



Original Research Paper

DIVERSITY AND DISTRIBUTION OF CRUSTACEAN FAUNA IN MANGROVE ECOSYSTEM OF KALI ESTUARY, KARWAR, WEST COAST OF INDIA

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ABSTRACT

The present study was carried out in the mangrove ecosystem of Kali estuary. Samples were collected from the three fixed stations for the period of thirteen months from January 2020 to January 2021 at regular monthly interval to study the diversity, distribution, the abundance & relative ratio of crustacean. In the present study Crustacean group comprised by two major groups prawns (penaeid) and crabs (portunidae). During the study period, crustacean showed marked variation in their density at all study stations. Among the three study stations, maximum crustacean population was recorded at Sunkeri (stn 2) whereas minimum density was seen at Mavinhole creek (stn 1) and Kinnar (stn 3) respectively. Among the three seasons, the maximum crustacean population was recorded during the post monsoon season ($610.8/10m^2$) and minimum during the south west monsoon season ($142/10m^2$) respectively.

Keywords: Crustacean, Diversity, Estuary, Mangrove, Karwar.

INTRODUCTION

Karnataka state has coastline of about 320 km comprising three maritime districts namely Uttara Kannada in the north, Udupi at the centre and Dakshina Kannada in the south. The Uttara Kannada coast has blessed with five major riverine systems of which the river Kali being located in the northern most part of the coastal district which comprises a different types of biotopes such as mangroves, brackish waters, creeks, freshwater zone etc.

Because of the diversified topography and current pattern of adjacent Arabian Sea, the river Kali exhibits typical features of biotope, where the nature of substratum and inhabiting fauna in and around river Kali is totally different from the marine habitat. River Kali is one of the major riverine system of Uttara Kannada district, originates in Kusavali in Supa taluka, after meandering about 165km in Sahyadri Ghat region, which drains in to the Karwar bay (Arabian sea) at the northern skirts of the district. This river exhibits varied types physico-chemical characters, which are mainly responsible for diversified habitats and fauna inhabiting in them.

Mangroves grow along the embankment of almost all the estuaries, deltas, backwaters, creeks and other protected areas of the coast. Present estimates show that the total area occupied by the mangrove vegetation alone is more than 114,000 ha in the west coast. If the mangrove waters or marshes are takenp into consideration, then the total area would be much more. Although the fringing mangroves are seen along the entire major estuaries of Karnataka coast. The Indian mangroves comprise approximately 59 species in 41 genera and 29 families. Of these, 34 species belonging to 25 genera and 21 families are present along the west coast. Thick belt of *Rhizophora mucronata* along the Goa and Karnataka coast exists in dominance. Precision and smart farming technologies can improve agricultural resource management by enabling more efficient use of water, fertilizers, and other farm inputs. These approaches also support better monitoring, planning, and decision-making, thereby contributing to improved agricultural productivity and sustainable farming practices (Geetanjali & Singh, 2025)

There are different types of faunal communities in mangrove waters which are dependent on the water component in one way or the other. The planktonic and

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benthic animal communities also play a very important role in the mangrove ecosystem just like the terrestrial animals. Sufficient data on the seasonal distribution and abundance of these organisms are available from Indian mangrove waters (Goswami, 1979). Apart from the species *Crassostrea* (oyster) and clams, there are other bivalves and gastropod species which are dominant in the mangrove waters. There are different species of crustaceans like *Penaeus indicus*, *P. merguensis*, and *P. monodon*, while the crabs are represented by *Uca* sp., *Scylla serrata*, *Thalassina*, etc. The fishes are represented by several species like mud skippers (*Periophthalmus* sp.), carangids, clupeids, serranids, sciaenids, mullets (*Mugil cephalus*), Hilsa, Seabass (*Lates calcarifer*), milk fish etc.

MATERIALS & METHOD

Different methods were followed by adopting the standard procedures in the field as well as in the laboratory to carry out the present study. Manuals of National and International Laboratories were also referred and made use to carry out the experiments.

Crustacean samples were collected from the three fixed stations for the period of thirteen months from January 2020 to January 2021 at regular monthly interval. Samplings and analysis of samples were made as per the standard procedure (APHA, 2000). Totally three study stations were selected and fixed in the mangrove ecosystem of Kali estuary, Karwar on West coast of India. The location of study stations are shown in the Figure 1.

