

MANGROVE ECOSYSTEMS

**A MANUAL FOR THE ASSESSMENT
OF BIODIVERSITY**

**A follow up of the
National Agricultural Technology Project
(NATP.), ICAR.**

*Mangrove Ecosystem Biodiversity :
Its Influence on the Natural Recruitment of
Selected Commercially Important Finfish and Shellfish
Species in Fisheries*

Edited by :
Dr. George J. Parayannilam



Central Marine Fisheries Research Institute
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A Manual for the Assessment of Biodiversity

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Crustacea (Crab)

S. K. Chakraborty, Gurudas Chakravarty, Sunirmal Giri, S. Dam Roy and George J. P.

Brachyuran crabs, a bioenergetically significant group constitute one of the most dominant macrobenthic faunal components in all the mangrove ecosystems of the world. Several species of commercially important crabs like - *Scylla serrata* occur in mangroves. Brachyuran crabs play significant role to maintain the steady state condition of mangrove ecosystems several ways. The feeding activities of detritivore crabs such as - *Uca*, *Macrophthalmus*, *Dotilla*, *Sesarma* etc. help in the degradation of organic matter, especially mangrove litters and decaying woods. They also influence the functioning of mangrove ecosystems as burrowers since their repeated burrowing and reburrowing activities enhance the soil aeration, mixing of different soil profiles, nutrient cycling, maintaining of fluidity etc. (Montague, 1980, 1982 ; Bertness, 1985). Furthermore, crabs create a wide variety of *bioturbation* structures which are very significant for trapping sediments and mangrove seeds (Choudhury and Choudhury, 1994). In India several taxonomic works on estuarine and mangrove brachyuran crabs have been done (Chakraborty *et al.*, 1986; Mandal and Nandi, 1989; Chakraborty and Choudhury, 1992; Dev Roy and Das, 2000 etc.). A total of 55 species of brachyuran crabs under 31 genera have been reported earlier from the mangrove habitats of India (Dev Roy and Das, 2000). Eighteen species of brachyuran crabs under 9 genera and 4 families were identified from Sundarbans Mangrove Ecosystems (Chakraborty and Choudhury, 1992).

Identification characters :

General scientific terms

Cephalothorax:

This is the anterior rigid part of the crabs, made up of six head segments and 8 thoracic segments, all fused together.

Carapace :

The entire body of a crab is covered dorsally by a tough cuticle, called carapace or shell of crabs. The carapace is composed of fused **tergites**. The anterior portion of carapace in between the orbits is known as **front**. Lateral sides of carapace are often differentiated into antero and postero-lateral borders. The dorsal surface of carapace is usually divisible into several regions such as **gastric, cardiac, intestinal** and **branchial**.

Stermites - Cephalothorax is covered ventrally by stermites, its lines of fusion are very prominent. Stermites extend into the body as folds, called **apodemes**.

Pleuron - The exoskeleton that covers the lateral sides of carapace is called **pleuron**.

Pleural fold - The margin of the carapace extending on either side is known as **Pleural fold** which is separated into an anterior **pterygostomial region** (also called jugal region) and a posterior **branchiostegite** which is continuous with the carapace forming the external covering of the gill chamber.

Appendages:

They are of three types **cephalic appendages, thoracic appendages** and **abdomen**.

Cephalic appendages - It includes **antennule or first antenna, second antenna, mandible, first maxilla and second maxilla**.

Scaphognathite - Exposed second maxilla develop into a lateral flap-like structure, called **scaphognathite**.

Thoracic appendages - It includes **maxillipeds, chelipeds and walking legs**.

Maxillipeds - There are three pairs. Biramous maxillipeds bearing **epipods** which serve to clean the gills.

Chelipeds - These are also known as first leg. They are uniramous, paired appendages and consist of **coxa, basis, ischium, arm or merus, weist or carpus** and the **chela** which is made up of **palm** (also called **hand or manus**) and fingers of upper finger is known as dactylus or movable finger and lower one is fixed finger (also called **thumb** or immovable finger or **pollex**).

