Journal of Environmental Science and Pollution Research 2(4) (2016) 126–128

ISSN: 2455-0272

Contents List available at JACS Directory

Journal of Environmental Science and Pollution Research

journal homepage: http://www.jacsdirectory.com/jespr

Abundance and Species Composition of Mole Crab, *Emerita asiatica* in the Intertidal Beach Sediment of Gopalpur, East Coast of India

S. Samantaray[1], L. Nayak[1], M.P. Pati[1], S.D. Sharma[2,*]

[1]*Department of Marine Sciences, Berhampur University, Berahmpur – 760 007, Orissa, India.*
[2]*CSIR -Institute of Minerals and Materials Technology (IMMT), Council of Scientific and Industrial Research, Bhubaneswar – 751 013, Odisha India.*

ARTICLE DETAILS

Article history:
Received 09 September 2016
Accepted 19 September 2016
Available online 12 October 2016

Keywords:
Mole Crab
Species Composition
Intertidal Beach
Gopalpur
East Coast of India

ABSTRACT

Research on sand crab or mole crab (*Emerita*) has been reported through many parts of the world with special reference to pharmacological, biological and ecological prospective. Seasonal distributional pattern of *Emerita* species in relation to water quality has been studied along the East Coast of India. But there is no research and reviews were found along the Odisha Coast although Odisha is one of the maritime states of India. Hence the present investigation is an attempt to know the abundance, species composition and distribution of mole crab, *Emerita asiatica* in the intertidal beach sediment of Gopalpur. Gopalpur coast is situated latitude 19.27° N and longitude 84.92° E, East coast of India. The mole crab *Emerita asiatica* were collected month wise from Gopalpur coast during 2011 and 2012. The numbers of mole crab from each month of both the year are noted. After collecting the mole crab *Emerita asiatica* were separated depending on their sex. The abundance and distribution of mole crab in the Gopalpur sandy beach varied from season to seasons. During the period of research, it was concluded that male population was more than the female and ovigerous female population from the month of February to the month of July. Male population was less than the female and the ovigerous female during the month of August to January in both the years.

1. Introduction

Odisha is one of the maritime states of India having a coastal length of about 482 Kilometers. Odisha state is situated in upper most western part of Bay of Bengal in north and Andhra Pradesh in south. Gopalpur is a small village which is one of the famous tourist spot of India. Gopalpur-on-sea is located on latitude 19.27° N and longitude 84.92° E of Southern Odisha which lies on a four km stretch of coastal belt of Bay of Bengal. The beach sediment is mostly composed of medium sand of mean particle size 250 to 350 µm, and is well sorted large scale sand movements caused by seasonally reversing longshore current and tidal dependent cyclic erosion and deposition affects beach stability.

A small benthic animal called Mole crab, *Emerita asiatica* belongs to family: Hippidae, Phylum:Arthropoda, which is also known as sand crab, sand fleas, or sea cockroach. Sand crab usually found on the beach in a large number from spring to fall. In winter wind carries the sand to offshore into sand bar. When the sand is transported back on the shore in the spring the crab comes with it [1]. The reproductive season varies from February to October. The egg hatches approximately in one month. The larvae under go to 8 to 11 stages. During this time it may drifted far offshore [2]. The *Emerita* has short life span i.e. for 2 to 3 year and it can reproduce in the first year of its life. The larvae may live as plankton for more than 4 months. The larvae of the mole crab carried to a long distance by the ocean currents and exhibit tidal migrations [3]. The number of zoea stages varies from species to species of *Emerita*. The main predator of *Emerita* are fish, sea birds, sometimes the fishermen use the sand crab as bait. The soft shelled mole crabs are used by the fisherman as food.

Mole crab occurs in a very well defined habitat, the wave wash zone of marine sandy beaches. The common sand crab, *Emerita analoga* and *Emerita asiatica* are filter feeders and exhibit a marked seasonality both in feeding behavior [4]. The mole crabs strain the microscopic food from the water in the wave surf zone of open sandy beaches through their long filamentous second antenna. These mole crabs can filter the foods in still water by extending and waving their antenna. The filter feeding sand crab *Emerita analoga* exhibit a marked seasonality both in feeding behavior [4]. *Emerita asiatica* shows protandric hermaphroditism character. The sex reversal in this crab is well documented [5]. The male and female looks similar but the major differences is female are large with carapace length 14 to 35 mm [6].

The mole crabs are generally live submerged in sand but they do not feed when totally submerged. Sand crabs *Emerita* species extends their antenna above the sand surface and the microscopic food from the water are collected [7]. These filter feeding animals generally live in the temperate zone because the microscopic foods are plenty available on these zones. The mole crab burrows backward in to the sand and face the sea. As each wave retreats, is extends their long plumose antenna and catches floating organisms and scarps the particles in to its mouth [8]. If the mole crab becomes uncovered by water, it coils its antenna and burrows backwards deeper to the sand. Mole crab generally feed upon the plankton mostly dinoflagellates and diatoms which are plenty available in the Gopalpur coast.

