



INDEX VALUE H, D AND E OF MARINE CRAB FROM AKKARAIPETTAI COASTAL WATERS, NAGAPATTINAM AREA, TAMIL NADU, INDIA

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ABSTRACT

The crustaceans are commercially important valuable sea food. The data collected on landings of crabs contributing directly to support the mankind. Nearly 13 varieties of commercially important species were identified during the study period January 2014 to December 2014 at the Akkaraipettai coastal landing in Nagapattinam area. Monthly variation in the total number of individuals (kg) was observed. The calculated index values showed that the highest Shannon's diversity value observed was 0.113 (July), 0.111 (August), 0.116 (September) and 0.102 (October). The Evenness index value was 0.110 (July), 0.109 (August), 0.113 (September) and 0.100 (October). The calculated richness index value was 3.432 (January), 3.400 (February), 3.465 (March), 3.615 (April) and 3.532 (June). Season wise mean (kg) variation of species recorded was premonsoon > monsoon > post monsoon > summer. From this study the highest and lowest index values for the crab species was calculated and recorded which is a useful technique to assess the crab species diversity in a marine ecosystem.

Keywords: Crab, Diversity, Richness, Evenness, Season, Index values.

INTRODUCTION

Among benthic communities, crustaceans are important members because more number of species present for human consumption and a tremendous variety of small species contribute to the complexity and functioning of tropical ecosystems (Hendrickx, 1995). Tropical and subtropical regions have more number of crab species compared to temperate and cold regions (Boschi, 2000). Tamil Nadu coast, one of the states in India has 404 species of crabs belonging to 26 families and 152 genera (Kathirvel, 2008). Maximum percentages of crab catches are landed from Gulf of Mannar, Palk Bay, Nagapattinam and Puducherry landings of Tamil Nadu coast in India (Rao *et al.*, 1973).

There were number of studies about the diversity of crabs near our study area reported. In Chennai coast (Thangaraj Subramanian, 2001; Krishnamoorthy, 2007; Lakshmi Pillai and Thirumilu, 2008), Gulf of Mannar areas (Jeyabaskaran and Ajmal Khan, 2007), Pondicherry mangrove areas (Satheeshkumar and Khan, 2011), Pichavaram mangrove areas (Ajmal Khan *et al.*, 2005; Ravichandran and Kannupandi, 2007) and Parangipettai coast (John Samuel *et al.*, 2004; John Samuel and Soundarapandian, 2009) reported.

Crustaceans are highly valuable commodities by virtue of their pivotal role in the seafood industry of the world. Many of the crabs are commercially important as a food source for people. India's marine and coastal ecosystem constitutes an important natural resource, since millions of the people dependent on them for their live hoods.

The crustacean fisheries of India have been assumed significant in recent years. Marine crustaceans found along the Indian coasts, Crab rank third after shrimp and lobsters by virtue of importance as an esteemed delicacy and also by the value of fishery they support. Biodiversity and abundance of decapods species have been carried out from different parts of the India by Radhakrishnan (1979) from the parangipettai coast. Sethuramalingam (1984) from the pitchavaram mangroves. Joel and Raj (1987) from pulicate Sea. Chakraborty and Choudhary (1992) from the sunderbans. Venkataraman and Wafar (2005) from the Indian waters. Kathirvel (2008) from the Indian waters. Bandekar *et al.* (2011) from the Karwar mangrove environment. Hence the present study was carried out to observe the diversity, richness and evenness of the commercially important crab species from Akkaraipettai coastal waters, Nagapattinam area, Tamil Nadu, India.

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MATERIALS AND METHODS

The study was carried out for the period from January 2014 to December 2014 at Akkaraipettai (Lat.10° 74' 99" N; Long. 79° 83' 95" E) landing centre, south east coast of India. Nearly more than 500 trawl nets were operating in this landing centre for capturing of crab. Present study data was collected from a single commercial trawl net every fortnight. The trawlers operate the trawl net at a depth ranging from 15-30 m. The sampling was made at randomly from 5-10 heaps contributing 100 kg.

