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RESEARCH ARTICLE

POPULATION STRUCTURE AND BREEDING SEASON OF FRESH WATER CRAB, MAYDELLIATHELPHUSA MASONIANA (HENDERSON) FROM GHO-MANHASAN STREAM (JAMMU, J&K) (NORTH INDIA)

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ABSTRACT

The present study deals with the population structure of freshwater crab *May delliathelphusa*. *masoniana*, focusing on then size frequency distribution, sex ratio, and breeding season. Crabs were randomly collected from the study area on monthly basis for a period of two years from Jan 2012 to Dec 2013. A total of 592 crabs were obtained of which 310 (52.36%) were females and 282 (47.63%) were males. The overall sex ratio comes to be 1:1.09 with considerable degree of seasonal fluctuations. The overall size frequency distribution exhibited males, females and juveniles. Sexual dimorphism was characterized by the larger sized males in relation to females. Breeding season indicated two peaks viz (June-July & Dec-Jan), with scarce young juveniles in the population.

INTRODUCTION

Freshwater crabs are found throughout the tropical and sub-tropical region of the world. Decapod crustaceans represent a large number of living species that inhabit a wide variety of biotopes. (Mantellatto and Souse 2000). The majority of species are narrow endemics, occurring in only a small geographical area. This can be attributed to their poor dispersal abilities and low fecundity and also to habitat destruction caused by world human population.

Compared to marine crabs, freshwater and terrestrial species show the following evolutionary trends, habitat specialization, brood protection and abbreviated larval development (Hartrioll 1988)

Information on the population biology of fresh water crabs is very scarce (Gherardi and Micheli 1989). Studies on population generally focus on description of density, size structure, sex ratio and breeding periods (Branco et.al. 2002)

There are around 1,300 species of freshwater crabs, distributed throughout the tropics and subtropics divided among eight families.

Despite this high diversity, the population biology of these organisms is still poorly known and particularly when we look at freshwater crab, *Maydelliathelphusa masoniana,* negligible information is on record from India, in general and Jammu region of J&K State, in particular.

In view of this background, present study, has been undertaken to investigate the various relevant parameters of population structure viz size frequency distribution, sex ratio and breeding seasons of *M.masoniana* from their natural habitat. Such studies become particularly relevant and helpful in chalking out the strategies to verify the factor accounting for the differences among population and to understand the biological constraints that are shaping the structure of these populations.

MATERIAL AND METHOD

The present study was conducted in their natural habitat viz Gho-manhasan stream fed by river Chenab in Jammu region ($32^0$67' Latitude: $74^0$79' Longitude E) J&K (North India).

Crabs were randomly collected by hand picking/ drag net on monthly basis from the study area.

In the laboratory, they were segregated sex wise based on their abdominal morphology, following which sex ratio was determined by using the formula.

$$\text{Sex ratio} = \frac{\text{No of female crabs}}{\text{No of male crabs}}$$

For all crabs, carapace width (cw) was measured by using vernier caliper scale. Based on the carapace measurement, different size classes were constructed for each sex. (FC_1,FC_2, FC_3, FC_4, FC_5, and FC_6, for females and (MC_1, MC_2, MC_3, MC_4, MC_5, MC_6 & MC_7 for males.)

RESULT

Size Frequency Distribution

On the basis of carapace width, different size classes were constructed for each sex (Table 2 & 3). Size of male crabs ranged from 2-3cm cw to 6-7 cm cw. In females, the size range was observed to be 2-3cm to 5-6 cm cw. No female was recorded in the class size of 6-7 cm cw. (Fig: 3 & 4)

From the study it is evident that comparatively males maintain large size than females. Crab population have been observed to comprise primarily of adult individuals (size>3cm cw). Juveniles/ small crabs were rarely spotted and that too in the ending August & March, months.