2. Experimental Methods

2.1 Sampling Location

Gopalpur coast is situated latitude 19.27° N and longitude 84.92° E (Fig. 1). The coast line of Gopalpur is completely sandy stretch for several kilometers towards north and south. The wave heights are usually in the range of 0.2 meters to 0.7 meters. The surf zone varies between 50 meters to 150 meters. The tides are semi diurnal. The highest high water level is 2.35 meters above. The south west monsoon of Gopalpur varies between May to September of each year. From October to December, the north east monsoon extends in the country. Wind force is high during South west monsoon in June-July and it is less during the North East monsoon. Long shore currents provide mechanism for sand movement along coast during the south-west monsoon, high energy wave coming from south and south-east causes enormous sand movements towards north. During north-east monsoon the pre dominant waves of north-east causes a return drift in the opposite direction. The width of intertidal zone varies from 25 meters to 50 meters depending on tide and season. During the calm weather, deposition of sand near low tide level results in the formation of sand bar of about 60 to 70 meters.

*Corresponding Author
Email Address: sbdsharma1984@gmail.com (S.D. Sharma)

Cite this Article as: S. Samantaray, L. Nayak. M.P. Pati, S.D. Sharma, Abundance and species composition of mole crab, *Emerita asiatica* in the intertidal beach sediment of Gopalpur, east coast of India, J. Env. Sci. Pollut. Res. 2(4) (2016) 126–128.

Fig. 1 Google image of Gopalpur coast showing latitude and longitude of study area

2.2 Materials and Methods

The present study was quantifying the population, abundance, species composition and distribution mole crab species, *Emerita asiatica* along Gopalpur Coast, East coast of India. Mole crabs were collected on monthly basis from January, 2011 to December, 2012. In every field trips triplicate samples was taken and their average was calculated for more accuracy. A total of 24 surveys were carried out for the collection of samples during the day time on the sandy beach in and below the surf line. The mole crabs (sand crab) normally find the swash zone of coastal line. The crabs were caught by hand with the help of container. The sample consists of *Emerita asiatica* of different size group from both sexes and the mole crabs were brought to laboratory with list disturbance in polythene bag with wet sand. Three types of crabs were collected such as male, female and ovigerous female. Population study of mole crab was made randomly taking 10 meter × 10 meter plot are selected at the observation side. The starting two point of plot were parallel to the beach, where the wave actions end. The width of plot was 10 meter and marked. The same method was repeated for 10 plots. The average was calculated per plot from which the population of mole crab/day of beach was calculated. This process was repeated for each month for two years. The mole crabs were identified by using standard literatures [9-10].

3. Results and Discussion

The mole crab *Emerita asiatica* were also collected from Gopalpur coast during 2011 and 2012. After collecting the mole crab *Emerita asiatica* were separated depending on their sex. The number of male, female and ovigerous female were cited on the Table 1. Month wise percentage compositions were plotted in the Fig. 2. It was observed that less number of male *Emerita asiatica* was found as compared to the female and ovigerous female from the month of August to the month of December during 2011 and 2012. Similarly the male mole crab *Emerita asiatica* found more in number as compared to the female and ovigerous female from the month of February to June 2011 whereas during the 2012 the male mole crab *Emerita asiatica* found more in number as compared to the female and ovigerous female from the month of April to July, 2012.

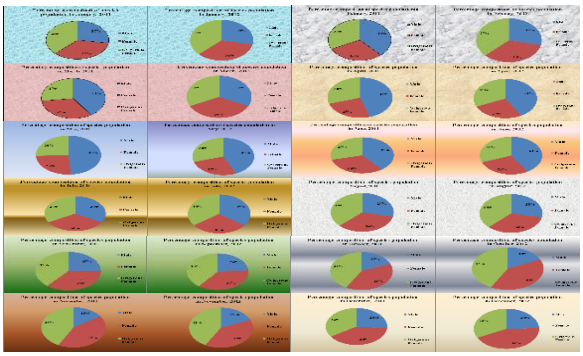

Fig. 2 Percentage composition, Month wise variation and Comparison in the population of Mole Crab (*Emerita asiatica*) from Gopalpur Coast During 2011 and 2012

Month wise percentage compositions of mole crab Emerita asiatica in relation to sex reversal (male, female and ovigerous female) were cited on the Fig. 2. Percentage composition analysis of mole crab *Emerita asiatica* during the study period, it was noted that in January 2011, the male, female and ovigerous female were observed to be 27%, 35% and 38% respectively. During January 2012, the percentage composition was observed to be 29% of male, 34% of female and 37% of ovigerous female. It showed a similar type of trend between the two consecutive years. In February 2011, 38% of male, 30% of female and 32% of ovigerous of *Emerita asiatica* were observed, whereas on February 2012, 29% of male, 34% of female and 37% of ovigerous female of *Emerita asiatica* were found. It was observed that more number of male was found during the month of February 2011 as compared to the month of February 2012.

