e-ISSN 2795-3248
p-ISSN 2795-3222

10.5281/zenodo.7936795 Vol. 06 Issue 05 May - 2023 Manuscript ID: #0827

FECUNDITY OF THE INVASIVE HEPU MITTEN CRAB, ERIOCHEIRHEPUENSIS DAI, 1991 (GRAPSOIDEA: BRACHYURA) FROM SHATT AL- ARAB AND ARABIAN GULF. IRAQ

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ABSTRACT

The present study was carried out to investigate the fecundity of species of Branchyuran crustaceans **Eriocheirhepuensis** Specimens were collected from different regions of Shatt-Al-Arab river, North-West Arabian Gulf and Khour Abdulla during the period from Autumn 2016 to Summer 2017 by fishing trawl net. The total wet weight of specimens ranged between (92.27-199.27) gm. The crab's carapace lengths were between (4.2 - 9.4) cm.Absolute fecundity was found to be from (252331.4 – 1636153.4) eggs/female. The relative fecundity ranged between (2181 – 13440.1) eggs/gm. The correlation values at the probability level of 0.05 betweenabsolute fertility rate with carapace width and total weight were r=0.93, r=0.96 respectively.

Eggs development stages in *E.hepuensiscrabs* are divided into seven stages.The objective of this study was to measurements the fecundity for assessing population reproductive dynamics and energetics and for estimating the annual reproductive output and how it is linked to recruitment and population growth.

KEYWORDS:

Eriocheirhepuensis, Fecundity, Hairy crabs, Hepu mitten crab, Invasive crabs.

Introduction

Native to China the Korean peninsula and Japan hairy crabs spend most of their lives in freshwater but return to saltwater for mating spawning and larval development. Migrating to the sea every autumn adult die after mating, Acrab's life cycle ends when the initial stage passes into fresh water (Hymanson*et al.*, 1999; Zang*et al*., 2001). *Eriocheirhepuensis* has become the most famous brachyuron species on the planet. It is one of only two crabs on the list of the world's 100 most invasive aquatic invertebrates (Lowe *et al*., 2004).

The four species of hairy crabs (called in South and East Asia) or crabs (people in Europe) are now assigned to *Eriocheir* De Haan 1835 (Brachyura: Grapsoidea: Varunidae) originally E. japonica (De Haan 1835) and *E. sinensis* H. Milne Edwards, 1853 and recently *E. hepuensis* Dai, 1991 and *E. ogasawaraensis* Komai Yamasaki Kobayashi Yamamoto and Watanabe, 2006 (Ng *et al*., 2008).

Wójcik and Normant (2014) described the stages of ovarian maturation and the stages of embryonic development in Chinese cancer *E.sinensis* in the south of the Baltic Sea, as samples were collected during the fall and winter from 2005 to 2012, and the width of the carapace in pregnant females ranged between (55.2-78.1) mm, And the width of the shield was not significantly associated with the developmental stages of the ovaries, and the results indicated that the low salinity in the south of the Baltic Sea gives a greater opportunity for mating, fertilization and embryonic development, and the low salinity levels help in the hatching process and the completion of the larval life cycle.

As for the appearance of the egg mass, Kobayashi (2001) appeared that the fecundity increased with increasing carapace width (CW)and decreased in the later ovipositions, estimated to range from 120000 (40mm clockwise) at first spawning to 600000 (70mm) and up to 80000 at first spawning, the second is 300000 the third is 20000-80000, females lay three eggs during the breeding season and die without moulting, given the energy costs of migration it may be more beneficial to use all the energy stored within a group, after entering the breeding season they give birth to many offspring before their physical strength runs out. Lifetime fertility potential can be estimated from total fertility, the range is from 230000 (40mm clockwise) to 980000 (70mm), both the mature size and first spawning fruit of *E. japonica* crabs are larger than other marine grapsid crabs but the regression line describing the CW fecundity relationship is the same as other grapsid crabs, the increased fertility per pup compensates for the larger adult size.

Fertility in 32 females *Potamonmesopotamicum* specie collected from the Tigris River has been studied as a primary indicator of reproductive status, and study several biometric variables were determined to determine growth relationships in *P. mesopatomicum* , estimates ranging from 340 per female (CW 4.6 cm) to 800 per female (CW 6.6 cm) with an average of 568, female egg masses were found to be between 2.0 - 3.35 g, the mean egg diameter was 2.066 ± 0.105 mm, different egg levels are evaluated (Ali and Al-Maliky, 2017).

The purpose of this study was to determine the abundance of *E. hepuensis* and studied fecundity to measure how many new individuals are being added to a population.

