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Biodiversity of Crabs in Pichavaram Mangrove Environment, South East Coast of India

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Abstract: In this study, the distribution of crabs in Pichavaram was recorded from December 2001 to November 2002 at monthly intervals. The species present on the substratum and on the vegetation area were recorded in quadrant each measuring 1 m^2. There are about 36 crabs species are distributed in Pichavaram mangrove environment. Crabs belonging to the family Grapsidae and Ocypodidae are most dominant forms. Substrate suitability; effects of tidal inundation and distribution of mangrove plants were the possible factors that could influence zonation and abundance of the crabs in the Pichavaram mangroves. The reason for depletion of crabs and their conservation measures are also discussed.

Key words: Mangroves, Pichavaram, grapsidae, ocypodidae, Vellar estuary, *Avicennia*, *Rhizophora*, *Sesarma*

INTRODUCTION

Mangroves are unique inter-tidal ecosystem of tropics and sub-tropics, which support genetically diverse groups of aquatic and terrestrial organisms. The mangrove ecosystems are of great ecological and economic significance in coastal protection, enrichment of water qnality and in production of fishery resources (Kathiresan and Bingham, 2001; Kathiresan, 2003). Crabs are among the most predominant species in many mangrove forests. They constitute about 80% of the macrofaunal biomass and can reach densities of 80-90 m^{-2}. The crabs depend directly on mangrove areas for survival, by feeding on leaves and liter. They have a significant role in detritus formation, nutrient recycling and dynamics of the ecosystem, together with numerous annelids and nematodes living in the sediment. The digging behavior by crabs enhances aeration and facilitates drainage of mangrove soils. They are adapted to the sediment conditions, tidal fluctuations and varying salinities found in the mangroves. Distribution and zonation studies of crabs in Indian mangrove are scanty. Joel *et al*. (1985) studied the distribution and zonation of 29 crab species in the Pulicat Lake, while Chakaraborthy and Choudhury (1992) observed 18 species in the virgin mangrove island of Sunderbans. However, nobody attempted the distribution of crabs in Pichavaram mangroves. Hence the present study was concentrated on the distribution of crabs in Pichavaram mangrove environment.

MATERIALS AND METHODS

Description of Pichavaram Mangroves

The Pitchavaram mangrove forest (Lat. 11°26'N; Long. 79°48'E) is located between the Vellar and Coleroon estuaries (Fig. 1). The forest occurs on 51 islets, ranging in size from 10 m^2 to 2 km^2, separated by intricate waterways that counect the Vellar and Coleroon estuaries. The southern part near the Coleroon estuary is predominantly mangrove vegetation, while the northern part near the Vellar estuary is dominated by mud flats. The Vellar estuary opens into the Bay of Bengal at

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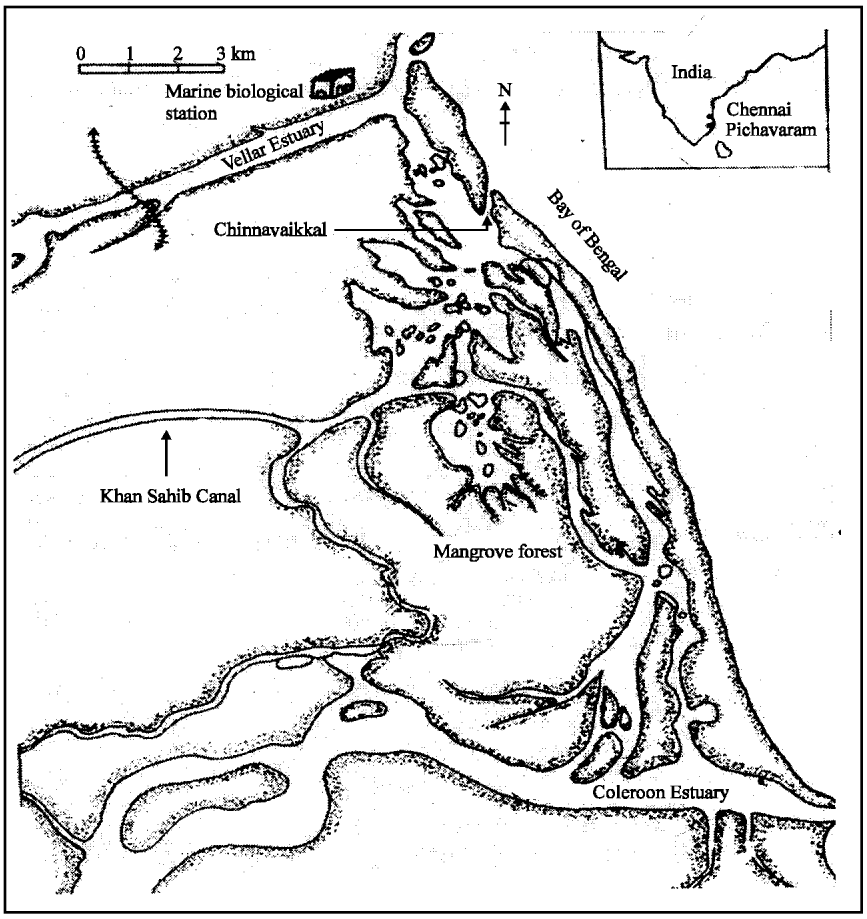