Walking legs - These are 4 pairs and all are long, pointed, uniramous and jointed structure. Each leg is made up of seven segments, viz. **coxa, basis, ischium, merus, carpus, propodus** and **dactylus**.

Abdomen - The abdomen of a crab is a flap-like structure and usually made up of six segments. The abdomen is articulated ventrally to the cephalothorax with a groove formed by somites. It is much broader in female than in male. The abdominal appendages and pleopods are rudimentary and in both sexes six pairs of pleopods are absent, while only two pairs of copulatory stylets formed by first and second pleopods are found in males. Anus is located at the terminal end of the last abdominal segment, at the junction with telson.

Brachyuran Crabs from Mangroves

Phylum- Arthropoda
Sub-phylum - Mandibulata
Class - Crustacea
Order- Decapoda
Section - Brachyura
Family- Portunidae
i) <i>Scylla serrata</i> (Forsk.)
ii) <i>Portunous pelagicus</i> (Linnaeus)
Family- Ocypodidae
i) <i>Ocypoda macrocera</i> . Edwards.
ii) <i>O. ceratophthalma</i> (Pallas)
iii) <i>Uca acuta acuta</i> (Simpson)
iv) <i>U. (Celuca) lactea annulipes</i> (H. Milne Edwards)
v) <i>U. triangularis bengali</i> (Nobili)
vi) <i>U. dussumieri dussumieri</i> (H. Milne Edwards)
vii) <i>Dotilla blanfordi</i> Alcock
viii) <i>Dotillopsis brevitarsis</i> (De Haan) Kemp
ix) <i>Scopimera globosa</i> De Haan
x) <i>Macrophthalmus pectinipes</i> Guerin
Family- Grapsidae
i) <i>Sesarma chiromantes bidens</i> (De Haan)
ii) <i>S. taeniolatum</i> White
iii) <i>S. longipes</i> Krauss
iv) <i>S. pictum</i> De Haan
v) <i>Metaplex intermedia</i> de Man

vi) <i>M. crenulata</i> Gerstaecker
Vii) <i>M. distincta</i> Edwards
Family - Calappidae
i) <i>Matuta victor</i> Grabricius
ii) <i>M. lunaris</i> (Forsk.)
Family - Maiidae
i) <i>Doclea japonica</i> Ortmann

Phylum Arthropoda:

1. Body is segmented and covered by chitinous cuticle.
2. Each body segment bears paired externally jointed appendages.

Sub-phylum Mandibulata:

1. Body is divided into two or three parts.
2. Appendages on the third head segment are modified as mandibles for chewing or grinding food.
3. Usually compound eyes are present; retinula of compound eyes consist of 8 cells.

Class Crustacea:

1. Body divided into cephalothorax and abdomen.
2. Head bears two pairs of preoral and three pairs of postoral appendages.
3. Uniramous, one or two pairs of antennae, other appendages are biramous.
4. Biramous appendages are either phyllopodium or stenopodium.

Order Decapoda:

1. First 3 pairs of thoracic limbs form maxillipeds.
2. Carapace well developed usually enclosing gill chambers on sides of cephalothorax.
3. Gills usually in three series present on thorax.

Section Brachyura:

1. Dorso-ventrally flattened cephalothorax
2. Antennae very small
3. Presence of small abdomen and europod.

Diagnostic characters of different families of Brachyura:-

Family- Portunidae.

The fifth pair of legs are modified for swimming

and usually has the propodite and dactylus; Singularly broad thin and paddle - like.

Family - Ocypodidae.

Amphibious, littoral and estuarine crabs, burrowing and commonly gregarious. The palp of the external maxillipeds is coarse and articulates at or near the antero-external angle of the merus: the exognath is generally slender and often more or less concealed; The interantennular septum is generally broad; The orbits occupy the whole anterior border of the carapace out side the front and their outer wall is often defective. The buccal cavern is usually large and a little narrower in front than behind, the external maxillipeds are foliaceous; The abdomen of the male narrow; Male opening sternal.

Family - Grapsidae

Mainly estuarine but some species are found in freshwater and brackish water border zones. The palp of the external maxillipeds articulates either at the antero-external angle, or at the summit or at the middle of the anterior border of the merus; the exognath is either abnormally slender or broad. The inter antennular septum is very broad; The orbit divided into two fossae. Male openings sternal.

