

Fecundity of the crab, *Potamon mesopotamicum* Brandis, Storch & Turky, 1998 from the Mesopotamian Marshlands, Iraq

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ABSTRACT

The Mesopotamian Marshlands of Iraq are the largest unique wetland in the Western Eurasia and have been subjected to great environmental changes which affected the population of the native crab, *Potamon mesopotamicum*. The fecundity of this species was studied as a basic indicator of their reproductive status. In the present study, the relationship between some biometric parameters and fecundity of the crab *P. mesopotamicum* from Tigris river of Qurna City, Iraq was determined. A total of 32 live ovigerous females were collected from Tigris river at Qurna city in December 2009. Fecundity ranged from 340 eggs per female (4.6 cm CW) to 800 eggs per female (6.6 cm CW), with an estimated mean of 568 eggs per female. Positive significant linear relationships were found between fecundity and carapace length (CL): $y = 155.15x - 145$, $r = 0.62$, $p < 0.001$, $n = 32$; carapace width (CW): $y = 143.31x - 221.5$, $r = 0.66$, $p < 0.001$, $n = 32$; Abdomen width (AW): $y = 212.3x - 104.3$, $r = 0.61$, $p < 0.001$, $n = 32$. The best correlation was found between CW and fecundity; Fresh weight (FW): $y = 4.30x + 280.80$, $r = 0.67$, $p < 0.001$, $n = 32$. Females were found to bear egg masses ranging between 2.0 and 3.35 gm. A mean egg diameter of 2.066 ± 0.105 mm. was estimated for different egg stages.

Keywords: Freshwater potamid crab, *Potamon mesopotamicum*, Fecundity, Mesopotamian Marshlands.

INTRODUCTION

The family Potamonidae are freshwater crabs represented by a large number of genera and species found in different habitats in Africa, Asia and Europe (Micheli, 1990; Brandis *et al.* 2000), as well as in other tropical and sub-tropical inland waters of the other continents (Srivastava, 2005; Cumberlidge, 2008). In Iraq the potamonids crabs consists of three species; *P. mesopotamicum*, *Potamon magnum* and *Potamon persicum* according to the revision of Brandis *et al.* (2000). These species were recorded from Tigris and Euphrates rivers, other streams, and from the Southern marshlands such as Al-Huwaizah marsh (Brandis *et al.*, 1998; Naser, 2009).

Shaw (1959) reported that crabs of the family Potamidae are physiologically well adapted to freshwater. Therefore, none of those species were recorded in the brackish water habitat of Shatt Al Arab estuary. The Mesopotamian Marshlands of Iraq are the largest unique freshwater wetland ecosystem in Western Eurasia and their biodiversity is considered of great value to the region and the world. It is providing habitats for a large number of important wildlife. Millions of native and migratory birds have been spotted in this region of Iraq, unfortunately, this ecosystem was subjected to great environmental changes during 1990 to 2003 when about 90% of the marsh area was drained. The Potamid crab, *P. mesopotamicum* was among several native

species of macrobenthic invertebrates which lost most of their natural habitat, and these species became ecologically threatened (Munro & Toaron, 1997; Partow, 2001).

However, only a few studies focused mainly on the taxonomy of Potamid crab of Iraq, whereas other biological aspects of this crab have never been studied. The aim, then, of the present study was to determine the fecundity of *P. mesopotamicum* after a few years of partially reflooding the marshes. Fecundity is the basic biological parameter for understanding the life cycle dynamics and the reproductive output of the animal population (Cobo & Okamori, 2008).

MATERIALS AND METHODS

P. mesopotamicum crabs were collected from the Tigris river at Qurna city north of Basrah city (31.34 12°N 47.30 11°E) during late December 2009. The crabs were manually captured by a skillful fisherman and placed in big plastic boxes containing enough river water, and transported to the laboratory of the Marine Science Center, within 2-3 hours. Fifty specimens were collected, consisting of 32 ovigerous females, 10 non-ovigerous females, and 8 males. The ovigerous females were reared in 3 tanks, each measuring

0.5 × 0.5 × 0.5 m, with 20 cm of river water. Carapace length (CL), carapace width (CW), and abdomen width (AW) were measured to the nearest 0.1 mm by a digital caliper. The fresh weight of the crabs was measured to the nearest mg by a digital Sartoreous type balance. All eggs from each ovigerous female were removed by forceps and the fresh mass of the total eggs was measured, and the mean egg diameter estimated by measuring 30 eggs with the aid of a binocular stereomicroscope fitted with an eye-piece micrometer. The Excel software programme was used for estimating and plotting the biometric relationships. Significant levels of the values were estimated from the critical values of the correlation coefficient table (Zar, 2010).

