e - ISSN – 2393-9672

European Journal of Environmental Ecology

Journal homepage: www.mcmed.us/journal/ejee

IMPACT OF RAINFALL AND WIND SPEED ON THE POPULATION DYNAMICS OF A FIDDLER CRAB, *UCA ANNULIPES* (H. Milne Edwards, 1837) AT MUTTUKADU ESTUARY, EAST COAST, TAMILNADU, INDIA

P. Arunan* and P. Sekhar

PG & Research Department of Zoology, Voorhees College, Vellore – 632001, Tamil Nadu, India.

Corresponding Author

P. Arunan
Email:- arunan_paul@yahoo.com

Article Info

Received 10/04/2015; Revised 29/05/2015
Accepted 05/06/2015

ABSTRACT

Impact of rainfall and wind speed on the population dynamics of the fiddler crab *Uca annulipes*, was investigated during a one-year period in the Muttukadu estuary, East coast, Tamil Nadu, India. The study specifically addressed factors such as absolute density, sex ratio and population structure. Six transects were bordered in a mangrove area of Muttukadu estuary. Monthly, two transects were randomly selected and visited. On each transect, ten 0.50 m^2 were sampled during low tide periods from April 2013 to March 2014. The data on monthly rainfall and wind speed was collected from the Regional Meteorological Centre, Nungambakkam, Chennai – 06. Totally 1158 crabs were collected of which 537 were male (46.37 %) 452 were female (39.03%) and 169 were young ones (14.60 %) during the study. Ovigerous females were present in all samples with greater frequencies in January 2014 whereas the highest young ones were present in October 2013.

Keywords: *Uca annulipes*, population dynamics, Sex ratio, Rainfall, Wind speed.

INTRODUCTION

Fiddler crabs of Genus *Uca* are a well characterized and diversified group of intertidal crabs inhabiting tropical and subtropical estuaries and mangroves of the old and new world [1,2]. The fiddler crab *Uca annulipes* has a widespread distribution and typically is a dominant species in the mangrove crab communities [3].

Fiddler crabs (genus *Uca*) are common intertidal inhabitants of marshes, salt flats and mangroves swamps along tropical, neotropical and temperate coastlines [2,4,5]. These crabs build complex burrows in substratum and display particular behaviour associated with burrow utilization [5]. Burrowing and foraging activities of fiddler crabs promote bioturbation of estuarine intertidal flats [6]. They also remove large amounts of sediment and change substrate characteristics, increasing water and organic matter contents, and changing the nutrient dynamics, which affects micro biotic growth and stimulates vegetal production [7,6].

Therefore the overall objective of this study was to investigate the absolute density, sex ratio and population structure with the relation to rainfall and wind speed to better understand life history strategies of fiddler crabs in this estuary.

MATERIALS AND METHODS

Muttukadu estuary located on the East Coast of Kanchipuram District, Tamil Nadu, India 30 Kms away from Chennai was chosen for this study: 13º 05' N, 80º 22' E. Six transects was bordered in a mangrove area of Muttukadu estuary. Monthly, two transects were randomly selected and visited. On each transect, ten 0.50 m^2 were sampled during low tide periods from April 2013

to March 2014. Crabs were collected by digging the burrows and removing the crabs. Cheliped size, abdominal morphology, and the number of pleopods assessed the sex of each crab. The ovigerous condition was also noted, sexed and checked for the presence of eggs on female pleopods. The data on monthly rainfall and wind speed was collected from the Regional Meteorological Centre, Nungambakkam, Chennai – 06.

RESULTS

During the sampling year from April 2013 to March 2014 totally 1158 crabs were collected. The number of male crabs (537) were collected (46.37 %) of which 318 (59.21 %) were having giant cheliped on right side and 219 (40.79 %) were having giant cheliped on left side, out of 452 females (39.03%) 309 were ovigerous females (68.36%) and 143 were non ovigerous females (31.64%). Only 169 young ones (14.60 %) were recorded. The highest abundance of males were recorded during June and October 2013 (Fig. 1 and Table 1). The maximum number of females were observed during January 2014. During the study period maximum rainfall 223.6 mm was recorded in the month of October 2013. No rainfall was recorded in the month of March 2014 (Fig. 2 and Table 2). Highest wind speed 9 Kmph was recorded in the month of May 2013. Whereas the lowest wind speed 5 Kmph was observed in the months of October 2013 to February 2014 (Fig. 3 and Table 3).

