RESULTS

Ecology: Maharashtra state is a maritime state the west coast with Thane, Mumbai, Raigad, Ratnagiri and Sindhudurg districts (from north to south respectively), and the Raigad district coast is about 240 kms. The survey localities given in (table 1). (south to north) on Raigad district coast showing different features of the coast viz. Sandy (S), Rocky (R), Muddy (M), Estuaries (E), Backwater (BW), Oyster bed (OB).

Table no.1. Showing study localities of Raigad district coast.

<table>
<thead>
<tr>
<th>Sr. no</th>
<th>Name of the localities</th>
<th>Coastal feature.</th>
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<td>Harihareshwar</td>
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CLASSIFICATION OF BIVALVE

Class **BIVALVE**

Order **ARCOIDA**

Superfamily **ARCACEA** (Lamarck, 1809)

Family **ARCIDAE** (Lamarck, 1809)

Subfamily **ARCINAE** (Lamarck, 1809)

*Arca granosa* (Lamarck)

Shell equivalve, very inflated, thick and heavy; covered with a dark brownish non-hairy periostracum, umbo broad and situated mid-way between the anterior and posterior ends. Shell valves broaden rapidly from the apex. Apex pointed towards the anterior. The number of hinge teeth ranges between 23 and 25 at the anterior side and between 35 and 38 at the posterior. The teeth are shorter beneath the umbo.

The radial ribs on the surface of the valves are distinct, strong and deeply set and showing their impressions on the inner side of the shells. The radial ribs are strongly tuberculated as small granules (hence the common name). The ribs are generally 20-21 in numbers. The ligament area is narrow and kite shaped, hinge straight with teeth converging towards the centre.

Popularly known as blood clam due to the presence of hemoglobin in its blood, hemoglobin as a respiratory pigment has a comparatively high oxygen retention capacity which favors the mud living clams with oxygen. A *granosa* spawns throughout the year with peak during April and January.

**Habitat:** Sandy bottom in intertidal zone.
**Anadara granosa** (Linnaeus)
Description: - Shell large up to 35 mm, thick and heavy, ribs strong, bearing prominent sets of tubercles, umbo central, and color white.
Habitat: Sandy bottom in intertidal zone.

**Arca bistrigata** Dunker
Description: - Shell large up to 19.5 mm, elongated, ribs well developed and sometime granular, color white with brown periostracum.
Habitat: In shallow water near low tide level on sandy shores.

Order **MYTILOIDA** (Ferussac, 1822)
Superfamily **MYTILACEA** (Rafinesque, 1815)
Family **MYTILIDEA** (Rafinesque, 1815)
Subfamily **MYTILINAE** (Rafinesque, 1815)

**Brachidontes variabilis** (Krauss)
Shell thick, strong and large up to 53mm, equivalve, equilateral and elongate triangularly ovate in outline.
Habitat: In shallow water near low tide level in muddy region, estuaries and backwater, attached to rocks or stones in mud.

**Perna viridis** (Linnaeus)
Description: - Shell thick and strong up to 73.5mm, equivalve, equilateral and elongate, triangularly ovate in outline. Umbo terminal, pointed, beak-like and downturned, single large hinge tooth in the right valve and two small hinge teeth on the left valve near the umbo. Anterior adductor muscle scar absent. Dorsal ligament margin curved; mid dorsal margin arcuate; posterior margin rounded, ventral margin concave. The green periostracum on the surface of the shell gives this species the common name ‘Green Mussel’. Green Mussels are found attached to hard substrata. They live in large clusters by attaching themselves by the proteinaceous byssal thread, secreted by a gland in the proximal part of the foot. They are suspension deepest and
deed only when submerged. They do not tolerate prolonged exposure to air or fresh water consequently they are found mainly below mid tide level. In addition to rocky open coasts and harbors,

**Habitat:** Green mussels are found in the estuarine mouths where the salinity is almost equal to nearby neretic waters.

**Subfamily MODIOLINAE**

*Modiolus metacalfei* (Hanley)

Description: - Shell is thin; anterior margin bluntly angular in the middle umbo sub-central, these is a keel running from umbo to posteroventral margin and the surface smooth except for posterior-dorsal area which covered by a fibrous periostracum; exterior yellowish brown, interior white. Adult shell is without hinge teeth.

*Modiolus metacalfei* is an inhabitant of the intertidal mud of the mangroves. It occurs on the seaward edge of the mangrove. Sometimes they are seen to colonize the estuaries. *Modiolus metacalfei* are infaunal, almost completely buried in the mud attached by a stout byssus to the dead branches to the fallen mangroves and also to the prop roots of the *Rhizophora* and other associated species. Usually the periostracum of the shell is eroded, especially in the region of the umbo, presumable by the mangrove soil. Modified respiratory and digestive organ help these animals to successfully lead a life in the turbid waters.

**Habitat:** Found in the below the mid tide leval on rocks in the crivices.

*Modiolus undulatus* (Dunker)

Shell is thin and large up to 43.5mm, almost completely buried in the mud attached by a stout byssus to the dead branches to the fallen mangroves, look like *perna viridis* but just different, hair on the shells.

**Habitat:** Found in the below the mid tide leval on rocks in the crivices.
**Modiolus striatulus** (Hanley, 1844)

Size small up to 4.2mm, highly variable species shell elongate trapezoid and gibbous in the middle sculpture with radiating ridges which are wider and more distinct on the anterior margin. Faecal pellet grooved ribbon type, longitudinally grooved and ridged, occurs attached to rocks, stones, wooden jetties in submerged water.

**Habitat:** Found in the below the mid tide level on rocks in the crevices.

Order **VENEROIDA**

Superfamily **VENERACEA** (Rafinesque, 1815)

Family **VENERIDAE** (Rafinesque, 1815)

Subfamily **CIRCINAE**

**Gafrarium divaricatum** (Gmelin)

Shell is large up to 35 mm. large, ovate and solid, sculpture with concentric radial ribs which give a reticulated appearance to the surface. Divaricating point of the radial, ribs lines a little to the front of the ventral margin. Lunule flattened, color light yellow with pale brown angular V-shaped markings, more numerous and close set on anterior and posterior margins,

**Habitat:** Sandy as well as rocky shores in intertidal zone.

Subfamily **SUNETTINAE**

**Sunetta scripta** (Linnaeus)

A flattened and very feebly inflated thick shell length up to 17mm, shaped roundly trigonal. Surface with faint concentric ridges with deep grooves in between, anterior slope slightly arched, lunule narrow and deeply depressed. Pallial line deeply sinuate, the escutcheon is deeply indented forming a flat shelf in the interior, the surface light brown with striking zigzag pattern of dark brown, corresponding with light zigzag interspacing, inside white with purple, margin of the inner surface toothed.

**Habitat:** Found below mid tide level in sandy beach.
Subfamily **MERETRICINAE**

*Meretrix meretrix* (Linnaeus)

Shell strong and length up to 36.5mm, glossy, triangular ovate, periostracum is thin, transparent, delicate and of gray or straw color. Surface more polished umbo large, inflated near the middle but slightly towards the anterior end, antero-lateral tooth of left valve stout and distantly notched; pallial sinus is very shallow and feebly developed. Hinge is delicate and weaker, transverse wavy bands of grayish blue or reddish brown or pinkish color invariably on the umbo region, purple to brownish longitudinal streaks radiating from umbo towards the ventral margin are seen though it’s transparent periostracum.

Occurs abundantly in backwaters and near the mouths of the estuaries, *M. meretrix* population is largely confined to sandy-mud bottoms and thus indicates substrate specificity, spawns about the beginning of September and again in May. Indiscriminate exploitation of this clam for lime resulted in dwindling of these clam beds. It needs strict efforts for conservation especially on the Raigad district coast.

**Habitat:** Found below mid tide level in muddy region especially backwater and estuarine.

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Subfamily **TAPETINAE**

*Marcia opima* (Gmelin)

Shell large up to 30mm, thick more or less elongate ovate glossy and inflated the surface is either smooth or finely concentrically striated, generally pale yellowish brown sometimes with purplish, or gray marking forming concentric undulating lines with three or four radial bands radiating from the umbo, with the umbo approximated and inclined forwards. Inner surface of the valves white; pallial line and the adductor muscles depression deeply sinuate, the lunule comparatively more depressed than *Meretrix* and clearly defined, hinge margin with three thick diverging teeth.

*Marcia opima* could also be differentiated in live conditions by a thin periostracum. This clam develops extensive beds along the soft bottoms of the estuaries and backwaters preferring the marine zone. It is seldom found up the river
mounds or the interior of the backwaters where the salinity is low. They grow to an average size of 45 mm and reach sexual maturity in three months (11-12 mm). Spawning begins from the beginning of summer when the salinity gradually increases. **Habitat:** Found below mid tide level in muddy region especially backwater and estuarine.

*Paphia textile* (Roding)

Shell elongate, up to 65mm, thick and heavy with smooth and glossy surface. Addactor muscles leave a deep impression. Pallian sinus deep and U-shaped, Hinge bears three cardinal teeth lunule greatly elongated. Colour pale yellowish white marked purplish grey inverted “v” markings or zig zag marking, **Habitat:** Sandy bottom in mesolittoral zone, during study period this species found only in summer season.