RESULTS

The estimated regression equations turned out to be significant positive linear relationships between fecundity and carapace length (CL): $y = 155.15x - 146.02$, $r = 0.62$, $p < 0.001$, $n = 32$; carapace width (CW) $y = 143.31x - 221.5$, $r = 0.66$, $p < 0.001$, $n = 32$; and abdomen width (AW) $y = 212.3x - 104.3$, $r = 0.61$, $p < 0.001$, $n = 32$ (Figures 1, 2 and 3). The best estimated relationship was found between CW and fecundity ($r = 0.66$, $p < 0.001$). Based on the examined ovigerous females, fecundity ranged

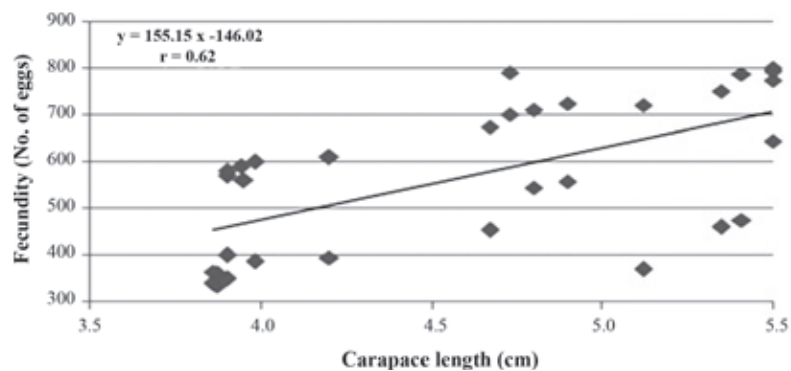


Figure 1. Linear relationship between carapace length (cm) and fecundity in *P. mesopotamicum*

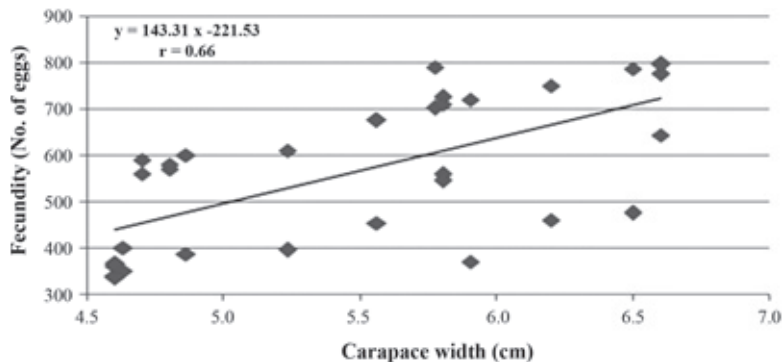


Figure 2. Linear relationship between carapace width (cm) and fecundity in *P. mesopotamicum*

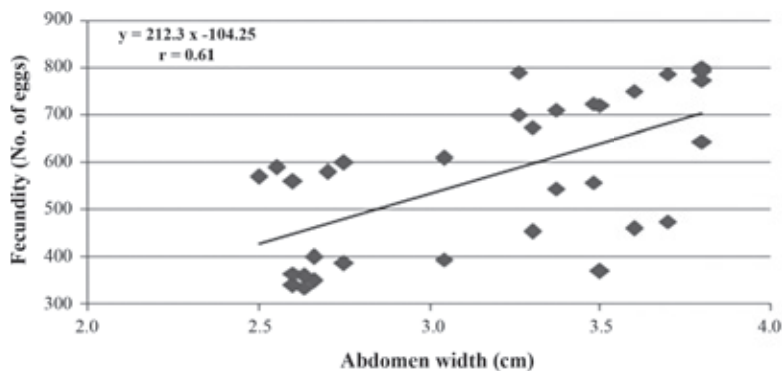


Figure 3. Linear relationship between abdomen width (cm) and fecundity in *P. mesopotamicum*

from 340 eggs per female of 4.6 cm CW to 800 eggs per female of 6.6 cm CW. However, an ovigerous female with a mean size of 5.51 cm CW and 3.17 cm AW was found to carry a mean number of 568 eggs.