All the collected specimens were preserved in 10% formalin for further identification purpose. The preserved specimens were identified to the species level using different identification keys available in the published literatures Sethuramalingam (1991), Venkataramani (2005), Kathirvel (2008) and Suthakar (2011).

Data Analysis

The collected data were subjected to Shannon diversity index, Richness index and Pielou's Evenness index.

Shannon Diversity Index (H)

$$\text{Shannon Index (H)} = -\sum_{i=1}^s p_i \ln p_i$$

Where,

P = is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N),

ln = is the natural log,

Σ = is the sum of the calculations, and

S = is the number of species.

Species Richness Index (d)

$$d = \frac{S - 1}{\log N}$$

Where,

S = number of species

N = number of individual

Pielou's Evenness index (e)

$$e = \frac{H}{\log S}$$

Where,

H = Shannon index

S = number of species

RESULT

Nearly 13 variety of commercially important species were identified during the study period January 2014 to December 2014 at the Akkaraipettai coastal landing namely

Portunus pelagicus, *p. sanguinolentus*, *Scylla tranqubarica*, *Scylla serrata*, *P. hastatooides*, *P. galadiator*, *Charybdis natator*, *Charybdis feriatius*, *C. lucifera*, *C. lophos*, *Sesarma reticulatum*, *Ocypode platylarsis*, and *Liocarcinus vernails*.

Monthly variation in the total number of individuals (kg) were observed during this study period (Table 1). The maximum quantity of species recorded were *P. pelagicus*, *p. sanguinolentus* and *S. serrata*. The moderate quantity recorded were *S. tranqubarica*, *P. hastatooides*, *P. galadiator*, *C. natator*, *C. feriatius*. The smallest quantities observed were *C. lucifera*, *C. lophos*, *S. reticulatum*, *O. platylarsis*, and *L. vernails*.

The index values were calculated (Table 1) and compared. It shows that the highest Shannon's diversity value observed was 0.113 (July), 0.111 (August), 0.116 (September) and 0.102 (October). The Evenness index value was 0.110 (July), 0.109 (August), 0.113 (September) and 0.100 (October). The calculated richness index value was 3.432 (January), 3.400 (February), 3.465 (March), 3.615 (April) and 3.532 (June).

Season wise mean (kg) variation of species (Table 2) recorded was premonsoon > monsoon > post monsoon > summer.

The maximum species observed in premonsoon season was *P. pelagicus* (1188.0±10.8), *P. sanguinolentus* (918.0±10.8), *S. tranqubarica* (576.0±82.5), *Scylla serrata* (792.0±31.2), *C. feriatius* (558.0±82.5) the minimum recorded was *P. hastatooides* (224.0±13.9), *P. galadiator* (378.0±54.0), *C. natator* (332.0±49.3), and *C. lucifera* (127.0±10.9).

The highest number of species observed in monsoon season was *P. pelagicus* (882.0±20.4), *P. sanguinolentus* (669.0±10.8), *S. tranqubarica* (539.0±94.2) and the minimum number recorded were *S. serrata* (378.0±54.0), *P. hastatooides* 320.0±62.4, *P. galadiator* (396.0±30.6), *C. natator* (472.7±35.9).

During postmonsoon season maximum of the species recorded was *P. pelagicus* (576.0±13.5), *Scylla serrata* (528.6±30.3) and minimum recorded were *P. sanguinolentus* (414.0±31.2), *Scylla tranqubarica* (324.0±54.0), *P. hastatooides* (199.3±32.4), *P. galadiator* (314.6±40.8), *Charybdis natator* (226.9±69.5), *Charybdis feriatius* (342.0±20.4), *Charybdis lucifera* (162.0±54.0).