*Phaphia malabarica* (Chemnitz)

Shell large up to 31mm, oval and comparatively light shell, Shell concentrically grooved throughout, the entire surface with deep impressions, outer covering is creamy or yellowish brown. The inner surface is smooth and moderately glossy throughout. The lunule is relatively shorter and broader than *Paphia textile,* length of the shell about one and one-third as long as high. Pallial sinus is ‘U’ shaped and very deep. Three short thick cardinal teeth. The tooth in front of cardinals in the left valve and the corresponding depression in the right are rudimentary. Both the anterior and posterior margin is narrowly rounded, **Habitat:** Found below mid tide level in muddy region especially backwater and estuarine.

Subfamily **DOSINIINAE**

*Dosinia prostata* (Linnaeus)

Description: - Shell moderately large up to 28.5 mm, thin and fragile, lunule deeply depressed and heart-shaped. Umbo prominent, bent forward and beak-like. Posterior margin crested with well developed striae. Surface finely and concentrically striated. Hinge teeth well developed. Color white with ashy grey concentric lines, **Habitat:** Sandy bottom in mesolittoral zone, also in rock crevices.
**Dsinia gibba** (Adams)

Shell moderately large up to 28.5 mm thin and fragile, highly, globular in shape among other *Dosinia* species smooth and glossy. Concentric striations very fine and close set, Growth lines prominent, color creamy white.

**Habitat:** Sandy bottom in intertidal zone.

Subclass **HETERODONTA**

Superfamily **SOLENACEA**

Family **SOLENIDAE**

**Razor clams**

Shell thin, smooth, greatly elongate, cylindrical with wide gape at both the ends. Beaks more or less terminal, hinge reduced with only a few cardinal teeth and behind them the external ligament. Sculpture smooth and covered by thin glossy periostracum. Siphons short, pallial sinus shallow, faecal pellet rod like form with definite linear segmentation, highly adapted for rapid burrowing into sand and mud.

**Gunus Solen** (Linnaeus, 1758)

**Solen brevis** (Gray, 1842)

Shell large up to 30mm, flattened, almost straight, tapering slightly at posterior end; posterior margin sub truncate; anterior margin distinctly angled sculpture with prominent growth lines, posterior adductor scar relatively broad, color olive brown, white sharply tinged pink posterior to umbo,

**Habitat:** Sandy bottom in mesolittoral zone, found vertical position always.
Family **CULTELLIDAE**

*Cultelus cultelus* (Linnaeus)

Shell small up to 26 mm, thin, fragile and transparent, both ends rounded. Lower margin curved upwards. Hinge tooth single, situated close behind front margin, color pale brown.

**Habitat:** Sandy bottom in mesolittoral zone, found vertical position always.

Subfamily **ARCTICOIDEA**

Family **TRAPEZIIDAE**

Shell moderately, ovate to sub-trapezoidal, sculpture consisting of coarse concentric growth lines and radial riblets, beak anterior, ligament external. Hinge with two cardinal teeth and anterior and anterior and posterior lateral teeth, internal margin smooth, pallial line usually entire, without sinus, color uniformly white or yellow, common in tropical and subtropical seas, primarily byssate nestling forms living in the crevices or beneath coral debris and rocks.

Genus **Trapezium** (Megerle von Muchlfeld, 1811)

*Trapezium sublaevigatum* (Lamarck, 1819)

Shell small up to 14.2mm, oblong, umbo small an anterior periostracum greenish brown dorsal margin sloping towards the posterior ventral margin straight anterior rapidly sloped, posterior produced obtusely rounded.

**Habitat:** Found below mid tide level.

Superfamily **CORVICULOIDEA**

Family **CORVICULIDAE**

Shell rounded-trigonal to oval, thick, strong fibrous periostracum, Sculpture concentrically striated or ribbed. Hinge with three cardinal teeth in each valve and one or two laterals, ligament strong, external, pallial sinus absent or shallow if present, color pouch, faecal pellet simplest being a plain red rounded in section. Foot large, siphonal opening prolong into small tubes, orifices with or without papillae, Gills two
pairs, outer pair smaller than the inner, the later serving as brood pouch. Faecal pellet simplest being a plain rod rounded in section, inhabitant of freshwater extending to brackish water.

Genus *Polymesoda* (Rafinesque, 1828)

*Polymesoda maxima* (Lamarck, 1818)

Shell large, solid, subtrigonal, tumid, thick, roughly striate; dorsal margin rather angulated; posterior margin abruptly sloping; anterior slope rather concave, Periostracum blackish brown umbo elevated and anterior. Cardinal and lateral teeth well developed. Muscle scars impressed, anterior adductor scar elongate; posterior adductor scar, broad, oval. Found buried in stiff mud of the mangroves areas, well adapted to the habitat, being able to tolerate long periods of low tide, and has the ability to resume filter feeding rapidly when inundated.

**Habitat:** Found buried in stiff mud of the mangroves areas, in mid tide level.

Superfamily **TELLINACE** (De Blainville, 1924)

Family **TELLINIDAE** (De Blainville, 1924)

*Tellina philippinarum* (Hanley)

Family **DONACIDAE**

*Donax incarnatus* (Gmelin)

Compared to *D.cuneatus* shell medium in size up to 10mm, triangular, compressed, variously colored. Umbo posterior and almost right angled. Anterior margin rounded; ventral margin convex and serrated. Anterior dorsal margin, long, straight and sloping gradually, posterior dorsal margin slightly convex and serrated. Posterior margin short steeply sloped and distinctly serrated. Shell surface sculptured with fine thread like concentric and radial striae; at the posterior region the concentric striae slightly ridged and crossed by prominent radial striae to give a dotted appearance, ligament short and brown, lunule small and present on both the valves.

Cardinal teeth complex consists of a thin anterior tooth and triangular thick posterior tooth, antero lateral tooth wide, distal to the cardinal tooth; posterior lateral
tooth triangular, strong and proximal to cardinal teeth. Adductor muscle scar moderately developed. Pallial line poorly developed. Pallial sinus oval shaped, the ventral ends falls obliquely to the pallial line and is in confluence with it.

**Habitat:** Found mid tide level to high tide level in sandy beach.

*Donax cuneatus* (Linnaeus)

Shell medium size up to 12.5mm, triangular and compressed. Color of the shell extremely variable, ranging from dull white to yellowish brown or grayish brown, commonly with dark brown or mauve rays radiating from umbo to ventral margin. Anterior margin is more rounded; ventral margin slightly convex and almost straight. Posterior dorsal margin short and steeply sloped, a short ligament close to umbo on the posterior dorsal margin. Posterior margin is truncated. Sculpture with fine concentric striae, slightly and conspicuously ridged on the posterior end. Radial striae fine, thread like except on posterior lobe. Lunule presents on the valves. Anterior adductor muscles scar rounded. The pallial sinus is exceptionally large and broader. The ventral margin of the pallial sinus is parallelly joining the pallial line. The cardinal teeth in *D. cuneatus* are distinct. The strong external ligament keeps the two valves intact when the animal dies and strewn onto the beach the two shells appear like “butterfly wings”.

Clean, sandy beaches are characterized by ‘*Donax* beaches’ beaches that are clean and generally of white quartz sand and highly populated with *Donax* are firm and compact underfoot. They do not retain standing water, and are always perceptibly sloped, but the gradient is always gentle, the profile steepening only at the beam or where coarse sand gives place to gravel.

*Donax cuneatus*, with its short siphons exists in huge numbers just beneath the sand surface at mid to low tide level. The streamlined shells can be pulled almost instantly into an upright position, and drawn down rapidly into the sand. In many places the *Danax* species have been shown to migrate with the rise and fall of the tides. The sand burrowing mole crab, *Emerita asiatica*, regularly accompanies *Donax cuneatus*. Spawning is initiated around December-January and extends up to June.
**Habitat:** Found mid tide level to high tide level in sandy beach.

*Donax scortum* (Linnaeus)

Shell large up to 28.5mm, thick very inflated, broadly triangular; umbo in folded, pointed and turned towards posterior. A sharp strong keel runs from umbo to the posterior ventral margin that ends sharply (acute). Distinct strong concentric ridges cover the surface. These concentric ridges are crossed by finer redial lines, which are weak or obsolete at centre. The ridges are strongly crested at the posterior and anterior margins. Posterior end is narrow, periostracum brown, cardinal teeth prominent. The shell is grayish white with pale violet umbo; inside of the shell violet. *D. scortum* appears to be a deep water species. The live specimens are not commonly encountered in the trawl nets operated in shallow waters. Dead shells often with holes drilled by moon snails are encountered along the beaches.

**Habitat:** Found mid tide level to high tide level in sandy beach.
Order **MYOIDA**

Suborder **MYININA**

Superfamily **MYACEA**

Family **CORBULIDAE**

*Corbula abbreviata* (Preston)

Shell medium up to 20mm, oval and comparatively light shell, Shell concentrically grooved throughout, the entire surface with deep impressions, outer covering is creamy or yellowish brown.

**Habitat**: Found mid tide level to heigh tide level in muddy region.


Suborder **PHOLADINA**

Superfamily **PHOLADOIDEA**

Family **PHOLADIDAE**

Subfamily **MARTESIINAE**

Genus *Martesia* (Sowerby, 1824)

*Martesia fragilis* (Verrill and Bush)

Shell medium up to 12.10mm, body is elongated, creamy whitish inner part of the shell.

