

## Diversity of Commercially Important Marine Crabs In Nagapattinam Coastal Area, Tamilnadu, India

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**Abstract:** The crustaceans are commercially important valuable sea food contributing directly to support the mankind. The data was collected for decapod crabs from the Akkaraipettai landing centre of Nagapattinam. Nearly 12 varieties of commercially important species were identified during the study period from January 2017 to December 2017 in Nagapattinam coastal area. The collected data were subjected to study the Species diversity (Shannon diversity index), Richness (Margalef Richness Index) and Evenness (Pielou's Evenness index) to assess the diversity of crab species. The calculated index values showed that the highest Shannon's diversity value observed was -0.1173 (March 2017), -0.1147 (February 2017), -0.1131 (January 2017) -0.111 (April 2017) and -0.0920 (November 2017). The Evenness index value was -2.0813 (January 2017), -1.9881 (February 2017), -1.8534 (March 2017), -1.7361 (April 2017) and -1.1777 (November 2017). The calculated richness index value was 4.6134 (March 2017), 4.6105 (February 2017), 4.6087 (January 2017), 4.6064 (April 2017) and 4.5825 (November 2017). Seasonal variation of species across various season showed the highest in premonsoon > monsoon > post monsoon > summer.

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

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### I. Introduction

The crustaceans forms has been major group in over all faunal diversity in India various fluctuating estimates made on the species diversity of crustaceans approximately 5000 species worldwide (Melo, 1996). Biodiversity and abundance of decapods species have been carried out from India by Venkatraman and Wafar, (2005) and Kathirvel (2008). West coast 226 species reported, east coast 461 species, Bay islands 520 species, Andaman and Nicobar islands 220 species after 837 species were reported.

The brachyuran diversity studies are available from Chennai coast (Subramanian 2001, Pillai and Thirumullai 2008), Pitchavaram mangrove areas (Ajmal Khan et al., 2005), Parangipettai coast (Samuel et al., 2004; Samuel and Soundarapandian 2009), Sakithivel and Fernando 2012) from Mudasal Odai and Nagapattinam. 210 crab species were observed from Gulf of Mannar (CMFRI, 1969a and 1998). Marine crustaceans found along the Indian coast crab rank second after shrimp. The commercially important crabs the genus *Scylla* rank first followed by *Portunus* sp (*P. pelagicus* and *P. sanguinolentus*). Portunid crabs are one of the good fishery resources of south east Asian seas, which swimming crabs, three spot crab (*P. sanguinolentus*) and blue swimming (*P. pelagicus*) are highly commercial value along with mud crab.

Abundance of crabs from October to November and February to May with peak season. Crabs were exploited by indigenous gears such gillnet, boat seines, shore seine and cast net in the inshore marine region and drag net, dip net and brackish water areas and catches the steadily increased due to mechanized trawling.

Marine crabs are economically important to Thailand. At a country level, they have long been exported to foreign countries in the form of living crabs (e.g. Singapore, Taiwan, China etc.) Some species such as the blue swimming crab, *Portunus pelagicus* and the mud crab, *Scylla* sp., are well-known in international markets. At a local level, they are a source of income for local fishing communities living in coastal areas. From an ecological point of view, they play an important role as predators, prey, and/or detritus feeders in the complex food web of coastal and marine ecosystems, especially in mangrove forests, seagrass beds and coral reefs. At the same time, they are prey for other marine animals such as squids, fish, turtles and mammals (Josileen 2011).

In Indian coast fifteen edible crabs are commonly available, among them twelve crabs are commercially valuable of local and export trade. The landing of fisheries data showed that Nagapattinam coast is very important to provide significant quantity of seafood supply for the nation and economically very important for the state. They are authorized to export, developing and managements of future research. The crab fisheries potential have been conducted by many workers in Indian waters.

Various authors have dealt with fishing methods and the landing of crabs from different parts of Indian coasts. Anzari and Harkantra (1976) and Ameerhamsa (1978) reported commercial fishing of crabs from Bombay waters. Bijukumar et al (2007) and CMFRI (2009) recorded crab fishery from Goa. Reports on crab fishing and fishery were also available from Karnataka [CMFRI (2010)], Kerala [Kathirvel M.2008], Tamil Nadu [Radhakrishnan 1979; Joel Raj (1987) and John Samuel et al (2004) ], Andhrapradesh [Pillai and Nair (1973) and Orissa [Sethuramalingam et al 1991]. From the previous crab landing reports the crab population is declining every year. So crab fishery resource study is essential to improve the population of the respective areas. Hence the present study was carried out to observe the diversity, richness and evenness of the commercially important crab species from Akkaraipettai coastal water of Nagapattinam, Tamil Nadu, India.

