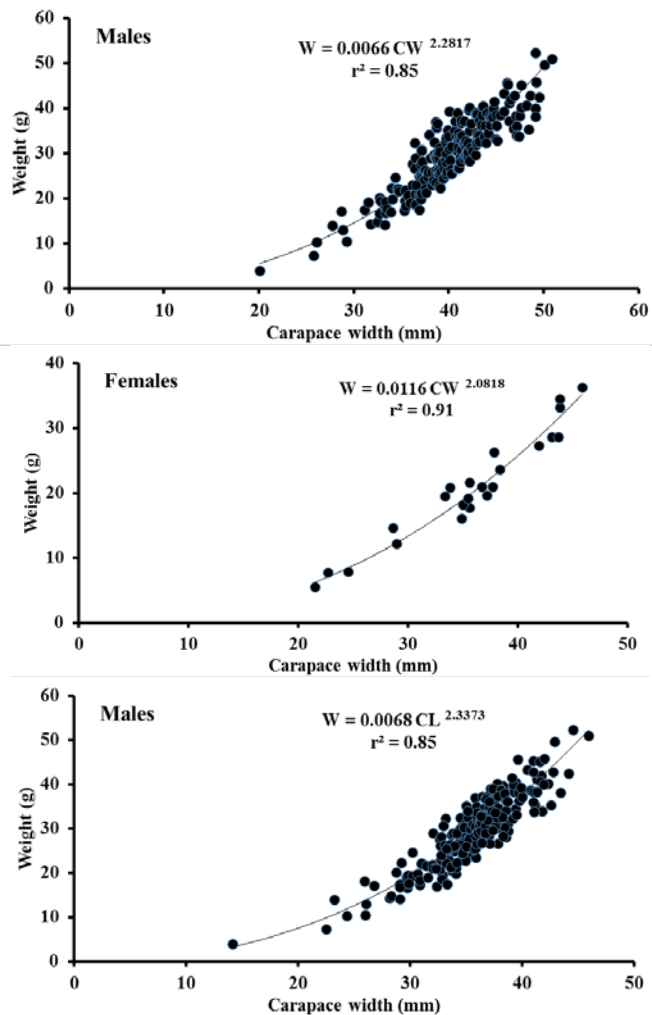

Fig. 1. Relationships between CW-W and CL-W for sexes

The relationships between carapace width and carapace length of marbled crabs was determined CL= 0.8456*CW+1.8389 for males and CL = 0.86 * CW + 1.1939 for females (Fig. 2). The highest correlation coefficient was obtained between CW and CL in both sexes (Fig. 2). There were also strong correlations between W and CW-CL for females and males.
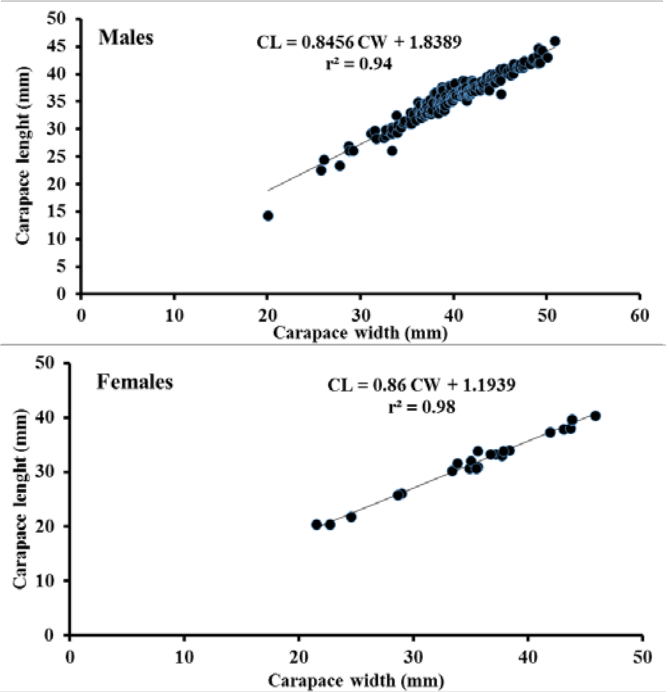

Fig. 2. The relationship between carapace width and carapace length of marbled crabs

Condition factor of marbled crabs ranged from 30.94 to 72.31 (with mean: 45.66±0.48). The highest mean condition factor (48.03) was recorded in March and the lowest (41.50) in August. In Ordu coasts of Turkey [12], the mean condition factors were gave as 49.03 for males and 45.79 for females. The highest monthly condition index (56.42) was recorded in March for males and (42.09) in May for females. In our study, similar results were found for the highest average condition factor (March).

This is the first study about some biologic parameters of the marbled crabs population in Sinop on the southern coast of Black Sea. The findings of our study will constitute an important database for future studies of *P. marmoratus* and of other crab species.

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