A positive significant linear regression was obtained between the fresh weight of the ovigerous

females and the total number of eggs per female as: $y = 4.30x + 280.80$, $r = 0.67$, $p < 0.001$, $n = 32$ (Fig. 4.). The *Potamon* females were found to bear egg masses ranging from 2.0 to 3.35 g per female; and the estimated relationship between the egg mass per female and the number of eggs was statistically significant. It is represented by the linear equation: $y = 14.7 - 58x + 190$, $r = 0.52$, $p < 0.005$.

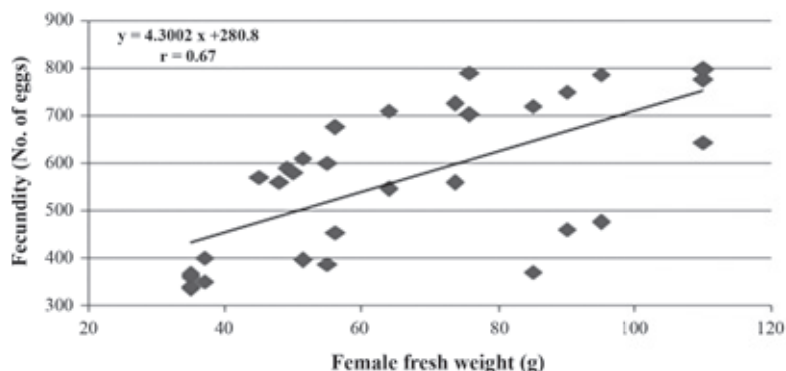


Figure 4. Linear relationship between female fresh weight and fecundity in *P. mesopotamicum*

Egg size

Embryonic development was arbitrarily classified into three stages:

Stage I: Yolk cells, yellow.

Stage II: Early blastula, embryonic tissue, orange.

Stage III: Limbs segmented and eyes pigmented, red.

The mean diameter of *P. mesopotamicum* eggs (30 eggs) was estimated to be 2.066 ± 0.105 mm.

DISCUSSION

As true freshwater brachyurans, the females of *P. mesopotamicum* hold relatively a small number of eggs, but they incubate the eggs under their abdomens and the broods are well protected by exopodites throughout the period of embryonic developmental stages (Micheli *et al.*, 1990). By this strategy, although the crabs produce a small number of offspring, the brood all hatch as small juveniles and therefore reducing mortality to a minimum. This is quite different from most marine and estuarine crab species which have

high fecundity but experience greater mortality, mostly by predation during the planktonic larval development period. Producing planktonic offspring is a strategy for dispersion and exploitation of new habitats. More details on these strategies have been discussed for the crab *Elamenessis kempfi* from the Shatt Al-Arab river system (Ali *et al.*, 1995). The present results show that the estimated relationship between biometric parameters and fecundity of *P. mesopotamicum* was a linear function of size, a general trend among brachyurans (Rana *et al.*, 2016). However, various recent studies presented a number of regression models ranging from simple linear relationships to more complex log-log relationships. In our results we found that the simple linear relationships are quite sufficient to represent significant positive relationships.

A comparison between the fecundity of *P. mesopotamicum* which ranged between 340 eggs for a female crab with carapace width of 4.6 cm and 800 eggs for a female crab with carapace width of 6.6 cm, and the fecundity of some other potamid crabs from various regions indicate the relatively high fecundity of the species being studied (Table 1). This finding was also observed in the brackish water crab *E. kempfi* from Basrah region (Ali *et al.*, 1995). It may reflect the high productivity of the Mesopotamian Marsh habitats.

Table 1. Fecundity of some potamonid crabs

Species	Locality	Fecundity	References
<i>Potamon koolooense</i>	India	124-375	Rana <i>et al.</i> 2016
<i>Candidopotamon rathbunae</i>	Taiwan	9-117	Liu & Li 2000
<i>Potamon fluviatile</i>	Italy	55-157	Micheli <i>et al.</i> 1990
<i>Potamon potamios</i>	Syria	75-215	Solong <i>et al.</i> 2015
<i>Potamon mesopotamicum</i>	Southern marshes, Iraq	340-800	Present study

CONCLUSION

The result of this investigation indicated that fecundity of the crab *P. mesopotamicum* can be a useful indicator of the environmental impacts on the native benthic invertebrates living in the Mesopotamian Marshlands of Iraq. Further studies on fecundity and other reproductive status of these populations are recommended to be carried out aiming at avoiding the extinction of these important species.

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