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DROVING BEHAVIOUR OBSERVED IN THE FIDDLER CRABS INHABITING THE ADYAR ESTUARY AND BACKWATER

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INTRODUCTION

Several species of shore living crustaceans leave their burrows when the near by substrate start drying up, in search of food and areas of richer food supply at the water's edge or moist areas in the lower intertidal zones. Such movements which mainly occur in summer in large groups known as droving have been reported in fiddlers as well. It is implied that droving has adaptive value either in locating areas of richer food supply (Murai *et al.*, 1982) or to colonise new areas where living conditions are more compatible.

Drove formation is related to both food productivity of the burrowing habitat and the ambient temperature (Murai *et al.*, 1983). Foraging activity of fiddlers is more noticed during daylight low waters. Sandy habitat has less food supply and hence droving occurs in crustaceans inhabiting the sandy areas (Murai *et al.*, 1982). The available literature on droving is limited and includes the studies of Miller (1961), Cameron (1966), Herrnkind (1968), Hockett and Kritzler (1972), Crane (1975), Robertson *et al.*, (1980), Murai *et al.*, (1982, 1983) and Nakasone (1982) on *U. pugilator* in the Southern United States, *U. tangeri* in Angola, *U. vocans* in Japan, *Dotilla* sp. in Zanzibar and Western Australia and *Mictyris* sp. in Australia. The three species of fiddlers recorded to drove so far belong to the three different subgenera, *Celuca*, *Afruca* and *Thalassuca*. The capacity to drove is not indicated by the carapace morphometry since the fiddlers which have narrow, moderate to narrow and

moderate to wide fronts exhibit this phenomenon. The intrinsic details of droving still remain unknown and mostly the fiddlers whose habitat lies near to the seashore drove.

For the first time droving of fiddlers in India is reported here. This includes migration in large numbers. Crane (1975) remarked that a season-long study will be more valuable as it is greatly needed and hence this work.

Observations

Observations were made in the Adyar estuary and backwater from Kotturpuram area to the mouth of the estuary (approximately 4 kilometers) during May and October, 1983 and 1984 for 12 days at a stretch during the forenoons (from 0600 to 1200 hrs) and day time low tides. The burrow densities have been worked out for these areas (presented elsewhere) and the emerging of fiddlers for droving has been observed using Super Zenith low power optical binoculars. Movement of the crabs to and from the waterline and from the burrow area (6 to 12 meters) has been noted. In addition, long distance migration to approximately 200 meters could be observed during hot summer when the atmospheric temperature fluctuated between 35 and 41°C. Short distance migrants were also considered as drovers. Droving for feeding purposes lasts for 10 to 15 minutes after emerging from the burrows. Long distance migration occasionally (beyond 20 meters, by the side of waterline) lasts for about 90 minutes with frequent deviation towards water's edge in *lactea annulipes* and its congener *triangularis bengali* does not exhibit such a phenomenon. The burrows vacated by *lactea annulipes* were occupied by *triangularis bengali* almost immediately during hottest days of summer. 9% of the males marked with Camlin indelible marker ink could be easily located beyond 100 meters from the burrow area in the estuary within two days. Resident crabs were generally smaller than the wanderers and mainly consisted of females. Amongst the wanderers, near the low water mark more numerous were

the youngones (both male and female) in the case of *lactea annulipes* while in *triangularis bengali* such a condition does not exist. When muddy areas start drying up resulting in the formation of high saline water puddles *lactea* tends to leave the scene on long distance migration and *triangularis* inhabiting the upper burrow areas start moving toward the areas near the pools whose waters indicate salinity upto 70 parts per thousand. During October, females and youngones of *triangularis* remain in the upper burrow areas while males of more than 7 mm carapace width could be seen droving near the waterline. The ovigerous females and youngones of *triangularis* wander only in the upper burrow areas where organic deposits of sullage, domestic refuse and city's solid wastes form the substratum. *U.* (*C.*) *triangularis* does not exhibit long distance migration and when compared with *lactea annulipes* droving toward waterline to feed is also less.

RESULTS

The results are presented in Tables I and II. It appears that droving for feeding is a round-the-year phenomenon while long distance migration is tied to the summer months. The number and composition of droves vary according to species and the nature of the burrowing habitat. Inhabitants of sandy and sandy mud areas tend to drove more while those inhabiting burrows in steeper gradients of clayey substratum do not exhibit droving. *U.* (*C.*) *lactea annulipes* exhibits droving in large numbers (more than one hundred individuals) and the drove mainly consists of males. Females with high ovarian index do not drove near the waterline. This reaffirms the view of Bergin (1981) that females would be more vulnerable to predation if exposed at the water's edge. Males drove farther from the burrow areas than the females and youngones. Long distance migration toward the mouth of the estuary characteristic of *lactea annulipes* does not occur in *triangularis bengali* but during the hotter months and especially in May *triangularis* moves in smaller batches toward the high saline water puddles from the dried up clay areas.