Fig. 1: The Pichavaram mangrove area

Parangipettai and links with the Coleroon River, which is a distributary to the river Cauvery. Pitchavaram mangrove is influenced by mixing of three types of waters; (1) neritic water from the adjacent Bay of Bengal through a mouth called Chinnavaikal, (2) brackish water from the Vellar and Coleroon estuaries and (3) freshwater from an irrigation channel (Khan Sahib canal), as well from the main channel of the Coleroon River. The mangrove covers an area of about 1100 ha, of which 50% is covered by forest, 40% by waterways and the remaining filled by sand-flats and mud flats (Krishnamurthy and Jayaseelan, 1983). The tides are semi-diurnal and vary in amplitude from about 15 to 100 cm in different regions during different seasons, reaching a maximum during monsoon and post-monsoon and minimum during summer (Muniyandi, 1986). The raise and fall of the tidal waters is through a direct connection with the sea at the Chinnavaikal mouth and also through the two adjacent estuaries. The depth of waterways ranges from about 0.3 to 3 m (Muniyandi, 1986).

Field study was carried out in the swamp of Pichavaram from December 2001 to November 2002 at monthly intervals. The study was undertaken in both creek and fringe mangroves. The species present on the substratum and on the vegetation area were recorded in quadrant each measuring 1 m^2. Crab burrow density was recorded in 5 randomly placed one square meter quadrates as per Jones (1984). Crabs were collected at low tide and preserved in 70% alcohol. The species were identified following the description of Williams (1984) and Sethuramalingam and Ajmalkhan (1991).

RESULTS AND DISCUSSION

Distribution of Crabs in Pichavaram Mangroves

In the present study 36 species of crabs are recorded in Pichavaram environment (Table 1). Crabs belonging to the family Grapsidae and Ocypodidae were the most dominant forms, which play a vital role in recycling the nutrients, enhancing the role of decay of plant materials and litter processing. Crab population was high during monsoon and post monsoon months in Pichavaram mangroves. Factors such as low salinity, 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. Sethuramalingam (1984) divided Pitchavaram mangrove areas into five zones based on the distribution of crabs. For instance, in Sesarma zone, Sesarmid crab species were dominant as other zones also had their specific crabs. Zonation of Pichavaram mangrove environment based on crab distribution (Table 2).

Among all the zones the dominant representatives were Sesarmid group of crabs. It included 13 species; of which, *Grapsus strigosus* and *G. tenuicrustatus* were very rare. The dominant species of *Sesarma* zones were *S. brockii*, S. *plictum* and *S. andersoni*. The other crab species recorded from these zones were *Neoepisesarma tetragonum*, *M. mederi*, *Metapograpsus messor*, *M. maculates*. Brachyuran taxa were dominant among other crab species distributed in Pitchavaram mangrove forest.