MATERIALS AND METHODS

Bottom trawling samples of the Chinese invasive crab *E.habuensis* used in fisheries were collected in the Khor Abdullah and Al-Mamar areas. Samples were stored in the refrigerator directly before reaching the laboratory. They were divided into males and females and morphoanatomical and physiological measurements were taken. Reproductive system Fertility and reproductive function. The wet samples were weighed using a Chinese Sartorius balance and then the length and width were measured. Use a ruler and vernier to measure the length of the shield and door hook. Samples were dried at 60°C for 24 hours in a US-made adhesive oven to determine dry weight.

Fecundity

Absolute Fecundity

Fertilization rate refers to the number of eggs present in each female's ovaries at 7 months of fertilization. The fertility of full-mature females of both types (90) was investigated. Eggs were separated to calculate the fertility rate. Eggs were weighed using a high-sensitivity balance and then four samples were taken. Secondary samples from different places in the egg mass. Each secondary sample weighed 01 g. Next the number of eggs in each secondary sample was averaged. Fertility was calculated according to the following formula (Kumar *et al*. 2003).N=W×n/w

Since:

N = fertilityW = egg mass weightw = average weight of the four secondary samples

N = the average number of eggs in the samples

Relative Fecundity

Relative fertility represents the ratio of the number of eggs to the female body weight, and the relationship between fertility and carapace width was expressed by the following equation: F=aLb

So that

F = fertilityL = shield widtha , b are constants

As for the relationship between fertility and body weight, it was represented by the following equation: F = aWb

So that

F = fertilityW = body weighta, b are constants

Results

Phenotypic measurements were taken for 80 males and females of Chinese river crab *E.hepuensis*. Their lengths range from (3.3-8.0) cm and (4.8-6.8) cm, and the carapace width ranges from (4.2-9.4) cm and (3.4-8.8) cm.

The wet ones weighed from (76.17-299.34) grams and (29.27-199.27) grams, respectively.

Absolute fecundity

Fig.1 showedthe absolute fertility rate (egg/individual) of the female Chinese crab *E.hepuensis* and its range Between (252331.4 - 1636153.4) eggs / individual, and the results of the statistical analysis showed that there were no significant differences (p>0.05) in the measure of absolute fertility between seasons.

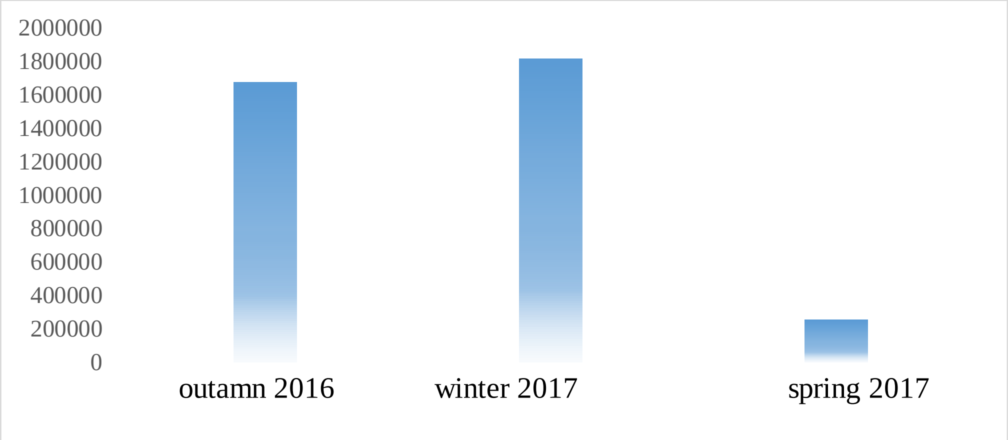

Fig. 1. Absolute fertility (egg/individual) in female Chinese crab *E.hepuensis*

Carapace width (cm) and total weight (g) were associated with absolute fertility in Chinese crab *E.hepuensis*.with a direct relationship. As the correlation coefficient between fertility and shield width was r = 0.93, while the correlation coefficient between Fertility and total weight r=0.96 (fig.2.fig.3)