TABLE I. *MIGRATION AND DROVING TOWARD WATERLINE DURING MAY, 1983 AND 1984.*

	AREA	COMPOSITION	DIRECTION OF MOVEMENT	DURATION
I	NEAR ADYAR BRIDGE	*lactea* males in large numbers	Toward the mouth of estuary parallel to the dried up waterline	Minimum 20 minutes Maximum 90 minutes Start before 06 30 hrs.
		lactea males and juveniles	Toward waterline Moist areas at centre	Minimum 5 minutes Maximum 10-12 minutes
		triangularis males, smaller females in batches of 10-15 crabs	Occasional foraging toward waterline	Minimum 5 minutes Maximum 10-12 minutes
II	NEAR CHETTINAD PALACE	*lactea* males and occasional females 10-50 crabs	Toward the lowtide line for foraging	Minimum 5 minutes
III	NEAR SANDBAR	—	—	—
IV	BACKWATER AT MRC NAGAR	*triangularis* males in groups of 10-15 adults with occasional smaller females	Toward high saline areas farther from sea sea	Minimum 15 minutes Maximum 30 minutes.

TABLE II. *MIGRATION/DROVING DURING OCTOBER*, 1983 and 1984.

AREA		COMPOSITION	DIRECTION OF MOVEMENT	DURATION
I	NEAR ADYAR BRIDGE	*luctea* in large groups, more males than females	Toward waterline for feeding and no long distance migration	Minimum 5 minutes Maximum 20 minutes
II	NEAR CHETTINAD PALACE	" "	" "	" "
III	NEAR SANDBAR	" "	" "	" "
IV	BACKWATER AT MRC NAGAR	NIL	NIL	NIL

Discussion

Migration of groups of fiddlers along the beach, their movements and return to the specific burrows after foraging have been elucidated by Altevogt (1957), Altevogt and von Hagen (1964), Herrnkind (1968, 1972). Robertson *et al.*, (1980, 1981) reported that the concentrations of Chlorophyll 'a' possibly in edaphic algae determined the foraging behaviour atleast in *U. pugilator* and that the fiddlers move long distances in search of rich algal gradients. One (1965) established that the Nitrogen content of the substrate significantly determined the droving and feeding behaviour in fiddlers. He postulated that more the percentage of finer particles more is the N-content of the substrate contributing to the growth of microbial organisms which maintain the food supply. Aspey (1978) opined that the behavioural variability has a survival advantage in fiddlers due to their periodical movement to different environments. Wilkens and Fingerman (1965) observed wandering of fiddlers on hot days for about 15-20 minutes and disappearance into the burrow for 3-4 minutes to escape sunlight and to lower body temperature.

Murai *et al* (1983) found that in *U. vocans* droving occurs more from the upper burrow areas of lower N-content in sandy areas where the content of organic matter and microbial organisms are less. In the Adyar estuary also droving occurs mainly in areas of sand where populations of *U.* (*C.*) *lactea* are present. Comparison of *lactea annulipes* and *triangularis bengali* of different areas indicates that droving may not be a species specific trait. Murai *et al* (1983) observed that *lactea* occupying sandy mud areas do not drove at all in Japan while the same species occupying sandy areas of Adyar estuary droves. *U.* (*C.*) *triangularis* which occupies irregular clayey areas where trapping of organic matter from receding water occurs does not drove to noticeable extent. Should droving occur, it happens for a shorter distance, probably to compensate the deficiency in the energy budget.

In both *lactea* and *triangularis*, crabs with hard carapace only exhibit droving tendency. No fiddler, whether male or

female droves or wanders immediately after moulting. This is indicated by the presence of moulting or recently moulted large males in the upper beach area resident populations. Murai *et al* (1983) opined that N-content of the burrowing habitat is not the only factor that has an effect on droving behaviour. Since droving for long distances or migration occurs mostly in summer, it may be one of the effective means of reducing body temperature by evaporation of water from epithelial membranes, in addition to seeking better habitats and feeding. Bliss (1968) expressed that the fiddler can reduce body temperature through transpiration and Edney (1960, 1961) found that body temperature of crabs in unsaturated air was 1-2°C below that of crabs in saturated air in the laboratory, while outside in the field live crabs exposed to sun registered a body temperature 5-8°C lower than that of similarly exposed dead dried crabs. It is possible that *lactea* droves to beat the effect of radiation of the sandier habitat.

The droving tendency has been observed to continue throughout the day from dawn to dusk for foraging while long distance migrations occurred mostly in the forenoons. Semi-terrestrial crabs like *Uca* carry small amount of water within branchial chambers, the remainder of each chamber being filled with air (Edney, 1960). It is probable that larger fiddlers drove or migrate to longer distances from the resident burrow areas due to the presence of more water in the branchial chambers. The migrants invariably enter into the nearest available burrows proximal to the waterline and spend a few minutes before resuming migration or go to the waterline itself to replenish the lost branchial water. Since *triangularis* does not expose itself to sunrays much when compared to *lactea* there may not be a necessity to drove for reducing body temperature or for food which is available in the burrow area itself.

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