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Sex Ratio

A total of 592 crabs were caught during the study period, 310 (52.36%) turned to the females against a total of 282 (47.63%) males Table 1, Fig 1. Sex ratio therefore, comes to be 1:1.09. Sex ratio, however never remain consistent, rather it exhibited seasonal variations. As evident from Table 1 and Fig : 2 females were more abundant then males in the month of June & July and males were dominant in month of Dec. However, Chisquare test (Chi.sq =7.8259; df=11; p-value < 0.7288) showed that sex ratio may be considered independent of the catching month.

Breeding season

From the present study as depicted in the table (2&3), the crab *M.masoniana* exhibit two peaks in breeding season viz June-July & Dec-Jan. It is during these months that sexually mature males and females with mean of 5-6 cm cw and 4-5 cm cw respectively were found maximum in the collection with highest of 17 males and 16 females, in the month of December.

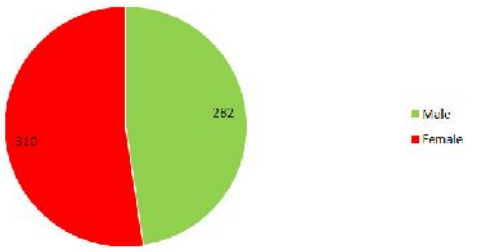

Fig 1 Overall sex ratio of crab of M. masoniana during the study period (Jan 2012- Dec 2013)

DISCUSSION

Size Frequency Distribution

M.masoniana is sexually dimorphic with males being larger than females viz males reaching upto 6-7 cm of cw and females with maximum of 5-6 cm cw (Table 2& 3).
The present study exhibited that the females reached morphological sexual maturity at smaller size 4-5 cm cw than males of size 5-6 cm cw. This observation is consistent with the pattern proposed by Shine (1988) for brachyurans who held that females allocate their energy for reproductive purpose such as spawning and egg incubation and therefore, tend to mature at smaller sizes than males, who invest their resources in somatic growth and reach maturity at greater sizes.

Present observations are also in accordance with the findings of Jiv off (1997) who held that in male blue crab, *Callinecles sapidus*, males attain maturity at size bigger than females.

On similar lines, Diaz and Conde (1989) while working on size frequency distribution exhibited that males reaching larger size than females, characterizes a dynamic equilibrium for a certain population with slight monthly variations and differential mortality rates.

Table 1 Monthly collection of. *M.masoniana*) from all the stations of Gho-manhasan stream during study period (Jan 2012-Dec2013)

Months	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Total No of Crabs (592)	35	40	40	40	44	55	55	54	53	52	60	64
Total no of Males (282)	70	21	21	20	20	24	25	28	24	23	26	33
Total no of Females (310)	18	19	19	20	24	31	30	26	29	29	34	31
Total no of Juveniles (	-	5	3	-	-	-	4	-	-	-	-	-

Table 2 Total no of female crab. *M.masoniana* of different class size carapace width (cw) (1cm class interval) during the study period (Jan 2012-Dec 2013)

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Total No of Crabs (310)	18	19	19	20	24	31	30	26	29	29	34	31
CW/CM1-2	-	-	-	-	-	-	-	-	-	-	-	-
2-3	-	-	2	-	-	-	-	2	2	1	-	-
3-4	6	5	5	8	8	9	10	8	10	11	12	9
4-5	9	9	8	10	12	16	14	10	12	13	16	16
5-6	3	5	4	2	4	6	6	6	5	4	6	6

Table 3 Total no of male crabs *M.masoniana* of different class size carapace width (cw) (1cm interval) during study period (Jan 2012-Dec 2013)

Months	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Total No of Crabs (282)	17	21	21	20	20	24	25	28	24	23	26	33
CW/CM 1-2	-	-	-	-	-	-	-	-	-	-	-	-
2-3	-	-	-	-	-	-	-	4	3	-	-	-
3-4	2	2	4	4	4	4	3	2	3	3	4	5
4-5	3	7	5	6	5	6	9	10	8	9	7	8
5-6	10	11	11	10	11	12	13	12	10	11	15	17
6-7	2	1	1	-	-	2	-	-	-	-	-	3

Table 4 Monthly variation of sex ratio of crab *M.masoniana* during the study period (Jan 2012- Dec 2013)