**Habitat**: It is usually found in floating wood or nuts in the open sea. Some time wood use to came on the beaches or in estuaries and they remain in mangrove resion in one place.

Order **OSTREOIDA**

Suborder **OSTRINA**

Superfamily **OSTREOIDEA**

The Superfamily Ostreoidea is true oysters, epifaunal in habit, living cemented with the various substratums by the left valve. Shell shape varies, often influenced by
and conforming to the substratum. Generally the shells are semicircular to elongate oval, more or less equatorial, but usually inequivalve, cemented with inflated left valve. Sculptures of thin, fallacious lamellae which are often eroded but occasionally developed into hallow spines. The valves flat or variously folded, most noticeable at the margins. All oysters with a single large adductor situated at centre towards the posterior ventral edge. Hinge without teeth but a variety of marginal ridges or pustules known as chomata may be present. Vermiculate chomata are long, narrow ridges present in dense patches just below the ligament. Nodular chomata are to oval, rounded denticles which often have corresponding pits in the opposite valve, occurs single or in small groups. Pustulose chomata are tiny pin headed occurs in multiples over the inner margin. Ligament is simple, forming three part triangle beneath the beaks. Shell varies in colour; most of them are grayish white ground color with shades of red to purple black occurring as radial or irregular markings.

Family **OSTRIDAE**

Subfamily **CRASSOSTREINAE**

*Crassostra cutuckensis* (Newton & Smith)

Shell large up to 72.5mm, the shell of *Crassostrea cutuckensis* is very irregular, marginal denticles (teeth) absent. The adductor muscle scar single, kidney shaped with the ventral edge pointed and the dorsal edge truncated), dark purple and sub centrally (anteriorly) placed. The external surface of the shell calves is laminated like overlapping leaves and distinct around the posterior margin of the shell. The attachment is by the lower half of the cup shaped left valve. The right valve is flat or slightly concave. Hinge is narrow, elongated and toothless.

It has been observed that the shape of the shell of *Crassostrea cutuckensis* varies in relation to the substrata on which it sees and grows. Those settling on rock surfaces are round, those growing on soft mud are elongated and narrow and on uneven surfaces is conforms to that of the substratum. Overcrowding results in highly irregular forms.
This is a euryhaline species found in dense population as thick beds in estuaries, backwaters, lagoons, coastal bays and rarely in the open coastal waters. They also colonize muddy bottoms. Sexes are separate and the gametes are discharged to the estuaries, breeds throughout the year with intensive spawning during April-May and August-September.

Feed largely on organic detritus and phytoplankton and the growth of this oyster varies from place to place depending upon the availability of food and the environmental conditions. *C. cutuckensis* develops a unique oyster-reef community with the associations and interactions of animal and plant populations.

*Saccostrea cucullatea* (Born)

Shell large up to 61.5mm, the presence of the denticles along the inner margins of both the shell valves is the generic character that distinguishes this oyster from *Crassostrea madrasensis* (in *saxostra* denticles are present on the lower margins of the valves). The denticles are prominent along the posterior margins of the valves with the corresponding pits. The adductor muscle scar is oblong and striated. *S. cucullata* is non-incubating, i.e. gametes are released into water. Shell more or less trigonal, sometimes oblong, extremely hard and the margin plaited (corrugated) i.e. to shape alternate ridges and grooves. Plaits more or less angular and at margins wavy.

*S. cucullata* was once considered a purely marine species and never forming beds in backwaters and estuaries. This species has now invaded the brackish habitats. Generally, *S. cucullata* occur firmly attached to sandstone, granite boulders or coral stones of the intertidal regions and also the marine zones of estuarine and the stilt roots of the mangrove *Rhizophora*.

Order **PTERIOIDA**

Family **ANOMIIDAE**

*Placenta placenta* (Linnaeus)

Shell large up to 110.4mm, the shell is very much compressed and sub-orbicular in shape, the height and breath approximately equal. The shell valve is
slightly unequal, very, flat, rounded and translucent. The adductor impression is at about the centre. The umbo is small. Two thin ridge-like teeth diverge from the umbo making characteristic inverted V shaped angle. The shell is fairly large with a diameter of 14 cm or even more.

It bears numerous concentric lines of growth on the exterior consisting of slightly projecting lamellae, the margins of which are minutely uneven with finger-like or spatulate processes. The shell of the adult window pane oyster is white in color. The windowpane oysters are represented in Indian coasts, especially on Raigad district coast i.e. Placenta placenta Linnaeus.

The Placenta placenta is a common and commercially important species. The left valve is somewhat irregular and it completely covers the right, which is much thinner and closely adheres to the substratum. The right valve has a deep cleft in the young stage, which closes in the adult, forming a perforation. Windowpane oysters are so called because of their thin translucent flat valves with iridescent luster which are utilized as window panes, inhabits muddy bottom of bays and creeks, which are more or less land locked. The species can tolerate wide range of salinity, P. placentalies on the surface, or obliquely partly buried in mud. The mantle cavity is open to inhalant currents nearly all round the shell and as in scallops and oysters, the “quick” adductor muscle can produce fast clapping movements of the valves to expel in borne sediment but there are no resultant swimming movements.

The window pane oyster shell are a source shells are a source of shell lime, meat is edible and the right valve is exported in good qualities and are used for glazing windows.

**Habitat:** Found below mid tide mark in mud and sand.

**Anomia achaeus** (Gray)

Shell small up to 26.5mm, windowpane oysters are so called because of their thin translucent flat valves with iridescent luster which are utilized as window panes, **Habitat:** found below mid tide mark in mud and sand.
Family **PSAMMOBIIDAE** (Fleming, 1828)

Subfamily **SANGUINOLARIINAE**

Genus *Sanguinolaria* (Lamarck, 1799)

*Sanguinolaria acuminata* (Deshayes)

Shell large up to 170 mm in length and height up to 50 mm in width, shell thin elongated. It having very long siphons during feeding, color brownish occurs in the back water,

**Habitat:** Estuarine muddy bottom up to two feet inside the mud at the low water mark.

Family **SEMELIDAE**

Genus *Theora* (H. and A. Adams, 1856)

*Theora opilina* (Hinda)

Shell large up to 47.5mm, body elongated like Marcia opima but this species is large, milky whitish color on the shell.


**Habitat:** Mainly below mid tide level on rocky shore, especially found only in summer season.
SYSTEMATIC LIST OF BIVALVE MOLLUSCS

Class **BIVALVE**

Order **ARCOIDA**
Superfamily **ARCACEA** (Lamarck, 1809)
Family **ARCIDAE** (Lamarck, 1809)
Subfamily **ARCINAE** (Lamarck, 1809)
1. *Arca granosa* (Lamarck)
2. *Anadara granosa* (Linnaeus, 1758)
3. *Arca bistrigata* (Dunker)

Order **MYTILOIDA** (Ferussac, 1822)
Superfamily **MYTILACEA** (Rafinesque, 1815)
Family **MYTILIDEA** (Rafinesque, 1815)
Subfamily **MYTILINAE** (Rafinesque, 1815)
4. *Brachidontes variabilis* (Krauss)
5. *Perna viridis* (Linnaeus)
Subfamily **MODIOLINAE**
6. *Modiolus metacalfei* (Hanley)
7. *Modiolus undulatus* (Dunker)
8. *Modiolus striatulus* (Hanley, 1844)

Order **VENEROIDA**
Superfamily **VENERACEA** (Rafinesque, 1815)
Family **VENERIDAE** (Rafinesque, 1815)
Subfamily **CIRCINAE**
9. *Gafrarium divaricatum* (Gmelin)
Subfamily **SUNETTINAE**
10. *Sunetta scripta* (Linnaeus)
Subfamily **MERETRICINAE**

11. *Meretrix meretrix* (Linnaeus, 1758)

Subfamily **TAPETINAE**

12. *Marcia opima* (Gmelin)

13. *Phaphia textile* (Roding)

14. *Phaphia malabarica* (Chemnitz)

Subfamily **DOSINIAENAE**

15. *Dosinia Prostata* (Linnaeus)

16. *Dsinia gibba* (Adams)

Superfamily **SOLENACEA**

Family **SOLENIDAE**

17. *Solen brevis* (Gray, 1842)

Family **CULTELLIDAE**

18. *Cultelus cultelus* (Linnaeus)

Subfamily **ARCTICOIDEA**

Family **TRAPEZIIDAE**

19. *Trapezium sublaevigatum* (Lamarck, 1819)

Superfamily **CORBICULOIDEA**

Family **CORBICULIDAE**

20. *Polymesoda (Gelonia) proxima* (Lamarck, 1818)

Superfamily **TELLINACE** (De Blainville, 1924)

Family **TELLINIDAE** (De Blainville, 1924)

21. *Tellina (Moerella) philippinarum* Hanley

Family **DONACIDAE**

22. *Donax incarnatus* (Gmelin)

23. *Donax cuneatus* (Linnaeus)

24. *Donax scortum* (Linnaeus)

Order **MYOIDA**
Suborder MYININA
   Superfamily MYACEA
   Family CORBULIDAE
   
   25. Corbula abbreviata (Preston)

Suborder PHOLADINA
   Superfamily PHOLADOIDEA
   Family PHOLADIDAE
   Subfamily MARTESIINAE
   
   26. Martesia fragilis (Verrill and Bush)

Order OSTREOIDA
   Suborder OSTRINA
   Superfamily OSTREOIDEA
   Family OSTRIDAE
   Subfamily CRASSOSTREINAE
   