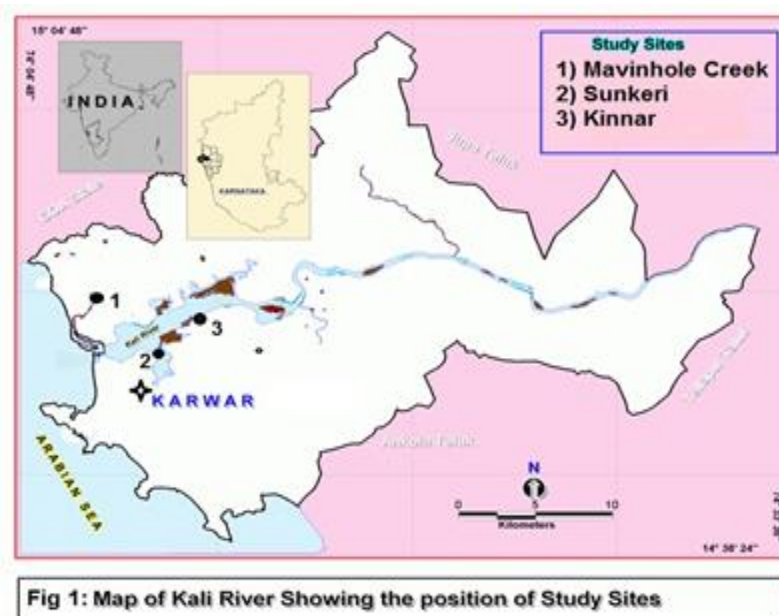


Fig 1: Map of Kali River Showing the position of Study Sites

RESULTS AND DISCUSSION

During the study period, crustacean showed marked variation in their density at all study stations. At station 1, crustacean density increased from January to May ($62-198/10\text{m}^2$) and it suddenly declined in June ($75/10\text{m}^2$) and thereby it gradually increased attained peak in October ($158/10\text{m}^2$) and later was gradually decreased with minimum density in January'09 (Figure 2). Figure 3 exhibits the monthly variation in crustacean density at study station 2, wherein minimum density occurred in August ($52/10\text{m}^2$) and maximum in April ($394/10\text{m}^2$) followed by October and December months values. There was a gradual decrease from April to August months when it attained minimum density at study site.

At station 3, the crustacean density was found comparatively lower than rest of the study sites, here the density showed maximum values in April ($249/10\text{m}^2$) and July ($224/10\text{m}^2$) whereas the minimum density was found in May month ($54/10\text{m}^2$) respectively (Figure 4). It is surmised, minimum density of crustaceans was

noticed at station 1 and maximum at station 2 and it is also clear from this figure that, in all study stations, the highest density of this community was recorded during pre and post monsoon whereas minimum density was registered during the south west monsoon season respectively.

Diversity of Crustacea:

The biotic community like crustacea explains the ecological and environmental condition of an area and were calculated in terms of number of individuals (N), number of species (S), total abundance (A), Margalef species richness, (d'), Pielou's evenness (J'), Shannon index (H') at each sites (Clarke and Gorley, 2001). Bray Curtis similarity for species diversity for all species belonging to crustacea was determined analytically by applying the PRIMER-v5 statistical package.

Table 1 explains the diversity profile of crustacea at study station 1. The species diversity of crustacea was estimated based on Margalef species richness (d) and Shannon index (H'). During the period of one year,

species richness (d) value ranged from 2.068 to 3.807 (Aug & Oct). Shannon index (H') values ranged from 1.477 to 2.822 during the study period. The Pielou's evenness (J') value also varied considerably among the months in this station, the minimum and maximum values were recorded during the January (0.803) and February (0.976).