Family- Calappidae

Carapace is of the ordinary brachyurous shape; The afferent branchial openings are found in front of the bases of the chelipeds; The antennae are small; The vasa deferentia perforate the bases of the fifth pair of legs.

Diagnostic characters of different species

Genus - *Scylla* De Haan, 1833

Carapace broad, transverse, somewhat convex with an almost even surface; front cut into four teeth; antero-lateral borders arched oblique and cut into nine subequal teeth (including the outer orbital tooth), postero-lateral margin shorter than the antero-lateral; Basal joint of antenna short, broad, its antero-external angle forming a lobule lying in the orbit, flagellum quite long and lodged in the orbital hiatus; Antennules folding transversely; Chelipeds massive; wrist and palm smooth, without ridges; Legs stout, moderately compressed; merus and carpus of the last pair shortened and broadened, dactyls typically foliaceous for swimming; Male abdomen triangular, five segmented, 3rd-5th terga fused, first tergum much concealed below the carapace.

1. *Scylla serrata* (Forskål, 1755)

Antero-lateral border of carapace cut into 9 sharp acuminate teeth of nearly equal size; Arm of the larger cheliped adorned with 3 spines on the anterior border; Leg joints unarmed.

Genus – *Portunus* Weber, 1795

Carapace usually broad and depressed or little convex; front cut into three to six – usually four teeth; antero-lateral borders cut into nine teeth (including the outer orbital angle) of which the 9th may be enlarged or not; antennules fold transversely; flagellum stands in the orbital hiatus; chelipeds longer, usually much longer than any of the legs and massive; legs compressed; abdomen of the male is five-jointed.

2. *Portunus pelagicus* (Linnaeus, 1758)

Whitish or pale bluish irregular spots present on the carapace; the granulation on the dorsal surface is very prominent; a spine present at the far end of the posterior border of the arm of chelipeds.

Genus - *Ocypoda* Fabricus, 1798

Coloured crabs - colours are red, yellow and whitish in different stages of development; Carapace deep, square or subquadrilateral, broader than long, moderately convex; Afferent branchial opening thickly fringed with setae between bases of 2nd and 3rd pair of legs; flagellum of antenna small and folding obliquely, inter-antennular septum broad; front narrow; Chelipeds very unequal in both sexes.

3. *Ocypoda macrocera* Edwards, 1861

Broad carapace; upper orbital margin oblique; the raised marginal row of granules on the external maxillipeds is less pronounced; the fingers of the smaller cheliped are lamellar upto the tips, which are broad and blunt, not pointed; stridulating ridge entirely of striae and less hairy.

4. *Ocypoda ceratophthalmus creatophthalma* (Pallas, 1772)

Carapace square and posterior elegantly beaded; upper orbital margin a little oblique; eyestalk prolonged beyond the eye into a style of variable length; stridulating ridge of large manus with tubercles gradually passing into striae with hairs; two rows of thick hairs on anterior surface of manus of first two pairs of legs; fingers (dactyl) of both chelipeds pointed at tip.

Genus - *Uca* Leach, 1814

Carapace deep, subquadrilateral or subhexagonal, broader than long, surface usually smooth, antero-lateral angles generally pointed; Antenna with well developed flagella; Antennules very small, folded obliquely orbits deep, little sinuous and oblique; Eyes small, terminal, eye-stalk slender; Epistome short but quite distinct; Chelipeds remarkably unequal in male, small and equal in female; Legs strong, dactyl very sharp; Abdomen consisting of 7 distinct segments in both sexes, often two or more segments fuse together.

5. *Uca dussumieri dussumieri* Maline Edwards, 1852

Two distinct long grooves running throughout the length in major dactyl of male on its outer surface and a similar groove on outer pollex; Inner dorsal margin of arm of major male chela adorned with an enlarged bicuspid distal tubercle; Merus of last pair of legs in males markedly slender than that of females; The space between two small antennules is very small.