Table 1. Summarized population dynamics data of fiddler crabs in Muttukadu Estuary from April-2013 to March-2014

Months	Males	Females	Ovigerous	Young Ones
April	30±1.448	*38±1.030	*21±0.444	*7±0.628
May	41±1.018	*25±0.831	*17±1.387	*12±0.496
June	53±0.272	*31±1.030	*23±1.030	*5±0.608
July	44±1.295	*40±0.521	*29±1.030	*11±0.628
August	50±0.902	*45±0.981	*32±0.628	*8±0.566
September	46±1.431	*33±1.405	*20±0.471	*17±0.753
October	53±1.594	*35±1.648	*22±0.801	*21±0.496
November	47±1.777	*40±0.608	*28±0.496	*13±0.753
December	45±0.566	*38±1.266	*24±0.874	*9±0.444
January	48±0.831	*50±0.608	*38±0.521	*14±0.521
February	42±0.737	*35±0.942	*22±0.444	*18±0.753
March	38±1.405	*42±1.515	*33±0.720	*13±0.608
Total	537	452	309	148

Values are expressed as mean ± SEM *p < 0.001.

Table 2. Rainfall in mm of the study area from April-2013 to March-2014

Months	Rainfall
April	0.4
May	54.2
June	164.3
July	148.3
August	168
September	179.2
October	223.6
November	181.8
December	81
January	1.4
February	6.2
March	0

Each Value is mean of monthly rainfall.

*Source: Regional Meteorological Centre – Nungambakkam, Chennai.

Table 3. Wind speed in Kmph of the study area from April-2013 to March-2014

Months	Wind speed
April	5±0.384
May	9±0.544
June	8±0.769

July	6±0.521
August	6±0.544
September	6±0.628
October	5±0.471
November	5±0.351
December	5±0.587
January	5±0.566
February	5±0.444
March	6±0.521

Each Value is mean of monthly wind speed.
Kmph – Kilo meter per hour *Source: Regional Meteorological Centre – Nungambakkam, Chennai.

Figure 1. Population dynamics of *Uca annulipes* in the study area from April-2013 to March-2014

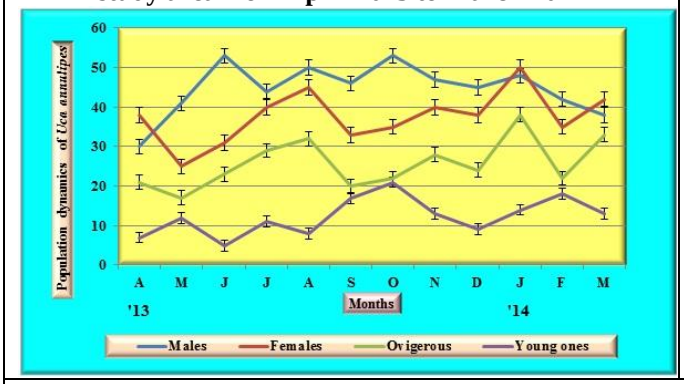


Figure 2. Rainfall in mm of the study area from April-2013 to March-2014

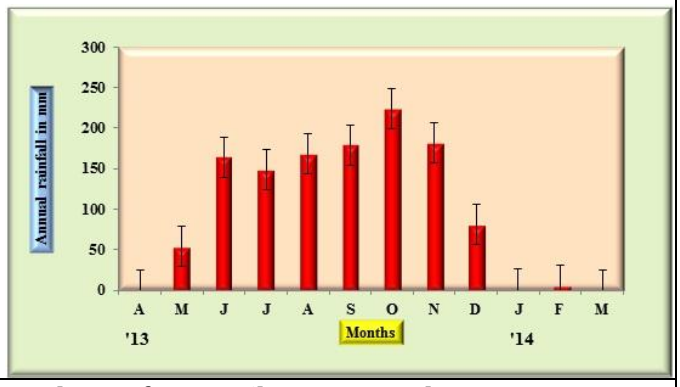
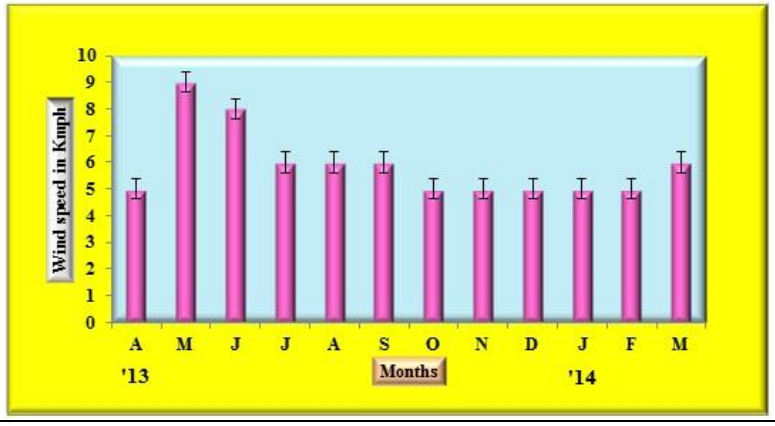