   27. Crassostrea cutackensis (Newton & Smith, 1912)

   28. Saccostrea cucullata (Born, 1778)

Order PTERIOIDA
   Family ANOMIIDAE
   
   29. Placenta placenta (Linnaeus)

   30. Anomia achaeus (Gray)

   Family PSAMMOBIIDAE (Fleming, 1828)
   Subfamily SANGUINOLARIINAE
   
   31. Sanguinolaria acuminata (Deshayes)

   Family SEMELIDAE
   
   32. Theora opilina (Hinda, 1843)
Table no. 2. Measurement of Bivalve Molluscs

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Name of the species</th>
<th>Length (in mm)</th>
<th>Height (in mm)</th>
<th>Depth (in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Arca granosa</em> (Lamarck)</td>
<td>33.00</td>
<td>35.00</td>
<td>31.00</td>
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<tr>
<td>2</td>
<td><em>Anadara granosa</em> (Linnaeus, 1758)</td>
<td>22.00</td>
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<td>21.50</td>
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<td><em>Arca bistrigata</em> (Dunker)</td>
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<td><em>Brachidontes variabilis</em> Krauss</td>
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<td>25.00</td>
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<td><em>Perna viridis</em> (Linnaeus)</td>
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<td><em>Modiolus metacalm</em> Hanley</td>
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<td><em>Modiolus undulatus</em> (Dunker)</td>
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<td><em>Gafarium divaricatum</em> (Gmelin)</td>
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<td><em>Sunetta scripta</em> (Linnaeus)</td>
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<td>11.00</td>
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<td><em>Meretrix meretrix</em> (Linnaeus)</td>
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<td><em>Marcia opima</em> (Gmelin)</td>
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<tr>
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<td><em>Paphia textile</em> (Gmelin)</td>
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<td><em>Phaphia malabarica</em> (Chemnitz)</td>
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<td><em>Dosinia Prostata</em> (Linnaeus)</td>
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<tr>
<td>16</td>
<td><em>Dosinia gibba</em> (Adams)</td>
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<td>26.50</td>
<td>14.40</td>
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<tr>
<td>17</td>
<td><em>Solen brevis</em> (Gray, 1842)</td>
<td>30.20</td>
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<tr>
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<td><em>Cultelus cultelus</em> (Linnaeus)</td>
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<td><em>Trapezium sublaevigatum</em> (Lamarck, 1819)</td>
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<td><em>Polymesoda maxima</em> (Lamarck 1818)</td>
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<td><em>Tellina Philippinarum</em> Hanley</td>
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<td><em>Donax incarnatus</em> (Gmelin)</td>
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<td><em>Donax cuneatus</em> (Linnaeus)</td>
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<td><em>Donax scortum</em> (Linnaeus)</td>
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<td><em>Corbula abbreviata</em> (Preston)</td>
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<td><em>Martesia fragilis</em> (Verrill and Bush)</td>
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<td>10.50</td>
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<td><em>Crassostrea cutuckensis</em> (Newton &amp; Smith)</td>
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<td>62.00</td>
<td>49.00</td>
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<tr>
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<td><em>Saccostrea cucullatea</em> (Born)</td>
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<td>59.00</td>
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<tr>
<td></td>
<td><strong>Placenta placenta</strong> (Linnaeus)</td>
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<td></td>
<td></td>
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<tr>
<td>---</td>
<td>---------------------------------</td>
<td>---</td>
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<td></td>
</tr>
<tr>
<td>29</td>
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<td>110.40</td>
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<td>7.00</td>
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<td>30</td>
<td><strong>Anomia achaeus</strong> (Gray)</td>
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<td><strong>Sanguinolaria acuminata</strong> (Deshayes)</td>
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<tr>
<td>32</td>
<td><strong>Theora opilina</strong> (Hinda, 1843)</td>
<td>47.20</td>
<td>49.00</td>
<td>25.50</td>
</tr>
</tbody>
</table>
Family Trochidae

Top Shell, Button shell

Shell is small to large in size, conical, pyramidal or turbinate with a flat base and distinct spire, around aperture, umbilicus narrow or completely filled with callus deposited. Interior in many iridescent. Inner and outer lips are in different planes. Operculum is thin, multispiral and with a central nucleus.

Animal is brightly colored, head bears two tentacles and two flattened palmettos in between the tentacles, foot with a thick fold on each side bearing tendril-like processes on the epipodium, food dorsally ridged and ventrally longitudinally divided. There is a single left ctenidium with symmetrical filament. Radula is rhipidoglossate with a central tooth, mostly with five lateral teeth and variable number of marginal.

The snails generally occur in the intertidal zone and subtidally at the depth of few meters. Majority of the members feed by scraping the detritus and algae from hard substrate. There are a few filter feeders, such as *umbonium* and carnivores such as *calliostoma*.

Based on shell characters the family is distinguished into seven subfamilies, namely Trochinae, Margaritinae, Monodontinae, Gibbulinae, Calliostomatinae, Umboniidae, and Solariiidae.

Sub family Trochinae

Shell is conical, with considerable size range, nodosely ornamented, base not exactly flat but excavated in the middle, aperture quadrangular. Columellar lip is straight, smooth, undulating or toothed. Outer lip is sharp.
1. *Trochus radiatus* (Gmelin, 1791)

Description: - Shell of medium size, up to 45mm in height, conical, a little broader than high, whorls convex, surface sculptured with three regular, spiral rows of rounded tubercles, upper most rows on each whorl broader than the rest, interstices obliquely striated, base rather flat, with strong spiral ridges, columella smooth and not denticulate, pale yellowish color with bright, broad, transpiral, dark reddish bands, basal surface with irregular reddish spots.

**Habitat:** Found mainly in the intertidal zone on rocky shores.

Subfamily **COLLIOSTOMATINAE**

Shell is small, conical or turbiniform, base generally flattened, sculptured with spiral beaded ribs or keels. Aperture is quadrangular, peristome discontinuous, columellar lip strongly.

2. *Coliostoma speciosa* (A.Adams, 1854)

Description: - Shell small, up to 10.4 mm in height, conical, whorls convex, sculptured with four to five granulated spiral ridges, the upper two sutural ridges more prominent than others, the lower three or four spiral ridges enclosing a thin granulated spiral ridge between the two thick ridges, base flat and ornamented with five strongly grained spiral ridges, aperture subquadrate, outer lip arcuate, color yellowish brown with red brown blotches.

**Habitat:** Found mainly in the intertidal zone on rocky shores.

Subfamily **MARGARITINAE**

Shell small to moderately large in size, thin, iridescent within, ovate conical or conical turbiniform. Outer lip is thick or thin, peristome not strongly prosocline, either interrupted or continuous, inner lip generally toothless or with a tooth.
3. *Euchelus attratus* (Gmelin, 1791)

Shell small, up to 25 mm in height, globose conic, sculptured with densely beaded spiral ribs, 12 on body whorl and 5 on the penultimate whorl, sutures deeply canaliculated, aperture circular, umbilicate, columella with a tooth at base. Color variable, marked by irregular, obliquely transpiral rows of purplish brown spots.

Subfamily *Umboniinae*

4. *Umbonium vestarium* (Linnaeus, 1758)

Shell small, up to 10.5mm in height, much smaller than the commercial Top Shell, ventricular, solid, depressed, glossy and smooth. Umbilicus filled by a large sub-circular, white or dark gray callus pad. Color of the shell highly variable, white, pink or brown with dark gray or purple marking, as many as twenty-four color morphs can occur in a population. Operculum circular brown and multi spiral.

Sexes are separate, ova and sperm released into water, fertilization external, warmer months favorable for breeding. Button top, unlike Trochus, is a filter feeder. Its feeding activity is seen mainly during high tide and at low tide it closes the aperture with the operculum and buried itself below the wet sand.

Huge quantities of button tops are collected from the coast near the Raigad district coast they are used in the manufacture of lime. Also they are used in the preparation of garlands, door hangings and in inlay work. The flesh is also reported to be eaten in some parts and is sold in some markets. Its use as a food is however, limited since the flesh part is very small.

**Habitat:** Found mainly in the intertidal zone on sandy beaches.


Shell smaller than in the other species of the genus, up to 30mm in length and 20.3mm in with, flatly conidial, whorls six, angular, sculptured with distantly placed spiral ribs nearing a little undulation costulations and a keel at the periphery, shoulder
of the body whorl with coronations separated by wide interspace, base smooth or with flat superficial ribs, aperture quadrate columella with a denticle and smooth thickened callosity around the umbilicus, interior of aperture with obsolete striations. Color brown with irregular and minute white reticulations.

**Habitat:** Found mainly in the intertidal zone on rocky shores.

**Family: TURBINIDAE**

**Turban shell**

Shell is small to very large in size extending up to 200mm in height, globose, strong and solid with a few whorls and an elevated spire. Aperture is fairly large and nacreous within. Columella is smooth and arched with callous deposit. It usually is without an umbilicus. Sculpture consists of spiral ribs or ridges. Operculum is a characteristic type. It is thick, solid, flat on the inner side and convex externally. Its inner surface bears a thin, chitinous layer while the outer surface may be smooth or ornamented. It is multi-spiral with a central or an eccentric nucleus.