6. *U. lactea annulipes* (Maline Edwards, 1837)

Carapace with antero-lateral margins almost straight, antero-lateral angles acute, dorso-lateral margins converging posteriorly and frontal groove broad; eye-brow short and narrow and orbit considerably oblique; tip of large dactylus hook-like; pollex tip with a small predistal tooth; gonopod without torson, anterior flange larger than posterior, gonopore opening through a narrow notch near posterior margin; The space in between two small antennules is more than *U. dussumieri*.

7. *U. triangularis bengali* Crane, 1975

Antero-lateral angles of carapace strongly acute; Dorso-lateral margins converging; Frontal groove moderately broad; Orbits strongly oblique; Eyebrow narrow; manus of large cheliped tuberculate; Dactylus with two broad shallow grooves-one just above gap and other in the usual proximal and subdorsal position; Chela tip simple, hooked and tip of dactylus hanging over tip of pollex; gonopod with short thumb.

8. *U. acuta acuta* (Stimpson, 1858)

Carapace strongly convex; Length of the carapace about three-fifth the greatest breadth; Front, measured between the eye-stalks, about a twelfth the greatest breadth of the carapace; Orbits

moderately oblique, both upper and lower borders much sinuous; The fingers of the large male cheliped have tips that work as tongs, owing to the presence of an enlarged tooth near the tip: the meropodites of the last pair of legs are nearly foliaceous.

Genus - *Dotilla* Stimpson, 1858

Lateral walls of carapace with deep convolute sculpture, front with narrow deflexed lobe; penultimate segment of 2nd maxilliped expanded; 4th segment of abdomen overlapping 5th and with a thick bush of hair at its distal end in both sexes; Abdomen of male not constricted; Chelipeds equal and dactylus slender and little deflexed.

9. *Dotilla blanfordi* Alcock, 1900

Carapace with two lateral oblique grooves running from antero-lateral angle to postero-lateral angle; Six-rayed of equal shallow grooves running from the mesogastric towards front, hepatic, branchial and cardiac; Gastric region with 4 symmetrical tubercles; Dactylus in cheliped is a little longer than manus; merus of legs with tympana.

Genus - *Dotillopsis* Kemp, 1919

Carapace cuboidal and dorsal surface deeply grooved; Penultimate segment of 2nd maxilliped a little expanded and ultimate segment terminal in position; Tympana of merus ill-defined; 5th, 6th and 7th abdominal segments of male narrow and 4th segment greatly expanded on either side; abdomen in female broadly oval.

10. *Dotillopsis brevitarsis* (de Man, 1888)

Sculpture of carapace prominent with deeply grooved furrows; frontal groove continued to posterior margin, orbits shallow but distinct; Manus with conspicuous longitudinal carinae at lower and inner portion; Dactylus with a row of hair at upper margin; Merus of external maxillipeds larger than ischium; Tympana of merus ill-defined; 1st and 2nd walking legs at the lower portion of manus and carpus with tuft of hairs.

Genus - *Macrophtalmus* Latreille, 1829

Carapace depressed and quadrilateral; Broader than long; Antero-lateral border with two prominent teeth; Frontal groove narrow; Orbit narrow occupying whole anterior border of carapace; Eyestalk very long and slender; Chelipeds equal or subequal in both sexes.

11. *Macrophthalmus pectinipes* Guerin, 1839

Lateral border of carapace convergent posteriorly and carapace with large spinous tubercles; Frontal groove narrow; Orbits oblique, Upper orbital margin elegantly denticulated and lower orbital margin unevenly crenulated; Eyestalk slender and curved but not projected beyond antero-lateral angle; Antero-lateral border with 3 acute teeth while postero-lateral border convergent: Base of the dactylus of male cheliped with a tooth and the upper margin thickly hairy; Merus of walking legs with a spine.