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Sex Ratio (S.R)	1:1.05	1:0.9	1:0.9	1:1	1:1.2	1:1.2	1:1.2	1:0.9	1:1.2	1:1.2	1:1.3	1:0.9

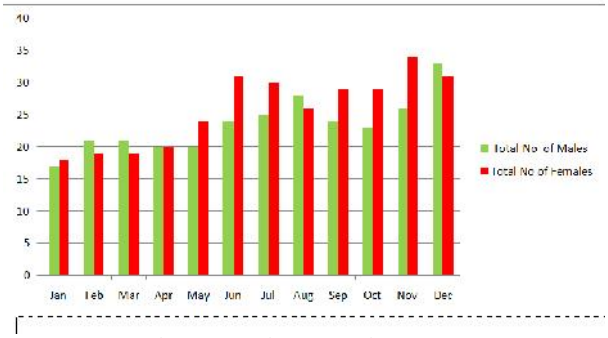

Fig 2 Monthly fluctuation of sex ratio of crab P.masoniana during the study period (Jan 2012-Dec 2013)

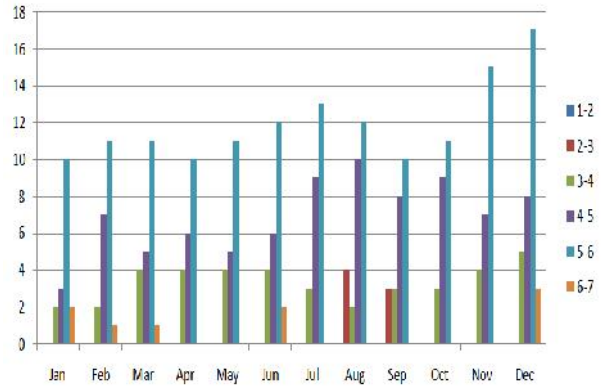

Fig 3 Size Frequency distribution of male crab M. masoniana of different class size carapace width (cw) during the study period (Jan 2012 – Dec 2013).

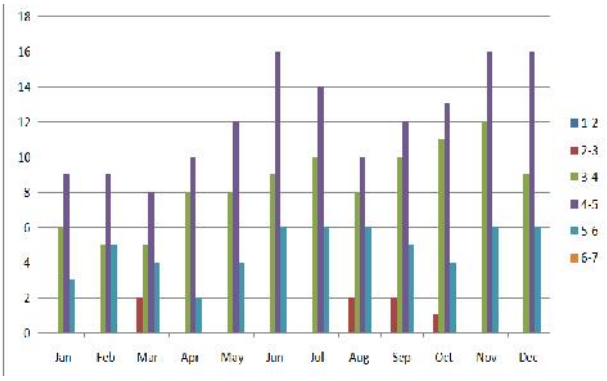

Fig: 4 Size Frequency distribution of female crab M. masoniana of different class size carapace width (cw) during the study period (Jan 2012 – Dec 2013)

From the present study, it is evident that three factors can help to determine the size of local population of *M. masoniana* (i) the difference in energy available for growth, with males growing more because they don't spend energy in egg production; but use their energy for structural metabolism (ii) the large reproductive effort exhibited by males may be due to their ability to fertilize more than one female. (iii) Males of large size have greater chance of obtaining females for copulation as a function of intra-specific fights (Abrams 1988)

From the tables 2 & 3 it is evident that the no of females of class size 4-5 cm cw were numerous than males of same class size.

However, males were reported to be dominant in larger class size of 5-6 cm cw (Table -3)

This is in accordance to the findings of Sigana (2002) who while working on crab *Thalamita crebata* in Kenya observed a similar trend in the class size of female 40.5-55.44 mm to be more numerous than males. Males, however were reported being dominant in larger size classes ranging from 55.4-80.44 mm.