The animal resembles trochids in the possession of a pair of tentaculate processes or lappets and elongate lateral cirri. Cephalic tentacles are ling. Foot is large and truncate anteriorly. Radula is rhipidoglossate with five lateral teeth. Sexes are separate. Fertilization is external and free-swimming veliger larvae are released. Turban shells have worldwide distribution. These are common in the intertidal region and a few species occur in the sub littoral region of reef ecosystem in warm temperate and tropical seas, they feed on algae.

**Subfamily TURBININAE**

6. *Turbo bruneus* (Roeding, 1798)

Shell of medium size, up to 54mm length, thick, slightly longer than broad, apex pointed, sculptured with uneven, raised, scabrous spiral ridges, shoulder of the body whorl keeled giving a sub-angular look, spiral ridges finely and transpirally grooved. Aperture moderately large, rounded, with a very narrow umbilicus, lip below columella extends downwards slightly, aperture silvery white with a pale
greenish tinge. Shell cream colored with dark brown or black and slightly wavy axial flames. Operculum finally granulates all over, dark purple on the columellar side and lighter towards the margin.

**Habitat:** Found mainly in the intertidal zone on rocks, (stones) shores.

**Subfamily ASTRAEINAE**

Shell is conical, longer than broad, with more or less carinate periphery, base flattened, sculptured with spiral striae and nodules or spimes. Aperture is obliquely ovate, with or without umbilicus. Operculum is oval and Horney.

**7. Astralium semicostata** (P. Fischer, 1880)

Shell small, up to 30.2mm in length, trochiform, elevated and conical, sculptured with oblique axial nodulose cords, just above suture and on the shoulder of the body whorl with prominent nodules, base almost flattened and sculpture with 10 to 12 beaded spiral cords separated by thin grooves, aperture obliquely ovate without umbilicus, columella with a strong fold, operculum not seen.

**Family NERITIDAE**

Shell is small to medium in size, mostly globose, thick, with a few whorls and a low spire, sutures shallow or strongly indented. Body whorl is large, rounded and inflated. Aperture is reduced to almost a D-shaped opening, its straight side bordered by the columellar edge. Umbilicus is lacking, is lacking. Outer lip may be thickened and toothed inside. Columella is also toothed and has an extensive, flattened callus, whose surface is often tuberculated or irregularly wrinkled. Surface usually is sculptured in marine forms with spiral ribs or striae and axial growth striae. Coloration is highly variable. Operculum is generally calcareous, with an internal appendage. Head shows a definite pattern of pigmentation. A pair of long, contractile tentacles arises from a tentacular base on the dorsal side of the head. From the outer base of each tentacle arises an eyestalk with eye at its tip. Foot is strong, but small in marine forms and enlarged in freshwater forms. Buccal cavity consists of a long,
ribbon-like radula with several rows of teeth. It is a rhipidoglossate radula (œ: 5:1:5: œ). Mantle cavity consists of a bipectinate ctenidium, a ridge like osphradium, kidney, hypobrancial gland and the terminal parts of digestive and reproductive system. Nervous system is typically streptoneurous in the majority.

Sexes are separate. Male has a penis and a prostate gland. Male gonoduct is an open, ciliated groove. Female reproductive system is more complicated than in the male. Fertilization is internal. Egg capsules are deposited in shallow water-filled depression on the surface of rock or underneath rock which afford some protection from the sun. Veligers have ling planktotrophic life.

The family has a cosmopolitan distribution, but majority of the species occur in the Indo-Pacific region. These inhabit intertidal rocks, mangrove swamps and jetties. The characters of taxonomic value are as follows:
1. Shell shape, coloration and surface sculpture
2. Nature of columellar callus
3. Nature of outer lip
4. Structure of teeth in the radula

**8. Nerita albicilla** (Linnaeus, 1758)

Description:- Shell of medium size up to 30.2 mm in length, very thick, somewhat obtusely triangular, whors three, narrow and gradually expanding towards the aperture, body whorl large and expanded, spire markedly depressed, scarcely reaching the upper extremity of the outer lip, suture faintly impressed. Aperture broadly semilunar, columella with large callus deposit, with fine and profuse granulations, those on the upper half larger than those on the lower half, columellar margin slightly convex 4 to 6 fine teeth in the middle, outer lip thickened, with 18-19 fine and close-set teeth on the inner margin, the knob-shaped superior most and inferior most teeth stronger than the rest. Sculptured with close-set spiral ribs diverging fan-wise towards the expanded outer edge of the shell, color variable, white, orange yellow, with densely or sparsely crowded, maculated or interrupted or
irregular black bands with blotches of orange. Operculum thick, externally flat, whitish and thickly granulated, internal surface light colored with a reddish-gray centre and whiter margin. It occurs in abundance on the rocky substrata in the shady and damp places in the lower eulittoral region, occasionally extending into sub-littoral region, Egg capsules were observed from February to September. 

**Habitat:** Intertidal rocks, mangrove swamps and jetties.

9. *Nerita oryzarum* (Recluz, 1841)

Description: - Shell small, up to 15.4 mm in height, globes or obliquely oval, rather solid, whorls 3½ to 4, spire obtuse, but slight exerted. Aperture with not much expanded but sloping columellar callus, granular in the middle and wrinkled in the upper half, columellar margin concave, with three distinct teeth, outer lip thickened, inner side with 12 to 14 teeth, the superior two teeth knob-shaped, border than the rest, the first tooth separated by a gap from the rest, other teeth longitudinally expanded. Sculpture with rather weak, small and smooth spiral riblets numbering 30 to 35; riblets alternately strong and weak, often two weaker ones after a strong one, riblets are numerous and crowded on the base of the body whorl. Usually slate colored and peculiarly mottled with zigzag maculation and sometimes an interrupted band of white, aperture white. Operculum externally ash-gray with white nuclear spot and numerous broadly rounded granules, those near the outer margin smaller and closer, internal surface flesh-red, slightly grooved on the inner margin and furrowed in the middle, apophyses strongly curved downwards. 

**Habitat:** Intertidal rocks, mangrove swamps and jetties.

10. *Nerita plicata* (Linnaeus, 1758)

Description: - Shell of medium size, up to 14.3 mm in height, globose, whorls three, rounded, spire prominently raised and clearly exerted beyond the level of the large, globular body whorl, apex pointed and sharply defined sutures not distinct. Aperture relatively smaller and further narrowed by the teeth, protruding into it;
columella with a callus deposit bearing longitudinally elongated wrinkle like ridges, some of the stouter ones produced below to form strong, widely set teeth on the columellar edge towards the aperture, teeth three, outer lip thick, sloping inward, with five teeth, sculptured with very strong, and knob-shaped enclosing in between three or rarely five teeth. Sculptured with very strong, raised spiral ribs separated by deep and well excavated interstices, ribs generally weaker on the lower third of the body whorl, color mostly of uniform yellowish-brown or absolute white, often with numerous irregular dark spots, columellar callus glistening white, operculum concave, yellowish-red with white does, smooth except for the faintly granulated outer margin, which bear small dark membrane, internal surface slightly convex, intense flesh red and highly polished, rib strong and curved, peg very faint.

**Habitat:** It lives attached to rocks, pebbles of concrete pilings high on the shore. At some places the vertical range of the species is as high as littorinids and receives only spray of braking waves.

**11. *Nerita squmulata* (Le Guillou, 1841)**

Description: Shell small, up to 21mm in height, suborbicular, broadly depressed. Spire obtusely flattened, only slightly raised above the level of the body whorl, whorls three, broadly expanded towards the aperture. Aperture broadly effused, columellar concave bearing three to four minute but distinct teeth in the middle, columellar surface concavely depressed, irregularly edged on the outer edge and finely tuberculated in the middle, outer lip outer margin thin, inner margin thickened with 15 to 17 elongate and wide spaced teeth, the first two superior teeth broader and longer than the rest. Sculpture with irregular and crowded spiral ribs, generally 12 to 14 well developed broad ribs enclosing in between weak and obsolete ribs, surface beast with short scaly processes giving the shell scabrous appearance. Color variable, black or opaque white with obliquely wave-sprinkled minute gray dots or orange yellow clouded with black, aperture white, outer lip margin fringed uniformly black or with dots of black, operculum slightly convex, externally brownish
with a pink tinge, finally granular, internally yellowish-white, peg merely an elevated portion with concentric ridges.

Remark: - Its occurs in abundance near mangroves, crawling on muddy substratum. It is also found in bays and jetties but very rarely adhering to rocks. It occupies a different ecological niche avoiding mixing with the related *Nerita chamaeleon*. The mantle is brownish gray with prominent black wavy liners in *N.chamaeleon* but dull white with black wavy lines in *N.chamaeleon*. The sculpture on the shell and the shape on the aperture are also distinct in the two species. *N.chamaeleon* occurs on rocks in the eulittoral zone and near the low water mark. *N.chamaeleon* breeds from October to November.

12. *Clithon aualaniensis* (Lesson)

Description: - Shell thin, generally small up to 5.5mm, globular, with low spire; bigger specimens mostly wider than long, but reverse in smaller ones. Whorls 3 or 4 rapidly increasing in size; spiral whorls imperfectly developed or eroded in many specimens, leaving a wide depression; body whorl comparatively large; suture shallow; umbilicus closed. Body whorl brilliantly shining and very prettily colored with various patterns and combinations of dark yellowish and white triangles and zigzag lines on a green background, with fine dark longitudinal lines; spiral band on yellow or green background; with a high degree of polymorphic color patterns that hardly any tow specimens look alike.