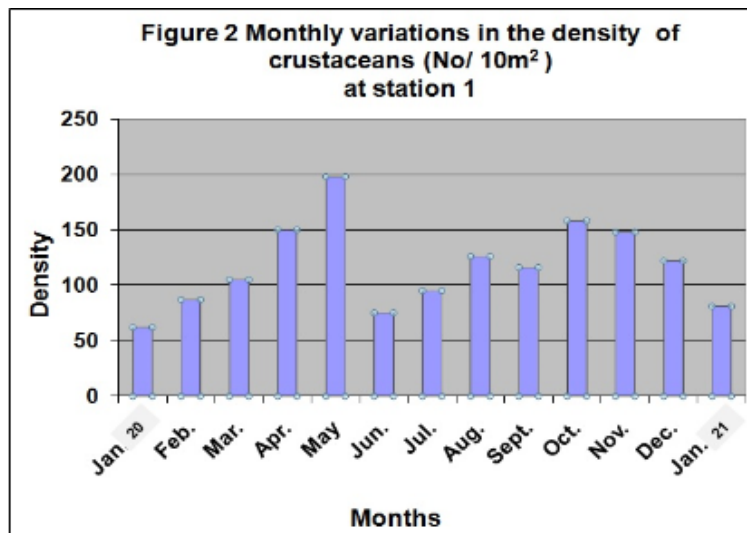
Table 2 describes the diversity profile of the crustacean at study station 3, wherein, the species richness (d) ranged from 1.333 to 3.466 during July and November months respectively. The H' values showed minimum and maximum during July (0.945) and November (2.401). Species evenness (J') showed values of 0.486 and 0.847 during July & November months.

In station 3, where the species richness (d') oscillated from 0.185 to 2.506 in the months of May and July (Table 3). In case of Shannon index values (H') it varied between 0.197 and 1.722 during August and November months respectively. The value of species evenness (J') was also varied considerably showing minimum and maximum values during August (0.180) and November (0.718) [Table 3] respectively.

On the basis of Bray Curtis similarity index, this is applied for crustacean species abundance at each study stations during the different months of the year. At study station 1, more than 95% similarity indices were noticed during, February-January'09; September-December were grouped into one cluster registering more than 96% whereas April & November forming as the second cluster of 98%. In rest of the months were dissimilar at this level Table 4.

Table 5 explains the similarity of density between the months. Maximum similarity of 96% (October & December) followed by and 97% in January '20 & '21 whereas the highest group of similarity (98%) was seen during the months of February & June.

Table 6 shows the variation in the similarity indices of this community at station 3 ranging from 82 to 99% during the months. The maximum similarity group of cluster was formed during the months of November & December registering the percentile of 99.12 followed by September & October (96.47%). In remaining months they were dissimilar at this level.



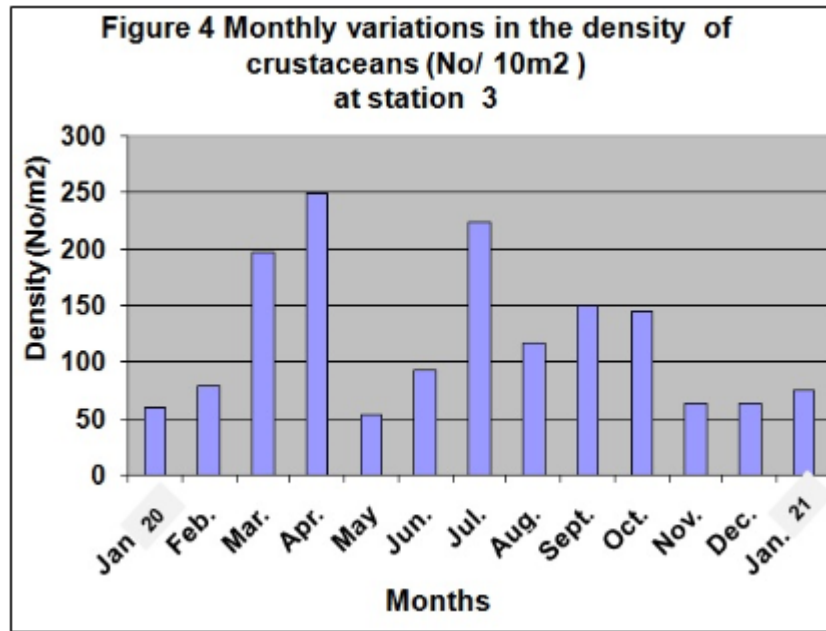
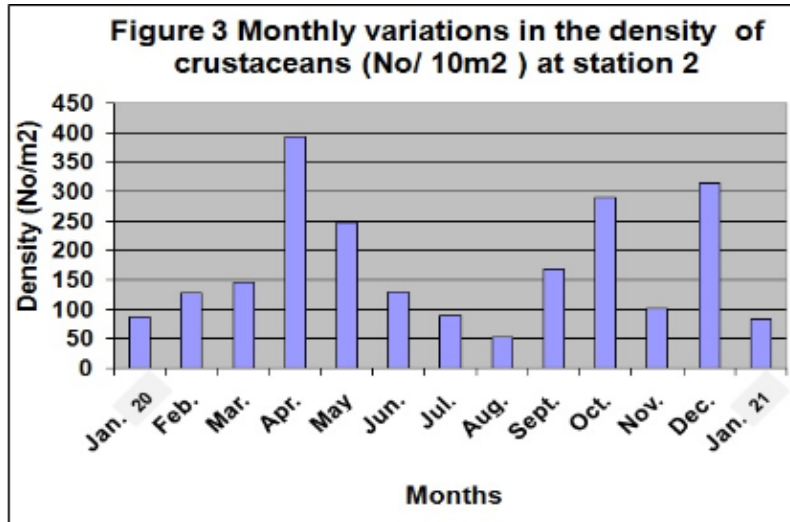