Moreover, small growth rates of females is the result of higher energy allocation for reproduction in females than males (Asakura 1992; Bertini & Fransozo 2000)In the present study few juveniles (size <3cm cw) were reported, that too in the months of March, August & September from the study area. The presence of juveniles during spring & post rainy season viz March, August & September concides with the abundance of phyto-zooplantons indicating nutrient accumulation during these months. This is in accordance with the work of Litulo (2004) who found that the reproductive and recruitment activity of fiddler crab *Uca annulipes* occurs in rainy season favouring food supply &larval flux.

Sex Ratio

The overall sex ratio differed from expected mean value of 1:1 during the months of June-July & Dec-Jan which happen to be the breeding season of this crab. Several causes may lead to this discrepancy such as differences between sexes in growth rate, differential migration & mortality.

According to Werner (1972) sex ratios differing from 1:1 are widespread among crustaceans. In *M.masoniana*, females tend to be more abundant than males (Table 2&3). The present study is in accordance to those recorded in hermit crab, where females tend to be more abundant than males (Ameyow-Akumfi, 1975; Martinelli et.al 2002).

Our observation is also in accordance with the findings of (Czernijewski & Wawrzynailew (2006, 2013). In Chinese mitten crab *Eriocheir sinesiss* where the overall sex ratio of 1:0.80 differed from the expected 1:1 ratio, with males dominant in month of December and female being abundant in the months of October and November.

Fluctuation in the sex ratio can be attributed to various factors (i) migration of male crabs towards sexually mature females during breeding season. (ii) burrowing habit of females during breeding season for incubation of eggs & protection of brood. Similar findings have also been reported in fiddler crabs and *Uca crenulata* (de Rivera, 2003) wherein he reported the burrowing habit of ovigerous females to be one of the major factor contributing towards the disturbed sex ratios.

Present findings also get support from the work of *Ali et.al* (2004) in *Scylla Serrata* of Swderbance mangrove where overall sex ratio of male to female was found to be 1:0.94 & fluctuations on monthly basis could also be observed. Sallam (2005) too reported fluctuation in sex ratio of *Dotilla Sulccats* from 1:1 with more males than females.

Our study get strengthened from report of Lawal-Are (2010) who studied sex ratio in blue Crab, *Callinectes amnicola* to be 1:0.96 exhibiting fluctuating pattern & females being abundant than males in rainy season.

Breeding Season

Breeding season is the period when the female crabs carry eggs and perform sexual activities. Presently as depicted in

Tables 2 & 3, two peaks with the breeding seasons viz June-July & Dec-Jan are evident with maximum number of sexually mature male & female crabs. Of the total ovigerous females collected, maximum (46.7%) belonged to the 4-5 cm size class (modal size class), 32.5% in class size of 3-4 cm and remaining 18.3% in class size of 5-6 cm. This is in accordance with the findings of Devi and Smija (2013) while working on crab *Travancoriana Schirnerae* Bott (1696) .

Our observations indicated that freshwater crab *M.masoniana* is a biannual breeder witnessed by maximum adult population of male & females during peak seasons and minimum/negligible number of juveniles in the month of March, August & September from the study area.

Such annual & seasonal breeding pattern has been observed in semi terrestrial & intertidal brachyuran crabs (Sastri, 1983; Henmi & Kaneto, 1989).

The present finding are in line with study of Tongdee (2001) who reported that in mud crab, *Scylla* species, 2 recruitments in a year occur indicating that these mud crabs were seasonal breeder & breed twice in a year.

A similar reproductive pattern was evident in hermit crab *D. brevirostris* which displays seasonal reproduction with several breeding peaks (Turra & Leite (2000).

CONCLUSION

Efficient management of crab fisheries requires knowledge of the reproduction and life history of the natural population. Knowledge of size frequency distribution, sex ratio and breeding season is of great importance in the commercial utilization of a particular species. Present information can be utilized in designing the aquaculture practices particularly harvesting schedules of the species as unplanned harvesting poses major threat to natural fishery resources which are dwindling at alarming rates.

An understanding of breeding period also helps reducing fishing efforts on ovigerous/juvenile carrying females to protect the young year classes. Further, present piece of work can provide a baseline data for more comprehensive research to be undertaken in the future.

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