Table 1 Month wise variation in the population of mole crab (*Emerita asiatica*) from Gopalpur coast during 2011 and 2012

2011					2012			
Month	Male	Female	Ovigerous Female	Total	Male	Female	Ovigerous Female	Total
January	11	14	15	40	10	12	13	35
February	13	10	11	34	12	9	10	31
March	15	12	10	37	10	11	10	31
April	18	10	12	40	17	11	13	41
May	19	10	10	39	16	10	11	37
June	15	12	11	38	16	11	12	39
July	13	13	13	39	14	12	14	40
August	10	12	13	35	9	11	12	32
September	9	13	14	36	9	14	15	38
October	8	17	18	43	8	18	19	45
November	7	19	19	45	8	17	18	43
December	10	15	13	38	9	16	12	37

Male, female and ovigerous female was in arrange of 41%, 32%, 27% of respectively. While in the month of March 2012 it was observed that 32% of male, 36% of female and 32% of ovigerous female were encountered. It was observed that the male were outnumbered in March 2011 than 2012. During the month of April 2011, the percentage composition of male, female and ovigerous female was 45%, 25% and 30% respectively. But in April 2012 the male was 41%, female was 27% and the ovigerous female was 32%. It shows population of female and ovigerous female in the year of 2012 was dominated over the year of 2011 except in their male counterpart. May 2011, the percentage of the male was 49%, female 25%, and ovigerous female 26% where as in May 2012 the percentage of male was 43%, female 27% and ovigerous female 30%. It was noted the number of male for the month of May 2011 and 2012 were more than the female and ovigerous female and also observed nearly half numbers from total mole crab of 2011 and 2012. June 2011, the percentage composition of population of mole crab was observed 39%, 32% and 29% of male, female and ovigerous female respectively.

June 2012, the male was 41%, female 28% and the ovigerous female 31%. Like the month of February, March, April, May of 2011 and 2012, the male percentage were more than the female and ovigerous female during the period of June 2011 and 2012. The percentage of male was 34%, female 33% and ovigerous female 33% was encountered in the month of July 2011. Similarly, percentage of male was 35%, female 30% and the ovigerous female 35% was observed in July 2012. On the month of July 2011, it showed female and ovigerous female were equal in number but in the month of July 2012 male and ovigerous female were equal in number.

On the month of August 2011 the male, female and ovigerous female was in a range of 29%, 34% and 37%, where as in the month August 2012 the percentage of male, female and ovigerous female 28% female, 34% and 38%. In both the year male percentage is less than the female and ovigerous female. The percentage composition of species population in September 2011 was found 25, 36 and 39 percentage. Similarly in the next year the percentage of the male, female and ovigerous female was in a range of 24, 37 and 39 percentage. The quantity of mole crabs was nearly more or less equal in number during the month of September 2011 and 2012. On the month of October 2011, the percentage of the mole crab species in an order of 19%, 39% and 42% while in the month of October 2012 it was 18%, 40% and 42%. As like September 2011 and 2012, it was also marked, the numbers of mole crabs were more or less equal to the month of October 2011 and 2012. November 2011, the male, female and ovigerous female crab was in arrange of 16%, 42% and 42%.

During the period of November 2012, it was in a range of 19%, 39% and 42%. It was observed, in the month of November 2011 and 2012 the ovigerous female was equal in number and the number of male is less than female and ovigerous female. The percentage composition of species population in December 2011 was observed to be 26%, 40% and 34% of male, female and ovigerous female. The male was 24%, female was 43% and the ovigerous female was 33% observed during the period of December 2012. It was found that the male percentage was less than the female and ovigerous female when we will compare between both the years.

Cite this Article as: S. Samantaray, L. Nayak. M.P. Pati, S.D. Sharma, Abundance and species composition of mole crab, *Emerita asiatica* in the intertidal beach sediment of Gopalpur, east coast of India, J. Env. Sci. Pollut. Res. 2(4) (2016) 126–128.