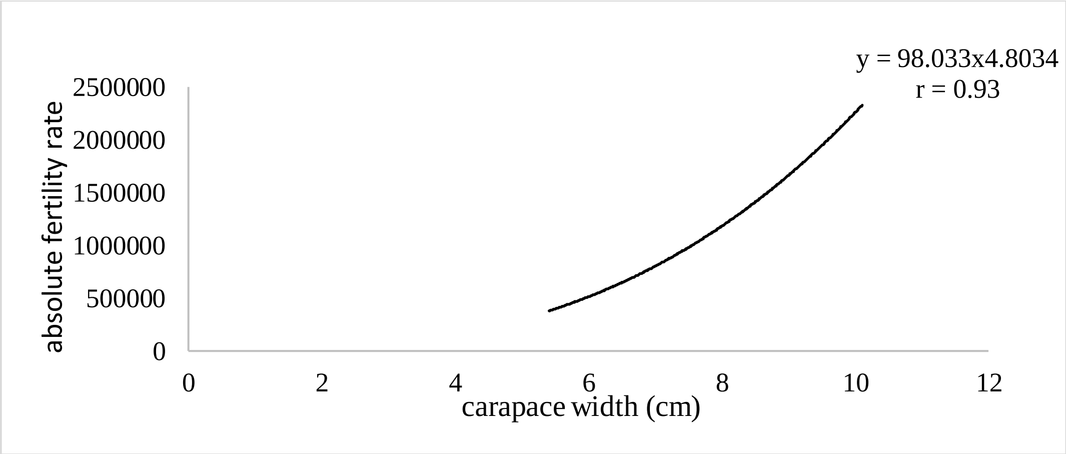

Fig. 2. Relationship of absolute fertility rate with carapace width (cm) in female Chinese crab *E.hepuensis*

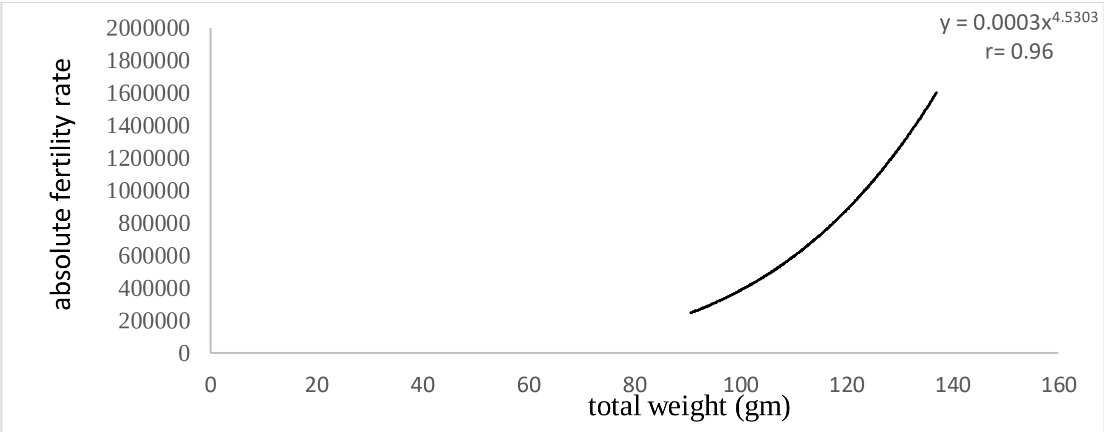

Fig. 3. Relationship of absolute fertility rate with total weight (gm) in female Chinese crab *E.hepuensis*

Relative Fecundity

The spirit of the relative fertility rate of female Chinese crab *E.hepuensis* between (2181 - 13440.1) eggs/g The results of the statistical analysis showed that there were significant differences. 0.05 (fig. 4).