Genus - *Sesarma* Say, 1817

Carapace square or squarish, usually deep, often depressed, gastric region well outlined, usually divided into five subregions, the four antero-lateral subregions projecting as four prominent post-frontal lobes; Front broad, about half or more of the anterior border of carapace, deflexed obliquely or vertically; Lateral borders almost straight and parallel, with or without tooth behind the outer orbital angle, postero-lateral regions generally crossed by oblique parallel lines; Pterygostomial region and vertical walls of carapace reticulated with fine hairs; Basal antenna-joint broad; Flagellum slender, short, lying in the orbital hiatus; Antennules transverse, inter-antennular septum broad; Epistome well defined, distinct and rather short from front to back; Buccal cavity square cut; the external maxillipeds leaving between them a large rhomboidal gap, major part of this gap filled by fringe of hairs; Chelipeds massive and unequal in male, less so and subequal in female; Palm high, short; Fingers subacute, hollowed at tip; Legs differing little in length, third pair longest, first and fourth pairs shortest; merus thin, broad; Abdomen made up of 7 distinct segments in both sexes, occupying in the male the entire breadth of the last pair of legs; In female, last segment small and deeply embedded in sixth segment.

12. *Sesarma bidens* (De Haan, 1835)

A small sharp tooth on the lateral border of the carapace immediately behind the outer orbital angle; carapace is slightly less transverse; the transverse ridges on the upper surface of the dactylus of the male chelae are coarser, tubercle-like and shorter.

13. *S. taeniolatum*, White, 1847

Carapace deep, nearly flat dorsally, square, its sides nearly parallel; A transverse granular ridge

on the inner surface of the palm; Finger meet at tip; Dactyl of the legs of good length.

14. *S. pictum* De Haan, 1837

Carapace is not so broad, its length being about five-sixths of its breadth between the antero-lateral angles; The front is not so broad, its extent being only half the breadth of the carapace; The meropodites of the legs are not so broadly foliaceous, their greatest breadth, in the middle two pairs, being less than half their length.

15. *S. longipes* Krauss, 1843

Length of the carapace is just equal to its breadth at the antero-lateral angles: Carapace deep; Its sides strongly divergent posteriorly where its breadth is much greater than its length; Two teeth (not including the orbital angle) on the lateral border, the posterior one being very small; Legs long and slender, with elongate dactyl; Third pair of legs not three times the length of the carapace.

Genus - *Metaplex* H. Milne Edwards, 1852

Carapace quadrilateral, more or less flat, much broader than long; cephalothoracic regions are well outlined; Cervical and branchial grooves distinct; Front deflexed; Lateral borders of carapace straight or slightly curved anteriorly, almost parallel and divided into 4 or 5 teeth; Basal joint of antenna very short; Flagellum fairly long; Antenna lodged in the orbital hiatus; Antennules folded almost transversely, inter-antennular septum broad; Outer wall of orbit incomplete, lower border crenulate; Eyes not filling the orbits, eye-stalk not much extended; Epistome short, distinct and prominent, buccal cavity aquarish, a rhomboidal gap left between the external maxillipeds exposing the mandibles; Chelipeds differing markedly in the sexes; Legs slender; second and third pairs longer than the first and last pairs, third pair being the longest; Abdomen consisting of 7 distinct segments in both sexes; In males third to fifth segments often fused together; in females, seventh segment small and deeply impacted in the sixth.

16. *Metaplex crenulata* (Gerstaecker, 1856)

Regional areas of carapace very distinct and strongly curved; No prominent lobe on the dentary edge of chelipeds; Legs spine.

16. *Metaplex distincta* H. Milne Edwards, 1852

Lower orbital border of male extended to the level of second notch of the antero-lateral border of carapace and its orbital portion cut into 9-11 small,

obscurely-bilobulate blunt teeth diminishing in size very regularly from within outwards; Anterior border of merus of last pair of leg armed with a subterminal spine.

17. *Metaplex intermedia* de Man, 1888

Dactylus of chelae of male with a prominent lobe projecting on the dentary edge: Chelipeds of male markedly unequal: Palm of larger cheliped of male higher than long.