The maximum species observed in summer was *S. serrata* (513.0±19.0) and minimum number of species was *P. pelagicus* (270.0±76.4), *P. sanguinolentus* (297.0±38.2), *S. tranqubarica* (324.0±15.7), *P. hastatooides* (135.0±38.2), *P. galadiator* (270.5±0.7), *C. natator* (162.0±76.4), *C. feriatius* (297.0±38.2).

Least number of species recorded in all the seasons were *C. lophos*, *S. reticulatum*, *O. platylarsis*, and *L. vernails*.

Table 1. Monthly mean (Kg) variations of species at Akkaraipettai during the year January 2014 to December 2014.

Species	Jan	Feb	Mar	Apr	Jun	Jul	Aug	sep	Oct	Nov	Dec
<i>Portunus pelagicus</i>	593 ± 2.12	701 ± 1.41	432 ± 0.71	323 ± 1.41	214 ± 2.83	1187 ± 2.12	1080 ± 0.71	1296 ± 0.71	972 ± 0.71	1025 ± 1.41	647 ± 2.12
<i>P. sanguinolentus</i>	431 ± 1.41	431 ± 1.41	376.5 ± 2.12	271 ± 0.71	323 ± 1.41	1025 ± 1.41	918 ± 0.71	809 ± 1.41	755 ± 1.41	702 ± 0.71	549.5 ± 0.71
<i>Scylla tranqubarica</i>	369 ± 12.7	322 ± 2.83	269 ± 1.41	214 ± 2.83	430 ± 2.12	485 ± 2.12	646 ± 2.83	593 ± 1.41	646 ± 2.83	479 ± 1.41	489.5 ± 0.71
<i>Scylla serrata</i>	539 ± 1.41	559 ± 0.71	485.5 ± 0.71	378 ± 0.71	646 ± 2.12	809 ± 0.71	754 ± 2.83	809.5 ± 0.71	431.5 ± 0.71	323 ± 2.12	376 ± 2.83
<i>P. hastatoides</i>	215 ± 1.41	218.5 ± 2.12	161 ± ± 1.41	160 ± 2.83	106 ± 2.83	214 ± ± 2.83	239 ± ± 1.41	214 ± ± 2.83	268.5 ± 2.12	299 ± ± 0.71	389 ± ± 1.41
<i>P. galadiator</i>	269 ± 0.71	323 ± 1.41	349 ± 1.41	269 ± 2.12	269 ± 1.41	377 ± 2.12	322 ± 2.83	431.5 ± 0.71	376 ± 2.83	431 ± 1.41	378.5 ± 2.12
<i>Charybdis natator</i>	215 ± 0.71	298 ± 2.83	161 ± 1.41	107 ± 2.12	215 ± 1.41	279 ± 1.41	336 ± 2.83	376.5 ± 2.12	431 ± 1.41	499 ± 1.41	484.5 ± 2.12
<i>C. feriatus</i>	106 ± 2.83	485 ± 1.41	431 ± 1.41	322 ± 2.12	269 ± 1.41	648 ± 0.71	485 ± 1.41	539 ± 1.41	322.5 ± 2.12	107 ± 2.12	214.5 ± 2.12
<i>C. lucifera</i>	161 ± 1.41	107.5 ± 0.71	213 ± ± 4.24	2.5 ± ± 0.71	5 ± ± 1.41	162 ± ± 0.71	4 ± ± 1.41	215 ± ± 1.41	5.5 ± ± 3.54	11 ± ± 1.41	4.5 ± ± 0.71
<i>C. lophos</i>	1.5 ± ± 0.71	4 ± 1.41	3.5 ± 0.71	27 ± 2.12	1.5 ± ± 0.71	3 ± 1.41	107 ± 1.41	53.5 ± 0.71	46.5 ± 2.12	7.5 ± 0.71	9.5 ± 0.71
<i>Sesarma reticulatum</i>	214 ± 2.83	3 ± ± 1.41	5.5 ± ± 0.71	6 ± ± 2.83	3 ± ± 1.41	3 ± ± 2.83	52.5 ± 2.12	54.5 ± ± 2.12	33 ± ± 2.83	38.5 ± 2.12	3.5 ± ± 2.12
<i>Ocypode platylarsis</i>	4.5 ± ± 2.12	4.5 ± ± 0.71	6 ± ± 1.41	1.5 ± ± 2.12	3 ± ± 2.83	3 ± ± 2.83	107 ± ± 1.41	38 ± ± 2.83	29 ± ± 1.41	24 ± ± 1.41	4 ± ± 1.41
<i>Liocarcinus vernails</i>	3 ± 1.41	1.5 ± 0.71	2 ± 1.41	4 ± 2.83	2.5 ± ± 0.71	4 ± 2.83	4 ± 2.83	17 ± 3.54	11 ± 1.41	10 ± 1.41	5.5 ± 4.95
Shannon Diversity Index (H)	0.08	0.090	0.081	0.06	0.07	0.113	0.111	0.116	0.102	0.097	0.091
Pielou's Evenness index (e)	0.08	0.088	0.079	0.06	0.07	0.110	0.109	0.113	0.100	0.095	0.089
Species Richness Index (d)	3.43	3.400	3.465	3.62	3.53	3.229	3.239	3.211	3.299	3.214	3.279