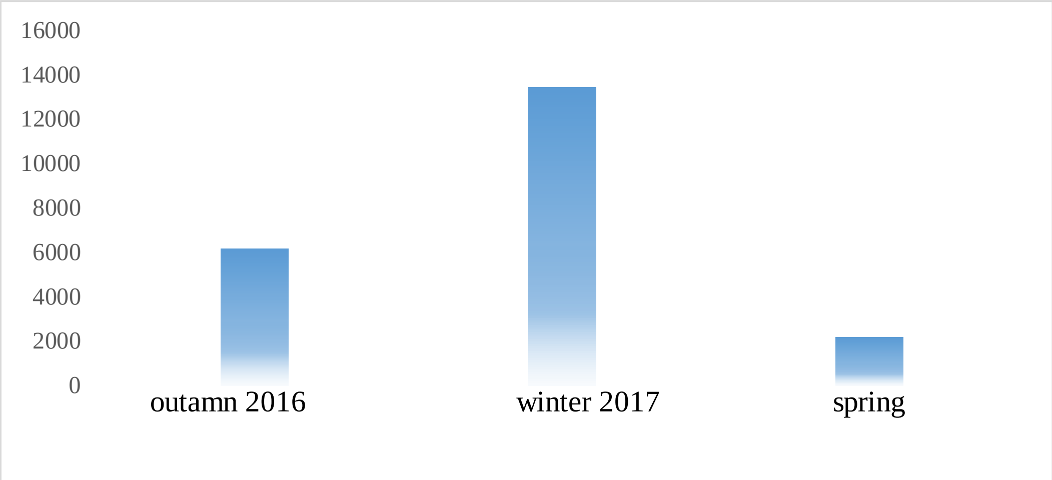

Fig. 4. Relative fertility (egg/gm) in Chinese crab females *E.hepuensis*

Eggs development

Egg development stages in *E.hepuensis*crab are divided into seven stages starting with egg size differentiation. Embryo development from the external egg. Fig. 5 explain The female Chinese crab *E.hepuensis* egg-bearing. The first stage is characterized by the small size of the egg pale yellow color and invisibility of any part except the yolk. The second stage is marked by yellow color and the yellow mass begins to move from side to side and a small space appears between the mass and the egg shell. Third stage eggs have a dark yellow shell and a large space in the center of the yolk. In the fourth stage the shape and color of the egg does not change much from yellow to orange. In the fifth stage there is an increase in the size of the egg-shaped eye spot and the orange color. In the sixth stage the eggs are brownish-black and eye spots begin to appear. In the seventh stage the eyes are large and dark in color and the embryos organs begin to separate and the baby is ready to emerge.

Fig. 5. The female Chinese crab *E.hepuensis* is egg-bearing

Discussion

The fertility and size of the eggs that females incubate are so important to the life of an organism that the fertility of an individual is compared to the size of the eggs she carries and species generally lay smaller eggs. They are more fertile than larger egg-laying species (Kangas, 2000).

The environment in which an individual lives affects the size of eggs which in turn affects fertility. Freshwater species are less fertile than saltwater species due to their larger eggs as noted by Ramirez-Liodra (2002).

Factors affecting reproductive performance closely related to geographic location are environmental factors such as food abundance temperature salinity timing of reproduction and metabolic rate. Fischer *et al.* (2009) pointed out that carapace width hook size and leaf size are important factors affecting embryo development.

The relationship between female body weight and egg weight is one of the important relationships for estimating potential yield related to fishery management (Cooper *et al*. 2013). Muino (2002) described that relative fertility is influenced by several factors including environmental factors such as female size diet and gonadal development.

And egg yolk formation is highly dependent on the quality and quantity of natural food as it affects the number of eggs produced (Darnell *et al*. 2009). The results showed a positive correlation between egg weight and female weight (relative fertility) and this may be related to the fact that most of the individual's weight is used for food energy production. Some of these forces lead to growth when the eggs are young (Dickinson *et al*. 2006). Several studies in Brachyuran have shown that increasing female size does not only increase fertility as Litulo (2004). The study on the species *Ucaannulipes* and this due to the large differences between different environmental conditions in the availability of food sources and the extent of predation and competition issues.

The present study characterizes eight developmental stages of blue swimmer crab and Chinese crab eggs. Stages of egg development in crustaceans were determined by Bawab and El-Sherif, (1988) and Ravi *et al.* (2013) who divided the stages of egg development into eight stages in blue crabs while Stewart *et al*. (2007) divided them into four stages.

Larger eggs contain more yolk and are food for the embryo because the larvae depend on the stored yolk. The size of the egg gradually increases until it reaches the hatching stage and the size of the egg changes. Female size has a significant effect on oocyte number and size due to expansion of abdominal space for pregnancy and subsequent production of large numbers of eggs according to different climates and regions (Sethi*et al.*, 2014). Larvae with a high survival rate have sufficient vitelline material for larval nutrition and development. This occurs in the mangrove crabs *Goniopsispuluchra* and *Eratuspisoni* (Hendrickx and Guerrero, 2004).

Distinct egg color change during embryonic development is common in crustaceans (Sigana 2002). The color changes as the yolk absorbs and changes from bright yellow to reddish orange. The color darkens with respect to the eyes (Parimalam 2001; Walker and Mohan 2009). because changes in the size and shape of the uterus are one of the most important factors in measuring the degree of maturity and one of the things to consider is the measurement of reproductive functions of GSI and its levels. Importance of knowing egg development stage for determining hatching period and managing fish culture

Fertilized eggs are filled with small yolk granules and surrounded by an envelope. A structural mass is formed that fills the front edge and center of the egg then several organelles appear in the center which form the internal organs and cells then coalesce to form a large mass that fills the egg. Then the eyes on both sides of the egg are shown in black and the final stage is marked when the internal organs are shown. The embryo is clearly visible and the hooks and legs are visible in the pre-hatching stage and this stage has been recorded in individuals of Brachyuron species (Sarkar*et al*. 2009).

There was no significant difference in Chinese crabs. The size of the eggs and their color depends on the pollination that takes place over time.

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