Aperture oblique, semi-lunar, relatively small, somewhat deep columellar side somewhat convex, white, yellow or grayish, columellar callus small, inner columellar edge somewhat concave, minutely toothed in the center the number of serrations or teeth 4-5; outer lip thin and not reflected, sexes are separate, has probably no free swimming pelagic larva. Eggs are laid within capsules, attached to shell of another animal of the same species. From these capsules miniature snails complete with shells emerge.
**Habitat:** It lives attached to rocks, pebbles of concrete pilings high on the shore. At some places the vertical range of the species is as high as littorinids and receives only spray of braking waves.

13. *Clithon meticularis* (Benson)

Description: - Shell oval, dull brown, with blackish-brown, longitudinal, undulating and rarely with very fine, aperture broad; Columella callus small and smooth; operculum semi lunar.

**Habitat:** In the crevices of mid or under surface of bricks, dykes and also in between mid tide mark to high tide mark with grass. This species is primarily a backwater form extending into freshwater.

14. *Neritina smithi* (Wood, 1828)

Description: - Shell oval, white or dull brown, with strong black, longitudinal, undulating and interrupted lines and bands, rarely with rarely with very fine, wavy and close set black lines; aperture broad; Columella callus small and smooth; operculum semi lunar.

**Habitat:** In the crevices of mid or under surface of bricks, dykes and also in between mid tide mark to high tide mark with grass, this species is primarily a backwater form extending into freshwater.

15. *Dostia violacea* (Gmelin)

Description: - A symmetrical shell with a smooth surface and lack of spiral suture ate characteristic features of this genus *Neritina*. Shell is thin, ovate, *Crepidula* shaped, spire minute, color yellowish brown with well defined columella with 7-10 denticles. Columellar plate tinged brownish orange, operculum semi-lunar, external surface smooth.

**Habitat:** On hard substrata like pillars and bricks of the brackish environments.

16. *Nerita planspira* (Anton, 1839)
Description: - Shell of medium size, up to 26.5 mm in height, angularly semiglobose, flattened above with an ontuse shoulder angle, whorls three, narrow, compressed at the spire, broadly expanded at the aperture, spire very small, flatly impressed, sutures not distinct. Aperture with even columellar callus, granulated at the upper half and just below it a shallow depression bearing granules, columellar margin with four broad based and unequal projecting teeth, a ridge-like elevation in between the superior-most tooth and the posterior part of outer lip; thickened and broadly effused, lightly wavy in outline, inner side smooth with very faint indications of teeth, sculptured with 20 to 25 elevated, rounded and somewhat broader spiral ribs alternating frequently with barrow, thread-like riblets. Color yellowish-gray with maculation or zigzag striation of brownish-black, aperture yellowish-white, columellar callus yellowish-white with a long blotch of black on its upper half, outer lip fringed with black and a yellowish-white interior. Operculum flat, smooth, purplish, white near the nucleus, internal surface flesh-red; whitish, and pointed anterior end, yellowish and broader posterior end, the parietal margin somewhat tucked in to accommodate the large columellar teeth.

Habitat: It occurs adhering to roots and stems of coastal mangrove plants *Rhizophora* sp. one or two feet above the substratum.

17. *Nerita grayana* (Recluz, 1843)

Description: - Shell of medium size, up to 28 mm in height, ovate globose, and thick, whorls 3½, rather narrow, spire short but distinct and elevated, apex white and pointed. Aperture proportionately larger, columellar callus slopes deeply inwards, with strong wrinkles- uninterrupted in the upper half but shorter and scantly set in lower half-columellar margin concave with two to four strong and blunt teeth, a ridge-like elevation on the posterior side, outer lip moderately thickened, with a callosity on the interior bearing 19 to 20 small teeth the first superior (posterior most) knob-shape and the rest longitudinally elongated and moderately weak. Sculptured with strong, exalted and crenulated spiral ribs, numbering 24 to 30, on the upper half of the whorl strong ribs enclose thin ribs between them, interspaces broader than the ribs. Color
grayish black flecked with white, apex white, aperture light yellow, outer lip
tessellated and flecked with black. Operculum flat, thickly granulated, gray with white
nucleus, internal surface also grayish, rib strongly developed and furrowed.
Remark: - It occurs on the roots and ranches of mangroves along with *Nerita
planospira* and was observed to thrive well out of water even during high tide.
**Habitat:** Intertidal rocks, mangrove swamps and jetties.

18. *Nerita chameleon* (Recluz, 1843)

Description: - Shell of medium size, up to 20 mm in height, solid and globose,
whorls three, convex, spire low, but pointed, suture faintly impressed. Aperture
crescentic, small, deep, columellar area thick, callus traversed by irregular
longitudinal ridges on the inner and outer halves with granulation in between,
columellar margin of outer lip thin and sharp, inner margin with callosity bearing 10
to 12 distinct teeth, the first and second superior teeth knob-shaped and the inferior
most tooth stronger than others, sculptured with variable number of crenulated spiral
ridges crossed by faint axial lines of growth, colored with blotches of black, green or
yellowish-green, sometimes with three broad, dark-brown or dark-green spiral bands,
columellar dull white, outer lip fringed with black spots or with a thin back band,
operculum slightly convex, extremely grayish, almost regularly and finely granular,
internally brownish-red in color.
**Habitat:** Rocky intertidal zone.

Family LOTTIIDAE

Subfamily PATELLOIDINAE

19. *Potamacmaea fluviatilis* (Blanford, 1868)

Description: -Shell of medium size, up to 14.7 mm in length, oval, thin, apex
anterior, sculptured with a number of radiating striae, exterior olive brown.
Radula docoglossate, with 65 transverse rows of teeth, central absent, two pairs of
lateral teeth one behind the other, bearing six cusps each, three marginal’s on either
side with 13 cusps on each.
Remark: - It is an estuarine form occurring in the crevices of bricks and wooden poles, and on *Avicennia* plant up to one meter height above the ground.

**Habitat:** Intertidal rocks, mangrove swamps and jetties.

**Family PATELLIDAE**

**True Limpets**

Limpet shape has been developed by a few other gastropods and hence it often becomes difficult to identify specimens based on their shells. Anatomical details are necessary for ascertaining the identity of limped-shaped shells.

Shell is simple, oval or rounded, cap or saucer-shaped without any perforation or notch. Apex is central or towards the anterior third. Shell exhibits variation in size, shape, color and sculpture depending on the habitat of the species. Exterior surface of shell is sculptured with radiating ribs and concentric striae. Limpets of this family are distinguished from the other families of the superfamily Patellacea, namely Acmaeidae and Lottiidae, by the absence of ctenidium and the presence of a gill cordon on either side of the animal. It may be either continuous or broken. Radula is long and narrow and in the genus *Cellana* it is four times longer than the shell.

The family is widely distributed. It is represented by about 90 species in all seas, with about five species in Indian waters. These are algal grazers and occur commonly in the intertidal zone of rocky coasts. The family is divided into two subfamilies, namely Patellinae and Nacellinae and can be distinguished on the basis of radula. In the former it is shorter and folded, whereas in the latter it is fairly long and coiled in loops.

**Subfamily NACELLINAE**

It includes two genera, namely *Cellana* and *Nacella*. The former genus, which is restricted to the Indo-Pacific, is represented by two species along Indian coasts.

**20. Cellana radiata** (Born, 1778)

Description: - Shell of medium size, up to 23.5 mm in length, thin roundly, ovate, anteriorly narrow, apex generally towards the anterior third; numerous narrow, approximately equally flat-topped radial riblets separated by linear grooves, and
conspicuous growth striae, underlying radial folds absent, exterior with purplish brown markings on a yellow background, often with whitish rays, interior iridescent with irregular dark brown blotches on the margin.

**Habitat:** In rocky intertidal zone.

**Order** MESOGASTROPODA

Shell is mostly porcellaneous and operculate. It usually is conical with a high spire or of turreted shape. Mantle cavity has amonopectinate left ctenidium, a bipectinate osphradium and usually a single hypo-bronchial gland situation the right side. Radula is taenioglossate. Heart has a single auricle and ventricle. Sexes are separated or sometimes united and with a complex reproductive system. Majority occurs in marine habitat with some on land or in freshwater.

It is the largest order embracing as many as 94 families. About 47 families are known to occur in India, three of these on land and two in freshwater. Among the marine families, the following common and better-known ones are dealt with below.

**Family** LITTORINIDAE

**Periwinkles**

Shell is small to medium is size, up to 40 mm in height, turbinate to ovate-conical or pyramidal with flattened or pointed spire, thin and light. Aperture rounded to oval with a thickened columella and thin outer lip. Umbilicus is absent. Sculpture consists of spiral cords and axial growth striae.

Head has a pair of tentacles with dark eyes situated at their outer base, a short and broad anterior snout with the mouth at its tip. Food is moderately sized, sub-circular in front and obtuse behind. Mantle cavity has a vascularized roof and contains a small or reduced amonopectinate ctenidium and osphradium. Radula is very long and taenioglossate (2-1-1-1-2). Digestive system consists of esophagus with a pouch and an elongate stomach containing style sac and gastric shield.
Sexes are separate. Male has a penis behind the right tentacle and the female has a well marked groove to receive the sperms. Fertilization is internal, oviparous or ovoviviparous.