Seasonal variation in populations of the sand crab was reported by many authors. Similar types of works were carried on the species of *Emerita analoga* on sandy beaches in southern California [11]. Some of the works also characterized on the population of the mole crab, *Hippa Adactyla* (Fabricius), in the intertidal sediment at Kavarittiatoll, Lakshadweep Island [12]. The authors found a makeable difference in the species composition of *Emerita asiatica* along the coast of Gopalpur. The total percentage composition of species population studied during 2011 and 2012 observed that the male population was more than the female and the ovigerous female from the month of February to the month of July for both the year 2011 and 2012. From August to January 2011and 2012, the male percentage was less than the female and the ovigerous female. The highest numbers of mole crabs *Emerita asiatica* were observed to during the month of November 2011 and October, 2012 (45 numbers/100 m^2). The lowest numbers of mole crabs were observed to 31 numbers/100 m^2 during the month of February and March 2012. There were two peak season for the abundance of mole crab i.e., one is during the month of November 2011 and another during the month of October 2012.

The abundance and distribution of mole crab in the Gopalpur sandy beach varied from season to seasons. The mole crabs are generally found within 2 to 3 cm buried in sand facing towards the sea during wave action. The present study showed there was a less number of male *Emerita asiatica* found as compared to the female and ovigerous female from the month of August to the month of December during 2011 and 2012. Similarly the male mole crab *Emerita asiatica* found more in number as compared to the female and ovigerous female from the month of February to June 2011 whereas during the 2012 the male mole crab *Emerita asiatica* found more in number as compared to the female and ovigerous female from the month of April to July, 2012. High temperature of air and water also increase the number of females than male [13]. Seasonal variation in the sand crab *Emerita* was also studied in the Santa Barbara area of California [4].

4. Conclusion

From the above discussion by compiling 2 years of field observation, it is being concluded; male population was more than the female and the ovigerous female from the month of February to the month of July. Male percentage was less than the female and the ovigerous female from August to January. A number of works has been done through many parts of the world on Mole crab species but no research work has been done yet along the Odisha Coast. Hence it's a base line research as well as a primitive initiative to know about the species. The present investigation is carried out to know their population, abundance, species composition and distribution in the intertidal beach sediment of Gopalpur.

References

[1] H.J. Humm, G.N. Wharton, A.S. Pearse. Ecology of sand beaches at Beaufort, N.C. Ecol. Monogr. 12 (1942) 137-190.
[2] J. Cubit, Behaviour and physical factors causing migration and aggregation of the sand crab *Emerita analoga* (Stimpson), Ecol. 50 (1969) 118-123.
[3] I.E. Efford. Feeding in the sand crab, *Emerita analoga* (Stimpson, Decapoda, Anomura), Cruttaceana 10 (1966) 166-182.
[4] N.B. Barnes, A.M. Wenner. Seasonal variation in the sand crab *Emerita analoga* (decapoda, hippidae) in the Santa Barbara area of California, Limnology and Ocenography 13 (1968) 465-475.
[5] T. Subramoniam, Sex reversal in a mole crab *Emerita asiatica*, Inter. Symp. Invest. Reprod., Univ. Calif. Davis, Ecol. 3 B (1979) 259-268.
[6] T. Subramoniam, Aspects of sexual biology of the anomuran crab *Emerita asiatica*, Marine Bio. 43 (1977) 369-377.
[7] G.E. Maccinitie. Movements and mating habits of the sand crab *(Emerita analoga*), Am. Midland Nattr. 19 (1938) 471-481.
[8] R.E. Snodgrass, The sand crab *Emerita talpoida* (Say) and some of its relatives, Smithsonian Misc. Collections 8 (1952) 117.
[9] S.A. Fernando, O.J. Fernando, A field guide to the common invertebrates of the east coast of India, Published: Center of Advanced Study in Marine Biology, Annamalai University, Parangipetti, 2002, pp. 47-50.
[10] R.D. Barnes, Invertebrate Zoology 3rd Ed., W.S. Saunders Company, United Kingdom, 1974, pp. 587-590.
[11] A.M. Wenner, D.M. Hubbard, J. Dugan, J. Shoffner, K. Jellison. Egg production by sand carbs (*Emerita analoga*) as a function of size and year class (decapoda, hippidae), Biol. Bull. 17 (1987) 225-235.
[12] B.S. Ingole, R.A. Sreepada, Z.A. Ansari, A.H. Parulekar, Population characteristics of the mole crab, *Hippa adactyla* (Fabricius) in the intertidal sediment at Kavaratti Atoll, Lakshadweep Islands, Bull. Marine Sci. 63 (1998) 11-20.
[13] J. Sivakumar, B. Nappinai, J. Jayanthi, M.G. Ragunathan, Effect of temperature on the population of *Emerita asiatica* (H. Milne Edwards, 1837) in the Kovalam beach, East coast, Tamil Nadu, India, Ind. J. Pharm. Bio. Res. 2 (2014) 22-26.

Cite this Article as: S. Samantaray, L. Nayak. M.P. Pati, S.D. Sharma, Abundance and species composition of mole crab, *Emerita asiatica* in the intertidal beach sediment of Gopalpur, east coast of India, J. Env. Sci. Pollut. Res. 2(4) (2016) 126–128.