Table 1: Monthly variation in the species diversity and richness of crustacean fauna at Study Station 1

	S	N	d	J'	Brillouin	Fisher	H'(loge)	1-Lambda'
Feb.20	18	87	3.8066	0.9763	2.5083	6.8917	2.8220	0.9476
Mar20.	16	105	3.2230	0.9279	2.3335	5.2577	2.5728	0.9195
Apr.20	18	150	3.3927	0.9133	2.4408	5.3408	2.6398	0.9225
May20	17	198	3.0255	0.8304	2.2104	4.4541	2.3527	0.8823
Jun.20	15	75	3.2426	0.8041	1.9185	5.6382	2.1776	0.8454
Jul.20	13	95	3.6351	0.8617	2.0049	4.0734	2.2102	0.8618
Aug.20	11	126	2.0677	0.6158	1.3501	2.8987	1.4768	0.6026
Sept.20	15	116	2.9451	0.8940	2.2169	4.5889	2.4210	0.8995
Oct.20	17	158	3.1604	0.8782	2.3113	4.8334	2.4883	0.9038
Nov.20	17	148	3.2017	0.8753	2.2931	4.9572	2.480	0.8961
Dec.20	17	122	3.3305	0.8171	2.1074	5.3687	2.3152	0.8551
Jan.21	17	81	3.6409	0.8288	2.0745	6.5605	2.3483	0.8783
Jan.20	16	62	3.6344	0.8028	1.9167	6.987	2.2258	0.8556

Table 2: Monthly variation in the species diversity and richness of crustacean fauna at Study Station 2

	S	N	d	J'	Brillouin	Fisher	H'(loge)	1-Lambda'
Feb.20	16	128	3.0914	0.6602	1.6667	4.8267	1.8304	0.7567
Mar.20	18	145	3.4158	0.7801	2.0677	5.4147	2.2548	0.8356
Apr.20	19	394	3.0118	0.5937	1.6690	4.1669	1.7482	0.7270
May20	19	248	3.2647	0.7086	1.9652	4.7909	2.0865	0.8146
Jun.20	12	129	2.2634	0.6463	1.4736	3.2336	1.6061	0.6789
Jul.20	7	90	1.3333	0.4860	0.8518	1.7738	0.9458	0.4436
Aug.20	9	52	2.0246	0.8094	1.5531	3.1409	1.7784	0.7782
Sept.20	12	168	2.1467	0.6318	1.4629	2.9578	1.5699	0.6755
Oct.20	17	290	2.8219	0.4839	1.2827	3.9429	1.3709	0.5220
Nov.20	17	101	3.4668	0.8473	2.1562	5.8529	2.4007	0.8714
Dec.20	16	314	2.6089	0.5099	1.3377	3.5635	1.4139	0.6147
Jan.21	14	83	2.9419	0.6391	1.4894	4.8250	1.6867	0.7287
Jan.20	17	87	3.5826	0.6640	1.6529	6.3112	1.8814	0.7645

Table 3: Monthly variation in the species diversity and richness of crustacean fauna at Study Station 3