Figure 3. Wind speed in Kmph of the study area from April-2013 to March-2014



DISCUSSION

Many earlier workers have reported that spawning in the rainy season may provide a selective advantage to intertidal brachyuran populations since those periods of higher rainfall rate can cause changes in the salinity of water and promote an increase of nutrients concentration, favoring the development of planktonic larvae, and increase primary productivity of the seawater [8,9]. It has been reported that at the same time, spawning in the rainy season may facilitate larval transport in to deeper channels where larval predation is lower [10-15].

It has been reported that in the monsoon rains and salinity of the media affect the breeding pattern in three crustaceans, *Uca annulipes*, *Portunus pelagicus* and *Metanpenaeus affinis* [16]. The influence of rainfall on the reproductive activity in the fresh water crab, *Barytelphusa cunicularis* has been reported [17]. It has been reported that sea temperature plays an important role for better reproductive pattern in marine invertebrates [18]. It has also been reported that in two species of *Scylla* of Pulicat Lake, the reproductive pattern is completely based on the influence of temperature and salinity [19].

Researchers have worked on the breeding biology of an anomuran crab, *Emerita asiatica* and has reported that females withstood low salinity, percentage of males are more during high temperature seasons, more females during high water temperature, humidity and

wind speed, sex ratios varied according to seasons and does not exhibit 1:1 ratio, a direct relationship was seen between carapace length and fecundity ratio, a direct relationship between ovarian development and egg stages and a direct relationship between number of eggs and the carapace width [20].

The monsoon rains affect the breeding pattern, egg development and subsequent release of larvae of estuarine and coastal decapods by changing the salinity content [16, 21]. The researcher have reported that there was a relationship between rainfall and reproduction in *Macrobrachium malcolmsonii* [22]. Scientists have recorded the release of young ones which depend mostly on North-East monsoon rains and hence considered the field crab, *Paratelphusa hydrodromous* as an annual breeder [23]. In large number of animals rainfall may influence reproduction, especially in those forms which live in dry regions. One can examine the problem of salinity in relation to the rainfall, when rains or overflowing streams alter the salinity of brackish water bodies into which they drain, or of the sea [24].

The rainfall was higher during October 2013, in this period more males were recorded followed by females and young ones. There was no rainfall during March 2014, during this period more females were recorded followed by males and young ones.

The wind speed was higher during May 2013, in this period more males were recorded followed by females and young ones. The wind speed was lower during January 2014, in this period more females were recorded followed by males and young ones. Due to the increase in wind speed automatically the high tide waves were formed more vigorously. It indicates the rainfall and wind speed has created an impact on the population density of this species. The variation noted in population density of *Uca annulipes* showed there is a relationship between rainfall and wind speed fluctuations; it can be concluded that rainfall and wind speed fluctuations have influence on the population of this species in Muttukadu Estuary. Hence, the rather stable rainfall throughout the year and moderate changes in estuarine water may well be conducive to population density of *Uca annulipes*.