## II. Materials and Methods

The study was carried out for the period from January 2017 to December 2017 at Nagapattinam (Lat.10.74 99°N; Long.79.8395°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 collect data for watching the landing of crabs and then fisherman giving more information were collected by interviewing them personally. The average of daily commercial crab landing was worked out from the data thus obtained and raised to the number of fishing days to assess the monthly total crab landings of the centre. The data were, collected for all the months except the second of half April-16 to May-30. 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 assess the diversity of Crabs species with reference to Species diversity (Shannon diversity index), Species richness (Margalef richness index) and Species evenness (Pielou's evenness index).

#### a) Shannon Diversity Index (H)

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

S = is the number of species.

#### b) Species Richness (Margalef richness index)

Where,

S = number of species

N = number of individual

#### c) Pielou's Evenness index (e)

Where,

H = Shannon index

S = number of species

## III. Result

12 variety of commercially important crab species were identified during the study period from January 2017 to December 2017 in Akkaraipettai landing centre of Nagapattinam. (Table-I)

Identified crab species are *Portunus pelagicus*, *p. sanguinolentus*, *Scylla tranqubarica*, *Scylla serrata*, *P. galadiator*, *Charybdis natator*, *Charybdis feriatius*, *C. lucifera*, *Charybdis variegata*, *Podaphthalamus vigil*, *Charybdis granulate* and *Charybdis truncate*.

Monthly variation in the total number of individuals crab species were observed during this study period (Table 2). The maximum quantity of species recorded were *P. pelagicus*, *p. sanguinolentus*, *S. serrata* and *Scylla tranqubarica*. The moderate quantity recorded was *P. galadiator*, *C. natator*, *C. feriatius* and *Podaphthalamus vigil*. The minimum quantities were observed in *C. lucifera*, *Charybdis variegata*, *Charybdis truncate* and *Charybdis granulate*.

The index values were calculated (Table 4) and compared. It showed that the highest Shannon's diversity value observed was -0.1173 (January 2017), -0.1147 (February 2017), -0.1131 (March 2017), -0.1111 (April 2017) and -0.912 (July 2017). The Evenness index value was -2.0813 (January 2017), -1.1040 (December 2017), -1.9881 (February 2017) -1.8534 (March 2017) and -1.1777. The calculated richness index

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value was 4.6087 (January 2017), 4.6064 (April 2017), 4.6134 (March 2017), 4.6105 (February 2017) and 4.5813 (July 2017).

Seasonal variation of crab species were recorded and represented in (Table 3). variation of species was premonsoon > monsoon > post monsoon > summer.

The maximum species observed in premonsoon season was *Charybdis feriatu*s (281±93.6), *P. gladiator* (241±80.3), *C.granulate*(216±72), *Podophthalmus vigil* (215 ±71.6), *S. tranqubarica* (215±71.6), *P. sanguinolentus* (211±70.3), *C.natator*(194 ±64.6), *P.pelagicus* (161±53.6) , *C.truncata* (155±51.6), *Scylla serrata* (150± 50).The minimum recorded *C.lucifera* (101±33.6) and *C.variegata* (38±12.6).

The highest number of species observed in monsoon season was *P. pelagicus* 264±88), *P. sanguinolentus* (241±80.3), *S. tranqubarica* (258±86) and *S. serrata* (245±81.6) , *Charybdis feriatu*s (235±78.3) , *P.vigil* ((188±62.6) *P. gladiator* 108±36) and the minimum number recorded were *C. natator*( 92 ±30.6) , *C.lucifera* (42±14) , *C.granulate* (36±12), and *C.truncata* (23± 7.6).

During postmonsoon season maximum of the species recorded was *P. pelagicus* (433±144.3), *S. tranqubarica* (415±138.3) , *Scylla serrata* (401±133.6), *P. sanguinolentus* (393±131) *Charybdis natator* (203±67.6), *C.granulate* (202±67.3), *P.vigil* (193±64.3), *C.truncata* (167± 55.6), *C.lucifera* (143±47.6) ,*C.variegata* (100±33.3) and minimum recorded were *P.galadiator* (68 ±22.6), and *C . feriatu*s (68 ±22.6).