Table 2. Season wise mean (Kg) variations of species at Akkaraipettai during January 2014 to December 2014.

Species	Post-monsoon	Summer	Pre-monsoon	Monsoon
<i>Portunus pelagicus</i>	576.0 ± 13.5	270.0 ± 76.4	1188.0 ± 10.8	882.0 ± 20.4
<i>P. sanguinolentus</i>	414.0 ± 31.2	297.0 ± 38.2	918.0 ± 10.8	669.3 ± 10.8
<i>Scylla tranqubarica</i>	324.0 ± 54.0	324.0 ± 15.7	576.0 ± 82.5	539.3 ± 94.2
<i>Scylla serrata</i>	528.6 ± 38.3	513.0 ± 19.9	792.0 ± 31.2	378.0 ± 54.0
<i>P. hastatoides</i>	199.3 ± 32.4	135.0 ± 38.2	224.0 ± 13.9	320.0 ± 62.4
<i>P. galadiator</i>	314.6 ± 40.8	270.5 ± 0.7	378.0 ± 54.0	396.7 ± 30.6
<i>Charybdis natator</i>	226.9 ± 69.5	162.0 ± 76.4	332.0 ± 49.3	472.7 ± 35.9
<i>C. ferriatus</i>	342.0 ± 20.4	297.0 ± 38.2	558.0 ± 82.5	216.0 ± 10.8
<i>C. lucifera</i>	162.0 ± 54.0	3.0 ± 4.2	127.7 ± 10.9	6.7 ± 4.7
<i>C. lophos</i>	3.6 ± 1.5	15.0 ± 18.4	54.7 ± 53.0	21.7 ± 22.8
<i>Sesarma reticulatum</i>	74.3 ± 12.2	3.0 ± 1.4	37.0 ± 31.2	25.7 ± 20.6
<i>Ocypode platylarsis</i>	4.3 ± 1.2	0.5 ± 0.7	49.7 ± 54.2	19.3 ± 14.4
<i>Liocarcinus vernails</i>	1.3 ± 0.6	0.7 ± 0.7	7.7 ± 6.7	7.0 ± 4.4

DISCUSSION

In this study 13 species were collected and identified. The trawl nets operated by mechanized boat bring appreciable amounts of crabs with other fishes. Totally three families such as portunidae, sesarmidae and ocypodidae with four genus were collected in this study area. More number of species was recorded from family portunidae. Few numbers of species like *S. reticulatum*, *O. platylaris* and *L. vernails* reported from this study sites.