REFERENCES

1. Crane J. (1975). Fiddler crabs of the World (Ocypodidae, genus *Uca*) 1-736. Princeton University press, Princeton, New Jersey.
2. Christy JH and Salmon M. (1984). Ecology and evolution of mating systems of fiddler crab (Genus *Uca*). *Biol Rev*, 59, 483–509.
3. Macintosh DJ. (1988). The ecology and physiology of decapods of mangrove swamps. *Symp. Zool. Soc. Lond*., 59, 315-341.
4. Mouton EM and Felder DL. (1995). Reproduction of the fiddler crabs, *Uca longisignalis* and *Uca spinicarpa* in a Gulf of Mexico salt marsh. *Estuaries*, 18, 469–481.
5. Costa TM and Negreiros-Fransozo ML. (2003). Population biology of *Uca thayeri* (Rathbune, 1900). (Brachyura, Ocypodidae) in a subtropical South American mangrove area, results from transect and catch-per-unit-effort techniques. *Crustaceana*, 75, 1201–1218.
6. Colpo KD and Negreiros-Fransozo. (2004). Reproductive output of *Uca vocator* (Herbst, 1804) from three subtropical mangroves in Brazil. *Crustaceana*, 76, 1-11.
7. Genoni GP. (1985). Food limitation in salt marsh fiddler crab, *Uca rapax* (Smith) (Decapoda, Ocypodidae). *J Exp Mar Biol Ecol*, 87, 97-110.
8. Conde JE and Díaz H. (1989). The mangrove tree crab, *Aratus pisonii* in a tropical estuarine coastal lagoon. *Estuar Coast Shelf Sci*, 28, 639-650.
9. Mantelatto FLM, Faria FCR and Garcia RB. (2003). Biological aspects of *Mithraculus forceps* (Brachyura, Mithracidae) from Anchieta Island, Ubatuba, *Brazil. Journal of the Marine Biological Association of the United Kingdom*, 83, 789-791.
10. Christy JH, (1982). Adaptive significance of semi lunar cycles of larval release in fiddler crabs (Genus *Uca*), test of a hypothesis. *Biol Bull*, 163, 251–263.
11. Wehrtman IS and Dittel AI. (1990). Utilization of mangrove leaves asa transport mechanism of estuarine organisms, with emphasis on decapoda Crustacea. *Marine Ecology Progress Series*, 60, 67–73.
12. Morgan SG and JH Christy. (1995). Adaptive significance of the timing of larval release by crabs. *American Naturalist*, 145, 457–479.
13. Lopez Greco LS, Herna´ ndez JE, Bolanos JE, Rodriguez EM and Herna´ndez G. (2000). Population features of *Microphrys bicornutus* Latreille, (1825) (Brachyura, Majidae) from Isla Margarita, *Venezuela Hydrobiologia*, 439, 151–159.
14. Ashton EC, McIntonsh DJ and Hoghart PJ. (2003). A baseline study of the diversity and community ecology of crab and molluscan macrofauna in the Sematan mangrove forest, Sarawak, Malaysia. *Journal of Tropical Ecology*, 19, 127–142.
15. Nobbs M. (2003). Effects of vegetation differ among three species of fiddler crabs (*Uca* spp). *Journal of Experimental Marine Biology and Ecology*, 284, 51–50.

16. Pillay KK and Nair NB. (1971). The annual reproductive cycles of *Uca annulipes*, *Portunus pelagicus* and *Metapenaeus affinis* (Decapoda, Crustacea) from the South West Coast of India. *Mar Biol*, 11, 152-166.
17. Diwan AD and Nagabhushanam, R. (1974). Reproductive cycle and biochemical changes in the gonads of the freshwater crab, *Barytelphusa cunicularis* (West wood). *Indian J Fish*, 21, 164-176.
18. Orton JH. (1970). Sea temperature, breeding and distribution in marine animals. *J Mar Biol Ass.* U. K, 12, 339-336.
19. Joel DR and Sanjeevaraj PJ. (1982). The breeding of three edible portunid crabs of Pulicat Lake. Pro. I All Ind. Sym. Inver Reprod. University of Madras, 135 – 140.
20. Sivakumar J. (2014). Breeding biology and the population dynamics of the anomuran crab, *Emerita asiatica* (H. Milne Edwards, 1837) in the Kovalam beach, East Coast, Kanchipuram District of Tamilnadu, India. Ph.D. Thesis. University of Madras, Chennai.
21. Giese AC and Pearse JS. (1974). Introduction, general principles. In, Giese, A. C. Pearse, J. S. (eds.) Reproduction of marine invertebrates, Vol. 1. Academic Press, New York, 149.
22. Rajyalakshmi T. (1980). Comparative physiology of reproduction in arthropods. *Adv Comp Physiol Biochem*, 5, 37-84.
23. Kumarapillai C and Subramoniam T. (1984). Monsoon dependent breeding in the field crab. *Paratelphusa hydrodromous*. *Hydrobiologia*, 119, 7-14.
24. Nayar KK. (1977). Invertebrate reproduction. Oxford and IBH publishing and Co. New Delhi, 53-103.