The maximum species observed in summer was *S. tranqubarica* (181±90.5), *P. sanguinolentus* (176±88) , *S.serrata* (165±82.5) , *Charybdis natator* (164±67.6), *P. pelagicus* (148±74), *C. feriatu*s (139 ±6.9) and minimum number of species was *C.lucifera* (72±36), *P.galadiator* (70 ±35) , *C.granulate* (44±22), and *C.variegata* (19±9.5) .Least number of species recorded in all the seasons were *C.variegata* and *C.granulate*. The present study inferred than the premonsoon season support maximum and summer season has minimum catch in Nagapattinam coast.

**Table-I - List of Marine Crab species available in Nagapattinam during January 2017-December 2017**

SPECIES	FAMILY	ORDER
<i>Portunus pelagicus</i> <i>Portunus sanguinolentus</i> <i>Scylla tranqubarica</i> <i>Scylla serrata</i> <i>P. gladiator</i> <i>Charybdis natator</i> <i>Charybdis feriatu</i> s <i>Charybdis lucifera</i> <i>Charybdis variegata</i> <i>Podaphthalmus vigil</i> <i>Charybdis granulate</i> <i>Charybdis truncate</i>	Portunidae	Decapoda

**TABLE-2 :Monthly variations of Crab species (Mean and SD) in Nagapattinam during the year January 2017 to December 2017**

S.No	Species	January	Feb	Marc h	Apr	June	July	Aug	Sep	Oct	Nov	Dec
1	<i>Portunus pelagicus</i>	150 ± 14.45	145 ± 7.42	138 ± 4.12	100 ± 7.25	48 ± 2.94	52 ± 5.59	50 ± 8.42	59 ± 5.84	60 ± 7.81	72 ± 9.34	132 ± 6.97
2	<i>Portunus sanguinolentus</i>	135 ± 10.89	130 ± 11.20	128 ± 5.88	98 ± 2.36	78 ± 3.86	77 ± 5.95	69 ± 5.73	65 ± 7.13	66 ± 3.42	65 ± 6.74	110 ± 2.08
3	<i>Scylla tranqubarica</i>	147 ± 27.10	136 ± 8.60	132 ± 11.40	95 ± 7.12	86 ± 9.14	72 ± 5.8	75 ± 6.64	68 ± 3.74	64 ± 6.26	66 ± 4.64	128 ± 7.11
4	<i>Scylla serrata</i>	140 ± 9.82	135 ± 14.15	126 ± 10.46	100 ± 7.34	65 ± 9.20	58 ± 8.53	54 ± 8.04	40 ± 4.76	35 ± 5.70	78 ± 12.36	135 ± 12.02
5	<i>P. gladiator</i>	34 ± 2.88	22 ± 3.09	12 ± 0.81	10 ± 1.28	60 ± 3.55	76 ± 5.29	88 ± 2.70	77 ± 7.75	70 ± 6.44	20 ± 1.41	18 ± 1.28
6	<i>Charybdis natator</i>	68 ± 4.69	65 ± 6.90	70 ± 11.35	75 ± 9.06	89 ± 9.10	69 ± 3.59	70 ± 10.66	55 ± 4.64	51 ± 7.73	20 ± 2.15	21 ± 3.59
7	<i>Charybdis feriatu</i> s	18 ± 1.28	21 ± 2.5	29 ± 2.21	54 ± 4.64	85 ± 12.1	84 ± 1.82	98 ± 5.19	99 ± 8.44	95 ± 10.5	90 ± 9.11	50 ± 8.34

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8	<i>C. lucifera</i>	45 ± 2.21	48 ± 7.52	50 ± 5	34 ± 1.28	38 ± 2.08	33 ± 4.78	32 ± 5.16	36 ± 3.16	15 ± 0.95	17 ± 1.25	10 ± 1.32
9	<i>Charybdis variegata</i>	54 ± 4.43	28 ± 1.82	18 ± 1.28	10 ± 1.32	9 ± 1.30	8 ± 1.41	9 ± 1.30	21 ± 1.70	22 ± 1.28	40 ± 2.15	46 ± 2.64
10	<i>Podaphthalamus vigil</i>	97 ± 4.57	50 ± 6.13	46 ± 2.51	25 ± 1.25	75 ± 7.88	70 ± 3.10	71 ± 5.60	74 ± 10.86	65 ± 7.40	63 ± 10.89	60 ± 2.44
11	<i>Charybdis granulate</i>	69 ± 3.5	65 ± 3.5	68 ± 4.39	34 ± 2.37	10 ± 1.28	73 ± 2.64	72 ± 7.25	71 ± 6.86	12 ± 1.82	14 ± 1.28	10 ± 1.28
12	<i>Charybdis truncate</i>	58 ± 4.79	55 ± 4.34	54 ± 4.43	29 ± 4.57	17 ± 3.20	50 ± 3.69	52 ± 2.94	53 ± 3.30	11 ± 0.95	12 ± 1.41	10 ± 1.28