Periwinkles are cosmopolitan and are among the commonest snails in the intertidal zone, clinging to rocks or other hard substrate between the mid-tide and high tide lines. Some even occur a little above high tide limit receiving only occasional splashes or the braking waves.

Although littorinids are common the identity of many species was not clearly established till recently. The contribution made by Rosewater (1970, 1972) brought some stability in the nomenclature of littorinid species and provided background for further studies. The most valuable studies on littorinids in years were by Reid (1986, 1989a, 1992, 1998). Reid (1986) examined anatomical features of mangrove littorinids and revised a hitherto less known genus *Littoria*. He recognized twenty species from mangroves in the Indo-Pacific province from there three species were known earlier. *Littorina scabra* species complex has been divided into seventeen species.

Subfamily **LITTORININAE**

**21. Littorina scabra** (Linnaeus, 1758)

Description: - Shell large up to 24 mm in height, conical, fairly thin, light weight, with seven to eight well rounded whorls, suture impressed, aperture large, broadly rounded and columella smooth. Sculpture with flat or elevated spiral cords and axial lines, spire with a carinated keel, body whorl occasionally subcarinate or carinate at the periphery. Colour variable, pale gray or brown maculated with darker brown blotches below suture, columella white, outer lip with a white band on the interior.

**Habitat:** It occurs on the trunks and branches of mangrove trees, a little above high tide limit.

**22. Littorina undulata** (Gray, 1839)
Description: -Shell small to medium in size, up to 21 mm in height, conical and thin, pertrure semi-oval and sculpture with spiral cords. Shell cream coloured with dark or light brown dashes that form axial flame marks; columella violet.

**Habitat:** In rocky Intertidal zone.

23. *Nodilittorina melanostoma* (Gray, 1839)

Description: -Shell up to 9 mm in height, conical and thin, with six to eight flat-sided whorls. Aperture oval, columella weakly concave, glazed, with dark brown calulus, outer lip often narrowly shouldered. Surface covered with lightly incised spiral cords, angulated keel on the body whorl. Color pale yellowish, ornamented with closely spaced brown dashes arranged axially or in zigzag fashion, outer lip and interior of aperture pale yellow, columella dark brown, apex black.

**Habitat:** Intertidal rocks, from mid tide level to high tide mark.

24. *Nodilittorina vidua* (Gould, 1859)

Description: -Shell small, up to 17 mm in height, subglobose, whorls five to six, sculpture with raised, granulose spiral cords and fine, microscopic wavy spiral threads in the interspaces. Color grayish white, ornamented with reddish brown, flame-like axial blotches, columella dark brown.

**Habitat:** Intertidal rocks, from mid tide level to high tide mark.

Family **PLANAXIDAE**

Shell is somewhat similar to that of littorinids, but more solid, thicker and heavier. It is small to medium in size, up to 24 mm in height, conical and elongately ovate. Protoconch is generally glossy and pointed. A fibrous periostracum covers the shell. Aperture is lirate and angled above. Anterior canal is well developed. Posterior canal is also distinct and has a thick spiral ridge running inwards from its inner side. Outer lip is thickened and has 8 to 10 internal spiral grooves. Umbilicus is absent.
Surface is either smooth or with spiral cords or grooves but without avarices. Operculum is chitinous, almost smooth with subterminal, basal nucleus.

Head bears a pair of subulate tentacles with eyes at their outer bases. Foot is simple. Radula is taenioglassate. The snails are parthenogenetic and males were not observed. Instead of pallial gonoduct the female has a ciliated mantle groove. Eggs are incubated in a special groove in the ‘neck’ region. There is a planktonic veliger larva.

Planaxids occur along with littorinids under rocks or in the rock crevices near high water mark in the intertidal zone.

25. **Planaxis sulcatus** (Born, 1780)

Description: -Shell of medium size, up to 24 mm in height, solid, conical, body whorl slightly angular below. Aperture narrowly ovate, outer lip with distinct spiral ridges, columellar callus thick above, but thin and lamina-lime below, minutely striae, anterior canal V-shaped, posterior canal a shallow groove. Surface sculptured with strong spiral cords separated by regular and uniform spiral grooves and oblique axial growth striae. Color purple brown, with light gray spots on cords or oblique reddish brown stripes, outer lip edge and columellar base tinged with brown.

Remark: - It was found abundantly in association with species of *Nerita, Littorina* and *Cerithium* in the intertidal region. It is common on coral stores in the infralittoral fringe.

**Habitat:** Under rocks or in the rock crevices near high water mark in the intertidal zone.

26. **Planaxis nicobaricus** (Frauendeld)

Description: -Shell smaller up to 10.4 mm in height, Aperture lirate, outer lip thickened, the inner edge prominently denticulate with 7 to 9 teeth, often in some old specimens teeth not visible, with distinct anterior and posterior siphonal canals, columella concave with smooth callous, sculpture with obsolete spiral striae on the spire whorls and top of the body whorls.

**Habitat:** Under rocks or in the rock crevices near high water mark in the intertidal zone.
27. **Planaxis sp**

Description: -Shell smaller up to 7 mm in height, Aperture lunate, outer lip thickened the inner edge, with distinct anterior and posterior siphonal canals, columella concave with smooth callous, sculpture with obsolete spiral striae on the spire whorls and top of the body whorls.

**Habitat:** Under rocks or in the rock crevices near high water mark in the intertidal zone.

**Family** CERITHIIDAE

**Horn shells or Cerithid Snails**

Shell is small to moderately large in size, generally not more than 80 mm in height but occasionally growing up to 100 mm, narrowly elongate and turreted with many whorls, normally as many as 9 to 16. Aperture may be small or large in comparison with the shell size and smooth. Anterior canal is long or short, oblique or sharply recurved. Anal canal is a sharply defined incision flanked in many by a posterior columellar plait. Columella is smooth, calloused in many and often with fold. Outer lip is generally thickened and crenulated, nut smooth in many and with lirations on the interior in some. Umbilicus is absent. Sculpture is highly variable, with spiral cords, axial ribs, nodules or varices. There is a high degree of intraspecific variability among the species, especially in those belonging to the genera *Cerithium* and *Clupeomorus*. Color is also variable, white to dark brown. Operculum is horny, thin, brown, and usually multispiral with an eccentric nucleus.

Head bears two, long cylindrical tentacles with eyes at their outer bases. Foot is short and broad. Mantle cavity contains a weak, minipectinate ctenidium, long thin and bipectinate osphradium. Radula is taenioglossate. Digestive system consists of a pair of salivary glands, an esophageal gland, stomach with a gastric shield, a style sac enclosing a large crystalline style.

Sexes are separate. Male has no penis but there are spermatophores to store sperms. Pallial gonoduct is well developed and longitudinally open. Female has a sperm collecting pouch, a receptaculum seminis, albumen and capsule glands. Fertilization is internal and development may be planktotrophic or lecithotrophic.
Unlike potamidid snails, these occur in clear marine intertidal or shallow water on sand rubble substrates as epifauna or partially burrowing around rocks. These are microphagous herbivores and some feed on algal detritus. A few occur in estuarine habitats.

Subfamily CERITHIINAE

28. Clypeomorus batillariaeformis (Habe and Kosuge, 1966)

Description: Shell small up to 17 mm in height, thick, with 10 convex whorls, suture slightly incised and indistinct. Aperture ovate, columella with slight callus, outer lip thick, weakly crenulated, lirate on the interior, anterior canal short, narrow and slightly reflected, anal canal deeply incised groove flanked by columellar plait, sculptured with nodulose spiral cords, four to five on the penultimate whorl, nine to twelve cords on the body whorl, interspaces with fine undulating spiral threads, nodules of unequal size, with one or more varices on whorls. Color light cream, spiral cords with alternating dark brown and white spots, aperture and columella white.

Habitat: It found on hard substrate at the upper midtide level.

29. Ceithium bifaciata (Sowerby, 1855)

Description: Shell of medium size, up to 20 mm in height, slender and elongate, with 10 to 12 whorls. Apertures small, oval, columella with slight callus, outer lip thick, often with lirations on the interior, anterior canal short but deep, anal canal notch-like bordered by parietal columellar plait. Penultimate whorl sculptured with tree equally spaced, spiral, beaded cords, enclosing in between them fine spiral striae, body whorl with six or seven prominent, beaded spiral cords, enclosing in between inconspicuous secondary threads, color variable, white with blotches of brown or black, beads dark, aperture and columella white.

Habitat: It found on hard or loose rocky substrata near the high water mark.
30. *Cerithium* sp

Description: - Shell of medium size, up to 13.5 mm in height, rounded, pointed apex. Aperture ovate, outer lip rounded, expanded, thickened outside and also inner side, Common on the under and on the surface of stones in the infralittoral fringe.

31. *Cerithium trailli* (Sowerby, 1855)

Description: - Shell of medium size, up to 20.5 mm in height, elongate and turreted, with 15 to 17 straight sided whorls, pointed apex. Aperture ovate, outer lip rounded, expanded, thickened outside and interior crenulated; short, tubular and oblique anterior canal and constricted posterior canal, sculptured with regular spiral rows of beaded striae alternating with fine thread-like striae, body whorl with five beaded major spiral cords and a prominent varix opposite the aperture. Color white, beads chestnut or chocolate colored; varices, early whorls and aperture white.