Biodiversity and community structures are now recognized to be important determinants of ecosystem functioning. Monitoring of species diversity is a useful technique for assessing damage to the system and maintenance of good species diversity is a positive management objective. A diversity index is the measure of species diversity in a marine community. Here, the calculated highest species richness index (3.615) showed that Akkaraipettai area was the richest station, which indicating that it was the most diverse in respect of crab species. This characteristic was supported by the Shannon's diversity index showed highest value 0.116 and the highest evenness index value was 0.113. The advantage of this index is that it takes into account the number of species and the evenness of the species. The index value is zero when there is one species in the sample but increases either by having additional unique species or having greater species evenness. In the Akkaraipettai coastal area the lowest diversity index value observed was 0.065-0.073.

Fluctuations have been observed in the crab landings from month to month in mean (kg) number of species and these are due to fishery independent factors such as salinity, temperature and current and also fishery dependent factors such as rate of exploitation, season of exploitation and size exploited. Also factors such as possible physical changes in the substrate composition and availability of maximum

organic carbon during monsoon and post monsoon seasons may be attributed for greater abundance. Among all the crabs in Akkaraipettai the dominant representatives were portunidae family crabs. It includes three genres. The dominant species of Portunidae were *P. pelagicus*, *p. sanguinolentus* and *S. serrata* these dominant species were earlier reported from Arukkattuthurai to Pasipattinam, southeast coast of India by Varadharajan, 2012. The moderate quantity recorded was *S. tranqubarica*, *P. hastatoides*, *P. galadiator*, *C. natator*, *C. ferriatus*. The other crabs species recorded from these zones were *C. lucifera*, *C. lophos*, *S. reticulatum*, *O. platylarsis*, and *L. vernails*.

These commercially important crab landings were already reported by different authors (Varadharajan *et al.*, 2009 and Radhakrishnan, 1979) in south east coast India. Tamil nadu tops the list in crab landings all over India and the south east coastal belt has been proven as the strongest potential of edible sea crabs (Varadharajan *et al.*, 2009; Sanil Kumar, 2000). In the present study not only total contribution of the crabs but also individual contributions of crabs were maximum than other crab landing areas of south east coast. Landing is abundant in some areas in India is due to large number of trawl operations. This may be the reason for landing of crabs are maximum in other coastal areas than the Akkaraipettai landing centre (Varadharajan *et al.*, 2012; Soundarapandian *et al.*, 2008).

CONCLUSION

Season wise variations observed in this area is due to increase in pollution around this coastal ecosystem by manmade chemicals and the aquaculture practices is now adding pressure on crab population hence conservation of crabs species at Akkaraipettai coastal area is important.

From this study, the highest and lowest index values for the crab species was recorded and calculated. This is the useful technique to assess the crab species diversity in a marine ecosystem.