**Table 3.** Seasonal variations of Crab species (Mean/54 kg) in Nagapattinam during January 2017 to December 2017.

S.No	Species	Post-monsoon	Summer	Pre-monsoon	Monsoon
1	<i>Portunus pelagicus</i>	433 ± 144.3	148 ± 74	161 ± 53.6	264 ± 88
2	<i>Portunus sanguinolentus</i>	393 ± 131	176 ± 88	211 ± 70.3	241 ± 80.3
3	<i>Scylla tranqubarica</i>	415 ± 138.3	181 ± 90.5	215 ± 71.6	258 ± 86
4	<i>Scylla serrata</i>	401 ± 133.6	165 ± 82.5	150 ± 50	245 ± 81.6
5	<i>P. gladiator</i>	68 ± 22.6	70 ± 35	241 ± 80.3	108 ± 36
6	<i>Charybdis natator</i>	203 ± 67.6	164 ± 82	194 ± 64.6	92 ± 30.6
7	<i>Charybdis feriatus</i>	68 ± 22.6	139 ± 6.9	281 ± 93.6	235 ± 78.3
8	<i>C. lucifera</i>	143 ± 47.6	72 ± 36	101 ± 33.6	42 ± 14
9	<i>Charybdis variegata</i>	100 ± 33.3	19 ± 9.5	38 ± 12.6	108 ± 36
10	<i>Podaphthalamus vigil</i>	193 ± 64.3	100 ± 50	215 ± 71.6	188 ± 62.6
11	<i>Charybdis granulate</i>	202 ± 67.3	44 ± 22	216 ± 72	36 ± 12

12	<i>Charybdis truncate</i>	167 ± 55.6	46 ± 23	155 ± 51.6	23 ± 7.6
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**Table-4** -Monthly variations in the diversity indices of Marine Crab species in Nagapattinam during January 2017 – December 2017

Shannon Diversity Index (H)	-0.1131	-0.1147	-0.1173	-0.1111	-0.0738	-0.0912	-0.081	-0.0613	-0.0477	-0.092	-0.0736
Pielou's Evenness index (e)	-2.0813	-1.9881	-1.8534	-1.7361	-1.6249	-1.5511	-1.4598	-1.3175	-1.2697	-1.1777	-1.104
Species Richness Index (d)	4.6087	4.6105	4.6134	4.6064	4.5536	4.5813	4.5659	4.5278	4.49	4.5825	4.5533

#### IV. Discussion

In this study 12 species were collected and identified. The trawl nets operated by mechanized boat bring appreciable amounts of crabs ,shrimps ,lobster with other fishes. The crab species recorded was belonging to the family Portunidae includes the genera *Scylla*, *Portunus*, *Charybdis* and *Podophthalmus*. As in the present study, diversity of commercially important crab landings were already reported by different authors (Radhakrishnan, Soundarapandian P ,Varadharajan *et al.*,2009) south east coast India. Tamil Nadu tops the list in crab landings all over India and the coastal belt from Tuticorin to Mallipattinam has been proven as the strongest potential of edible sea crabs . In the present study not only total contribution of the crabs but also individual contributions of crabs were Nagapattinam.

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 (4.6087) showed that Nagapattinam 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 -0.1173 and the highest evenness index value was -2.0813 .

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 Nagapattinam coastal area the lowest diversity index value observed was -0.0477.

Fluctuations have been observed in the crab landings from month to month in mean and individual 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 maximum 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.

According to the Annual Report 2009-2010 released by the Central Marine Fisheries Research Institute, the west coast remains more productive, contributing 56% of the total catch in the country, while the remaining 44 % is contributed by the east coast. However, the fish landing in Tamil Nadu, Gujarat and Andhra Pradesh had shown an increasing trend during the same period (CMFRI ,2009). 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 maximum crabs were collected during summer and monsoon than pre-monsoon and post –monsoon. the crab belonging to family Portunidae were all seasons. Some scientist already reported that the crabs abundant maximum in monsoon(Chopra 1935,Sukumarn1997) and ( Rao et al ., 1973; Bijikumar et al., (2007) .

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 a Nagapattinam landing centre (Varadharajan *et al.*, 2012; Soundarapandian *et al.*, 2008).

## V. 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. This study is that coastal fishery landing reports are important contributors in country's economy, in terms of household income, employment and exports.

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