	S	N	d	J'	Brillouin	Fisher	H'(loge)	1-Lambda'
Feb.20	8	79	1.6020	0.5040	0.9286	2.2233	1.0481	0.4670
Mar.20	13	197	2.2713	0.5396	1.2893	3.1254	1.3840	0.6150
Apr.20	12	249	1.9936	0.4069	0.9357	2.6312	1.0038	0.4243
May20	11	54	2.5069	0.7180	1.4809	4.1759	1.7218	0.7372
Jun.20	3	93	0.4412	0.3424	0.3443	0.5926	0.3762	0.1961
Jul.20	2	224	0.1847	0.5435	0.3655	0.3026	0.3767	0.2197
Aug.20	3	117	0.4199	0.1801	0.1756	0.5613	0.1979	0.0831
Sept.20	4	150	0.5987	0.3030	0.3870	0.7552	0.4201	0.1868
Oct.20	7	145	1.2056	0.5135	0.9369	1.5356	0.9993	0.5654
Nov.20	11	64	2.4044	0.7182	1.5087	3.8258	1.7223	0.7440
Dec.20	11	63	2.4136	0.6482	1.3508	3.8555	1.5545	0.6784
Jan.21	11	75	2.3161	0.5710	1.2085	3.5529	1.3692	0.6335
Jan.20	5	60	0.9769	0.5737	0.8274	1.2967	0.9234	0.4819

Table 4: Monthly variation in the similarity indices of Crustacean fauna at Station 1 Mavina hole Creek

	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.21	Jan. 20
Feb. 20	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar.20	91.2349	0	0	0	0	0	0	0	0	0	0	0	0
Apr.20	78.7013	85.1681	0	0	0	0	0	0	0	0	0	0	0
May20	66.9620	73.8406	87.6590	0	0	0	0	0	0	0	0	0	0
Jun.20	91.9478	86.5452	72.3816	61.9265	0	0	0	0	0	0	0	0	0
Jul.20	92.4855	93.9320	79.2956	69.0412	89.1846	0	0	0	0	0	0	0	0
Aug.20	79.5732	88.5834	88.5827	77.9213	75.8156	86.2613	0	0	0	0	0	0	0
Sept.20	86.5679	95.2812	88.2280	77.4241	82.7592	90.8444	93.4861	0	0	0	0	0	0
Oct.20	75.8815	83.2236	97.3006	90.2421	70.5230	77.7810	87.0186	86.6559	0	0	0	0	0
Nov.20	78.4412	85.9051	98.9138	87.5267	73.0878	80.3375	89.6560	89.2868	97.2372	0	0	0	0
Dec.20	85.8504	83.4912	91.1358	79.7672	80.7656	87.8847	94.7358	96.8195	89.1684	91.9070	0	0	0
Jan.21	96.3667	89.0869	75.7521	65.0620	95.5681	90.7438	77.5989	84.5856	73.7882	76.3780	84.1108	0	0
Jan.20	86.7872	80.0162	66.5541	56.4893	92.0605	81.3631	68.2196	75.4714	64.6445	67.0931	74.5313	90.0540	0

Table 5: Monthly variation in the similarity indices of Crustacean fauna at Station 2 Sunkeri

	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.21	Jan. 20
Feb. 20	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar.20	93.7428	0	0	0	0	0	0	0	0	0	0	0	0
Apr.20	53.6020	58.0458	0	0	0	0	0	0	0	0	0	0	0
May20	71.6845	77.0640	79.0639	0	0	0	0	0	0	0	0	0	0
Jun.20	97.4230	91.8256	52.3947	69.9377	0	0	0	0	0	0	0	0	0
Jul.20	79.2050	73.2953	38.9708	53.6344	81.0561	0	0	0	0	0	0	0	0
Aug.20	62.2280	57.1063	28.5434	40.3645	63.5808	74.5570	0	0	0	0	0	0	0
Sept.20	86.3151	90.6528	61.6597	80.6019	88.4067	70.3673	53.9844	0	0	0	0	0	0
Oct.20	65.1227	69.6392	85.5198	92.1067	64.1248	48.9376	35.9452	74.4824	0	0	0	0	0
Nov.20	89.4076	85.2819	46.5224	63.5549	86.3993	86.9893	69.4594	75.8077	56.8484	0	0	0	0
Dec.20	62.0063	66.0652	88.9056	88.3060	61.2580	46.4387	34.0726	71.3817	96.0745	53.6473	0	0	0
Jan.21	82.1445	76.1538	40.6590	56.0478	80.6222	90.3479	78.3939	69.9198	50.3471	90.0025	47.6450	0	0
Jan.20	84.0211	79.4223	42.6283	58.5843	80.7402	90.0662	74.6816	70.3498	52.4544	93.7069	49.2688	95.8163	0