Genus - *Matuta* Weber, 1795

Carapace more or less flat, subcircular; Front almost as broad as orbit, trilobed, middle one more prominent than the others; Postero-lateral borders strongly convergent, generally with a strong spine at the junction of the antero-lateral and postero-lateral borders; Antenna extremely small, inconspicuous; Orbits large, oval with a deep groove in the lower border near the external orbital edge and a narrow gap at the inner angle; Eyestalks stout; External maxillipeds elongate, covering the buccal cavity; Chelipeds massive, equal; Stridulatory organ consisting of two elevated obliquely striated areas - one linear (proximal) and the other oval or subcircular (distal) on the inner surface of upper margin of palm of cheliped; Palm compressed, its upper border cristate and outer surface sculptured; Legs adapted for swimming and burrowing, dactylus of ambulatory legs broadened enormously in the first and last pair; Abdomen of adult male consisting of 5 segments with 3rd-5th segments fused and of 7 separate segments in female and young males; first tergum in both sexes completely concealed under the carapace.

18. *Matuta lunaris* (Forsk., 1775)

The tubercles on carapace rather indistinct, especially the anterior two; Front wider than orbit; Longitudinal ridge of dactylus strongly milled; A distinct spine-like tooth at the base of the lower outer angle of palm at its juncture with the wrist.

Genus - *Doclea* Leach

Body and appendages tomentose, usually very densely so; Carapace circular, armed at the sides and often on the dorsal surface also, with a few spines, the rostrum consists of 2 vertically compressed spines

which are fused together in almost the whole of their extent and are usually short; The eyes are small and the commencing orbits are formed by an acute post-ocular tooth and a little-prominent supra-ocular eave; The antennae are very short and inconspicuous; The buccal frame is some what arched in front; The chelipeds are short and slender in the female; longer, stout, with an enlarged and inflated palm, in the adult male.

19. *Doclea japonica* Ortmann, 1893

3 spines on the lateral border of the branchial region, the last being the largest and being placed rather higher up; there is a coarse spine or blunt tooth, on the posterior border of the carapace.

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Uca acuta acuta (male)



U. acuta acuta (female)



Uca triangularis bengali (male)



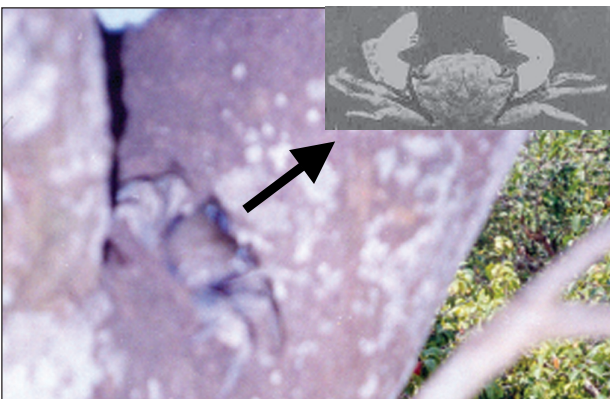
Uca triangularis bengali (female)



Uca lactea annulipes



Macrophthalmus sp.



Sesarma plicatum



Sesarma chiromantes bidens



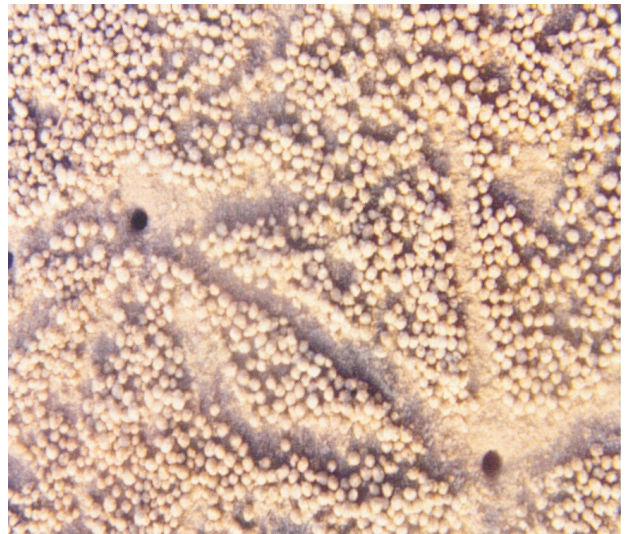
Sesarma lanatum



Thalamita crenata



Scylla serrata



Bioturbation structure of the branchyuran crab Ocypoda macrocera