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REFERENCES

- Ajmal Khan, S., Raffi, S.M. and Lyla, P.S., 2005. Brachyuran crab diversity in natural (Pitchavaram) and artificially developed mangroves (Vellar estuary). *Curr. Sci.*, 88, 1316-1324.
- Bandekar, P.D., Neelkantan, K., Kakati, V.S., 2011. Biodiversity of Crabs in Karwar mangrove environment west coast of India. *Recent Res. Sci. Tech.*, 3(4), 1-5.
- Boschi, E.E., 2000. Biodiversity of marine decapod brachyurans of the Americas. *Journal of Crustacean Biology*, 2: 37-342
- Chakraborty, S.K. and Choudhary, A., 1992. Ecological studies on the zonation of brachyuran crabs in a virgin mangrove islands of Sunderbans, India. *J. Mar. Biol. Ass. India*, 34, 189-194.
- Hendrickx, M.E., 1995. Checklist of brachyuran crabs (Crustacea: Decapoda) from eastern Tropical Pacific. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique*, 65, 125-150
- Jeyabaskaran, R. and Ajmal Khan, S., 2007. Diversity of brachyuran crabs in Gulf of Mannar (Southeast coast of India). In: *Biodiversity Conservation of Gulf of Mannar Biosphere Reserve* (Kannaiyan S, Venkataraman K, eds). National Authority, Chennai, India, pp. 68-82.
- Joel, D.R. and Raj, P.J.S., 1987. Marine Crab fisheries around Pulicat Sea. *Exp. J.*, 19, 18-21.
- John Samuel, N. and Soundarapandian, P., 2009. Fishery potential of commercially important crab *Portunus sanguinolentus* (Herbst) along Parangipettai coast, south east coast of India. *Int. J. Ani. Veterin., Advan.*, 1, 99-104.
- John Samuel, N., Thirunavukkarasu, N., Soundarapandian, P., Shanmugam, A. and Kannupandi, T., 2004. Fishery potential of commercially important portunid crabs along Parangipettai coast. In: *Proceedings of Ocean Life Food and Medicine Expo*, 165-173.
- Kathirvel, M. 2008. Biodiversity of Indian marine brachyuran crabs. *Rajiv Gandhi Chair Special Publication*, 7, 67-78.
- Krishnamoorthy, P., 2007. Brachyura. *Zoological Survey of India, Fauna of Chennai coast. Ecosystem Series*, 1, 83-109.
- Lakshmi Pillai, S. and Thirumilu, P., 2008. New record of brachyuran crabs from the Chennai coast. *J. Mar. Biol. Assoc. India*, 50, 238-240.
- Radhakrishnan, C.K., 1979. Studies on portunid crabs of Porto Novo (Crustacea: Decapoda: Branchyura). Ph.D. Thesis, Annamalai University, India.
- Rao, P.V., Vedavyasa, M., Thomas, M.M. and Sudhakara Rao, G., 1973. The crab fishery resources of India. In: *Proceedings of the symposium on living resources of the seas around India. CMFRI Sp. Publ.*, 581-591.
- Ravichandran, S. and Kannupandi, T., 2007. Biodiversity of crabs in Pichavaram mangrove environment. *Zoological Survey of India. In: National Symposium on Conservation and Valuation of Marine Biodiversity*, pp. 331-340.
- Sanil Kumar, S. 2000. New horizons in sea crab meat processing. *Sea Exp. J.*, 31, 41-43.
- Satheeshkumar, P. and Khan, A.B., 2011. An annotated checklist of brachyuran crabs (Crustacea: Decapoda) from Pondicherry Mangroves, south east coast of India. *World J. Zool.*, 6, 312-317.
- Sethuramalingam S., 1984. Studies on Brachyuran crabs from Vellar estuary, Killai backwater complex of porto Novo coast. Ph.D. Thesis, Annamalai University, 1984, India, p. 243.
- Sethuramalingam, S. and Ajmalkhan, S., 1991. Brachyuran crabs of Parangipettai coast. *CAS in Marine Biology*, Annamalai University, Tamil Nadu, India, pp.1-28.
- Soundarapandian, P., John Samuel, N., Ravichandran, S., and Kannupandi, T., 2008. Biodiversity of crab in Pitchavaram mangrove environment, South east coast of India. *Int. J. Zool. Res.*, 4(2), 113-118.
- Suthakar, M., 2011. Biodiversity, Resource, Nutrition status and Shell utilization of crabs from cuddalore coast. South East coast of India. Ph.D. Thesis. Annamalai University, India.
- Thangaraj Subramanian, V., 2001. On the exploitation of portunid crab *Podophthalmus vigil* (Weber) along the Chennai coast in Tamil Nadu. *Indian J. Fish.*, 48, 431-434.
- Varadharajan, D. and Soundarapandian, P., 2012. Commercially important crab fishery resources from Arukkattuthurai to Pasipattinam, South East Coast of India. *J. Mar. Sci. Res. Dev.*, 2,110.
- Varadharajan, D., Soundharapandian, P., Dinakaran, G.K., 2009. Crab fishery resources from Arukkattuthurai to Aiyampattinam, South East Coast of India. *Curr. Res. J. Biol. Sci.*, 1(3), 118-122.
- Venkataraman, K. and Wafar, M., 2005. Coastal and marine biodiversity of India. *Indian J. Mar. Sci.*, 34, 57-75.