Table 6: Monthly variation in the similarity indices of Crustacean fauna at Station 3 Kinnar

	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. 21	Jan. 20
Feb. 20	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar.20	59.9193	0	0	0	0	0	0	0	0	0	0	0	0
Apr.20	51.6813	88.7551	0	0	0	0	0	0	0	0	0	0	0
May.20	80.8554	50.2256	41.9992	0	0	0	0	0	0	0	0	0	0
Jun.20	87.7749	61.9134	53.6115	67.9055	0	0	0	0	0	0	0	0	0
Jul.20	51.5613	89.8841	91.8049	38.1114	59.3017	0	0	0	0	0	0	0	0
Aug.20	77.6429	71.3631	62.3665	59.2224	88.7795	68.7187	0	0	0	0	0	0	0
Sept.20	68.4046	83.3524	73.7105	52.0627	77.0713	79.9282	87.4104	0	0	0	0	0	0
Oct.20	72.8664	83.6945	73.9199	57.0331	76.7766	77.2330	87.0645	96.4677	0	0	0	0	0
Nov.20	87.6734	55.2025	46.5080	93.5365	75.2298	43.3191	66.1245	58.2508	62.9977	0	0	0	0
Dec.20	87.2511	54.8026	46.1287	93.8824	74.7212	42.8763	65.6106	57.7651	62.5420	99.1197	0	0	0
Jan.21	94.7851	60.4233	51.3085	86.8079	82.8000	48.8146	73.2896	64.7246	69.2610	93.2412	92.8673	0	0
Jan.20	85.4369	48.4236	41.2752	87.5286	77.5575	42.9377	67.4164	58.7929	61.4651	859.8441	90.6709	84.5673	0

CONCLUSION

Mangroves ecosystem are most productive and largely predator free. They provide a hydrodynamic trap for the recruitment of juvenile prawns (Stoner, 1988; Wolanski and Sarsenski, 1997). The analysis of commercial prawn catches have repeatedly shown a strong correlation between the abundance of prawns and the coverage of mangrove vegetation (Marto Subroto and Naamin, 1977; Turner, 1977; Sesakumar *et al.*, 1992; Vance *et al.*, 1996; Katherasan, 2002b). Thus, the prawns are highly dependent on mangrove ecosystem. This has been made clear by the statement of Macnae (1968) which says 'no mangroves, so no prawns'. These statements holds good in the present study also.

Crabs form one of the most conspicuous animals in the mangrove forests. The dominant genera *Scylla*, *Sesarma* and *Uca*, the ud crabs. They constitute up to 80% of the macarofauna biomass (Golley, *et al.*, 1962). The crabs can reach the density of 80-90 m² in the mangrove swamps. The two families of crab-the Grapsidae and Ocypodidae are particularly associated with the mangrove ecosystem. Some species depend directly on the mangrove for survival, by feeding on leaves and litter. This holds good in the present study also, and highest density of crabs were seen in the mangrove ecosystem of Kali estuary. In addition to this, higher population of this faunal community was observed during the post monsoon season which is followed by the

pre monsoon period. Interestingly, the population was found maximum in the former period than the latter one. This also indicates that, after southwest monsoon period, maximum quantum of litter found in this ecosystem which helps in escalating the organic carbon/matter which enhances the productivity of this ecosystem and also the density of these hard shelled crab faunal populations.

Among the three study stations, maximum crustacean density was recorded at station 2 ($2229/10\text{m}^2$) whereas minimum at station 1 ($1523/10\text{m}^2$). Prawns showed maximum density at all study stations of which the species *Penaeus merguensis* has contributed much to the total density of prawns at all stations ($118 - 538/10\text{m}^2$). In crabs, the *Dotilla myctiroides* has shown maximum density ($27 - 247/10\text{m}^2$). Among the three seasons, maximum crustacean population was recorded during the post monsoon season ($610.8/10\text{m}^2$) and minimum during the southwest monsoon season ($142/10\text{m}^2$).

From the above findings it can be stated that mangrove ecosystems of Kali estuary is highly productive in terms of faunal composition and their density. It is also evident from the data that the crustacean larvae were found throughout the year which suggests that these ecosystems are highly productive in terms of crustacean resources. This further indicates that, these are the very good breeding grounds of crustaceans and finfishes of commercial importance. Hence, proper care has to be taken in management, propagation, conservation of mangroves and for sustainable fishery in future days.

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