Table 1: Crabs of Pitchavaram mangroves

Families	Crab species
Grapsidae	*Plagusia dentipes*
	P. depressa
	Sesarma brockii
	S. plicatum
	S. andersoni
	S. bideus
	Neoepisesarma tetragonum
	N. medri
	Nanosesarma minutum
	N. patavicum
	Metapograpsus maculatus
	M. messor
	Metaplex elegans
	M. distincta
	Grapsus strigosus
	G. tenuicrustatus
	Ptychognathus altimanus
	Pseudograpsus intermedius
Ocypodidae	*Ocypoda macrocera*
	O. platytarsis
	Uca triangularis bengali
	U. lactea annulipes
	Macrophthalmus depressus
	M. erato
	Dotilla myctiroides
	Galene bispinosa
	Heteropanope indica
Gecarcinidae	*Cardisoma carnifex*
Portunidae	*Scylla serrata*
	S. tranquebarica
	Portunus sanguinolentus
	P. pelagicus
	Charybdis lucifera
	C. helleri
	Thalamita crenata
	T. chaptali

Table 2: Zonation of crabs

Name of the zone	No. of species	Species present
Cardisoma zone	1	*Cardisoma carnifex*
Sesarma zone	12	*Sesarma brockii*, *S. plicatum*, *S. andersoni*, *S. bideus*, *Neoepisesarma tetragonum*, *N. medri*, *Metapograpsus maculatus*, *M. messor*, *Grapsus trigosus*, *G. tenuicrustatus*, *Scylla serrata*, *Metaplex elegans* and *M. distincta.*
Ocypoda zone	5	*Ocypode macrocera*, *Macrophthalmus depressus*, *M. erato*, *Metaplex elegans* and *M. distincta.*
Uca zone	3	*Uca triangularis bengali*, *U. annulipes* and *Macrophthalmus depressus.*
Mixed zone	5	*Scylla serrata*, *Thalamita crenata*, *T. chaptali*, *Plugusia dentipes* and *Portunus sanguinolentus.*

Distribution and zonation of crabs were based on the substratum, water level and floral distribution. It included 13 species; of which, *Grapsus strigosus* and *G. tenuicrustatus* were very rare. The dominant species of *Sesarma* zones were *S. brockii*, *S. plictum* and *S. andersoni*. The other crab species recorded from these zones were *Neoepisesarma tetragonum*, *M. mederi*, *Metapograpsus messor*, *M. maculates*. Brachyuran taxa were dominant among other crab species distributed in Pitchavaram mangrove forest. Distribution and zonation of crabs were based on the substratum, water level and floral distribution.

Habitat Preference of Crabs in Pichavaram Mangroves

Pichavaram was found to be sandy along its vertical transect, with patches of mangrove vegetation. Table 3 shows that each species of mangrove crabs have its characteristic pattern of abundance and habitat preference.

Distribution of Crabs in Various Vegetative Zones of Pichavaram Mangroves

Based on the distribution of plants Pichavaram mangrove environment was divided into *Rhizophora* zone, *Avicennia* zone, back mangrove zone and non-saline zones. The crabs are distributed in different vegetative zones (Table 4). Maximnm number of crabs was distributed in *Avicennia* and *Rhizophora* zones. *Sesarma brockii* and other sesarmid crabs were present along the high water of neap tides and found to be sheltered amidst *Avicennia marina*. This is attributed due to the presence of rich nutrients in the *Avicennia* leaves when compared to other mangrove leaves (Rajendran, 1997).

Most of the juveniles and females of smaller crab were distributed along the lower shore regions. The females and juveniles of *Uca annulipes* were distributed close to the water edge along with their neighbours *Macrophthalamus depressus* and *M. erato*, which may be due to their lesser capacity to tolerate desiccation. The sand dominated substrata were suitable for *Portunus sanguinolentus* and *Thalamita chaptali*. From the study, it was confirming that substrate suitability; effects of tidal inundation and distribution of mangrove plants were the possible factors that could influence zonation and abundance of the crabs in the Pichavaram mangroves.

Reason for Depletion of Crabs

The population of commercially important mangrove crabs viz., *Scylla serrata*, *S. tranquebarica*, *Portunus sanguinolentus* and *P. pelagicus* are declining day by day due to indiscriminate fishing of berried females and also fishing of under sized crabs. Pesticides used in agricultural operation in and around Pichavaram mangroves were also posing serious threat to the crab population in general and larval farms in particular. The levels of HCH (Hexachlorocyclohexane) and DDT (p,p, -dichlorodiphenyltrichloroethene) were higher during wet season, although the trend was more pronounced with HCH than DDT. The levels of HCH were 630 ng L^{-1} in the water of Pichavaram mangroves in wet season and the levels were rather higher in global comparison. Similarly HCH occurs in high concentration in the sediments of Cauvery and Coleroon riverine systems, which also supplies to Pichavaram mangroves (Rajendran and Subramanian, 1997). Invariably the crab samples of

Table 3: Crabs, their abundance and habitat

Species	Abundance	Characteristic habitat
Sesarma brockii	Abundant	In between the prop roots of *Rhizophora* plants.
S. plicatum	Common	In between the prop roots of *Rhizophora* sp.
S. andersoni	Common	Open mud flats with mixed forests.
S. bideus	Rarely taken	Among roots of mangroves especially *Avicenuia* sp.
Neoepisesarma tetragonum	Abundant	Between the roots of mangrove trees.
N. medri	Rarely taken	Between the roots of mangrove trees.
Metapograpsus messor	Common	In between the roots of *A. marina*, *R. apiculata* and *R. mucronata*.
M. maculatus	Common	Pebbles and muddy banks of channels.
Grapsus strigosus	Rarely taken	In between the *Avicenuia marina* and *Sueda maritime*.
G. tenuicrustatus	Rarely taken	Between the *Aegicerus corniculatum*.
Ocypode macrocera	Common	Sandy substratum
Macrophthalmus depressus	Common	Sandy substratum and muddy banks of channels.
M. erato	Rarely taken	Muddy banks and pebbles of channels.
Uca triangularis Bengali	Abundant	All along the intertidal zones.
U. annulipes	Abundant	All along the intertidal zones.
Metaplex elegans	Common	Banks of channels and creeks.
M.distincta	Rarely taken	Mud flats with mixed forests.
Plagusia dentipes	Rarely taken	Muddy banks of channels.
Cardisoma carnifex	Common	Occurs in burrows and constructs castle in mangroves upper tidal level to supralittoral forest floor.
Thalamita crenata	Rarely taken	Banks of channels and creeks.
T. chaptali	Rarely taken	Under stones, between the mid to high tide level.
Scylla serrata	Common	In burrows made at muddy banks of channels, creeks and puddles and within thickets of mangroves from low to high water marks.
Portnuus sanguinolentus	Common	Muddy banks of channels.

Table 4: Distribution of crabs in different vegetation zones

Name of the zone	Crab species
Rhizophora zone	*Sesarma brockii*, *S. plicatum*, *S. bideus*, *S. andersioni*, *Neoepisesarma tetragonum*, *N. medri*, *Metapograpsus messor*, *Scylla serrata*, *Grapsus tenuicrustatus*, *Thalamita crenata* and *T. chaptali*.
Avicennia zone	*Sesarma brockii*, *S. plicatum*, *S. andersioni*, *Neoepisesarma tetragonum*, *N. medri*, *Grapsus strigosus*, *Ocypoda macrocera*, *Macrophthalmus depressus*, *Scylla serrata*, *Uca triangularis bengali*, *U. annulipes*, *Cardisoma carnifex*, *Metaplex elegans* and *M distiucta*.
Back Mangrove zone	*Neoepisesarma tetragonum*, *N. medri*, *Metapograpsus messor*, *Cardisoma carnifex* and *Ocypode macrocera*.
Non-saline zone	*Cardisoma carnifex*.

mangrove contain the compounds more than other species of aquatic animals collected from nearby areas (Ramesh *et al*., 1992). In recent years mangrove areas have been converted to shrimp ponds. The discharged effluents from the shrimp farms are also cause serous threat to crab population. So increase in pollution around mangrove ecosystem by man made chemicals due to aquaculture practices is now adding pressure on crab population (Subramanian, 2000). Hence conservation of mangrove crabs is paramount importance.

Conservation Measures

- A single female crab can produce up to eight million eggs in one mating season, so try to minimize their capture.
- Berried crabs should be released back if at all they are caught in the nets.
- Juveniles and undersized crabs should not be caught.
- Fishing of crabs should be strictly banned during their peak-breeding season.
- Awareness should be created among the local people and fishermen regarding the depletion of the crabs.

- Extension programmes of crab conservation should be carried out through media.
- Wastewater released into this complex area should be treated well before its release into the natural waters.
- To maintain the population, sea ranching of commercially important crab species should be practiced.

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