**Habitat:** It found on hard rocky substrata neat the high water mark.

32. *Cerithium* sp

Description: - Shell of medium size, up to 34 mm in height, elongate and turreted, pointed apex. Aperture ovate, outer lip rounded, operculum elongated, whorls are rounded, expanded, thickened outside and also inner side, Common on the under and on the surface of stones in the infralittoral fringe, common on the Raigad district coast.

**Habitat:** It found on hard rocky substrata neat the high water mark.

33. *Cerithium gennesi* (Fischer and Vignal, 1901)

Description: - Shell small, up to 23 mm in height, thick, whorls 11 to 12, elongate and uniform, sutures distinct. Aperture ovate, mall, with short and wide anterior canal, posterior canal a small incision flanked by parietal columellar plait, outer lip not very thick, extends slightly below the anterior canal, sculpture with
nodulose spiral cords, interspaces with smooth fine spiral striae, body whorl with a large dorso-lateral varix, color dull grayish white with darker nodes and white aperture.

**Habitat:** It found on hard rocky substrata neat the high water mark.

### 34. *Rhinoclavis* sp

Description: - Shell moderately large in size, up to 33 mm in height, solid and heavy, whorls 13 to 14, broader than in the other species of the genus, whorls angular, sutures not distinct, aperture squarish, outer lip simple and slightly expanded, columella with callous and a rounded flange near the anterior canal rudimentary. Sculpture with spiral rows of nodules, the row just below the suture larger than others, nodules regular and well spaced, rounded or often spinose, fine axial and spiral threads in between the rows of nodules, body whorl with 10 to 15 nodulose cords and obsolete lateral varix opposite the aperture. Color creamish, with irregular spots or purple brown, spiral cords ornamented with regular purple brown spots, aperture and columella white.

**Habitat:** It found on hard rocky substrata neat the high water mark.

### 35. *Cerithium bifaciata* (Sowerby, 1855)

Description: - Shell of moderate size, up to 21 mm in length and 10 mm in width, 10-12 whorls, pupiform in outline, whorls moderately inflated, body whorl large, lightly over half of the shell length, sculptured with beaded spiral cords, spiral lirae and spiral lines, body whorl with a prominent subsutural spiral cord and large varix on right dorsal surface, an obsolete varix opposite outer lip. Aperture oval and small, columella with narrow parietal callus, siphonal canal short, slightly reflected, posterior canal indistinct and bordered by distinct columellar fold, base of outer lip smooth bearing weak spiral lirae on the interior, base of outer lip extends over anterior canal, color white ornamented with brown blotches and spiral brown dots,
beads dark brown. Aperture and columella purple colored, operculum thin, corneous with eccentric nucleus.

Remark: - It occurs sympatrically in association with *Clypeomorus bifasciata bifaciata*, and *Clypeomours batillarae formis*, but at lower levels than these species in the intertidal zone.

**Habitat:** In rocky intertidal zone.

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36. *Cerithium sp*

Description: -Shell moderately large in size, up to 23 mm in height, solid and heavy, whorls 13 to 14, broader than in the other species of the genus, whorls rounded sutures not distinct, outer lip simple and slightly expanded, columella with callous and a rounded flange near the anterior canal rudimentary. Sculpture with spiral rows of nodules, the row just below the suture larger than others, nodules regular and well spaced, rounded or often spinose, fine axial and spiral threads in between the rows of nodules, body whorl with 10 to 14 nodulose cords and obsolete lateral varix opposite the aperture. Color creamish, with irregular spots or purple brown, spiral cords ornamented with regular purple brown spots.

**Habitat:** It found on hard rocky substrata intertidal zone.

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**Family POTTAMIDIDAE**

**Horn Shells**

Shell is small to large, up to 82 mm in height, long, turreted and usually thick, the number of whorls various from 10 to 16 with a high spire. Aperture is rounded or oval with a rudimentary anterior siphonal canal and in some a posterior siphonal notch, outer lip usually is thickened and grows beyond the columellar base. Surface of shell is generally sculptured with spiral cords and axial ribs that are often broken into nodules. Operculum is horny, thin and pauci-to multi-spiral. Nucleus is generally in the centre.

Head is broad with a prominent snout, which is wrinkled and highly contractile, a pair of tentacles projects from the neck, with eyes situated at their outer
bases. Tentacles may be spotted or banded with red and black. Foot is massive, subcircular anteriorly and obtuse posteriorly. Mantle cavity is very deep and consists of an elongate and prominent osphradium and a well developed monopectinate ctenidium occupying a considerable portion of the mantle cavity. Radula is taenioglossate and the stomach is quite large. Sexes are separate. Male does not possess a copulatory organ. A spermatophore is formed to store the sperms and to transfer them into the female. Pallial gonoducts are open. Eggs are laid in the form of mucus strings as long coils.

Potamidids are detritus feeders and are abundantly common in estuaries, backwaters and mangroves. Some can live out of water for days. The family is divided into two subfamilies, namely Potamidinae and Batillariinae, which differ in their shell and radular teeth characters.

Subfamily POTAMIDINAЕ

37. *Telescopium telescopium* (Linnaeus, 1758)

Description: - Shell very large, up to 82.5 mm in height, shell elevated and strongly conical, heavy and thick, with about 14 to 16 whorls, sutures not distinct. Aperture small and rounded, columella solid, strongly twisted and channeled, outer lip thickened, extended anteriorly as a flare over siphonal canal, sculptured with four unequal, flat spiral ridges on each whorl, last whorl rounded at base with one large and many small cords, color dark brown of black, interior shiny blue-black, columella mauve-brown.

Remark: - The species is equally at ease with submersion and exposure. The population density along West Coast of India is moderate. Eggs are laid in filamentous mass.

**Habitat:** It found near the high water mark estuaries backwaters.

38. *Cerithidea cingulata* (Gmelin, 1791)

Description: - Shell moderately large, up to 50 mm in height, elongated and thick, 13-15 flat-side whorls separated by shallow sutures. Aperture oval, columella
almost straight, outer lip thick and expanded broadly, arterially siphonal canal distinct and short with a varice-like bulge and blunt rib above, sculptured with prominent spiral ridges crossed by equally strong axial ribs forming rows of regular granular nodules. Color dark brown, often with a whitish band above the suture, nodules dirty white, interstices brown, interior of aperture white, lined with brown, sperculum spherical with a central nucleus.

Remark: - The species prefers submersion and periodical exposure. Eggs are laid in capsules that form a mass of filamentous threads. It has a planktotrophic veliger larva in its development.

**Habitat:** It found from mid tide level to high tide level of estuaries backwaters.

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Family **TURRITELLIDAE**

**Screw Shells**

Shell is small to large, up to 96 mm long and attenuates with numerous whorls. Aperture is proportionately small, rounded or angled at the top. Outer lip is thin with a convex outer margin. There is no umbilicus. Sculpture consists of spiral striations or ridges. Operculum is chitinous, circular, thin and multispiral with a central nucleus.

Head is large and bears long tentacles having eyes at their outer bases. Food is short, truncate anteriorly and narrow posteriorly, with a groove on the ventral side. It possesses a pedal gland at the posterior end. Mantle margin is fringed and has a siphinal fold on the right side. Mantle cavity consists of a ctenidium and a string-like osphradium. Radula is taenioglossate, 3-1-1-1-3. Digestive system contains small salivary glands, long and narrow esophagus and a large two-chambered stomach. Sexes are separate. Male is without a penis. Some deposit eggs in stalked capsules, while some brood the young within the oviduct. Veliger larva may be of short duration.

Majority of the species prefer muddy sands of tropical waters, these are detritus feeders and occurs from intertidal to offshore, mostly beyond the low tide line. It is a large family consisting of five subfamilies embracing 18 genera and an
estimated 150 species. In India two genera *Turritella*, belonging to the subfamily Turritellinae are reported. These are mainly distributed along the continental shores.

39. *Turritella bucillum* (Kiener)
Description: - Shell medium heavy, the whorls convex with many fine spiral ridges, the whorls at both end rounded and those in the middle sharply angular, the whorl dark brown.
**Habitat:** Intertidal zone on sandy beach.

49. *Turritella duplicata* (Linnaeus, 1758)
Description: - Shell large, up to 60.3 mm in height, about 18-20 whorls, the earlier whorls convex with many fine spiral ridges, on other whorls two sharp ridges in the middle, after the first six whorls the central ridge becomes elevated into a strong keel, other spiral ridges become obsolete or disappear, after about ten whorls another elevated ridge begins to appear and on the penultimate and body whorl both of these become less conspicuous. The whorls at both end rounded and those in the middle sharply angular, the upper half of each whorl medium dark brown and the lower pale cream brown.
**Habitat:** Intertidal zone on sandy beach.

41. *Turritella attenuata* (Reeve, 1849)
Description: - Shell large up to 96.5 mm in height, elongate and attenuate with 15 to 16 rounded whorls, Aperture sinuate, sculptured with raised spiral striations of equal size on earlier whorls, on later whorls, from 10th or 12th onwards, middle striation becoming stronger and others getting gradually weak and obsolete. Whorl strongly keeled in the middle, with sloping upper part and curved lower part. Colored light brownish or pinkish, upper part of whorls tinged with blue.
**Habitat:** Intertidal zone on sandy beach.

42. *Turritella columnaris* (Kiener, 1840)
Description: - Shell large, up to 18.5 mm in height, elongate, lanceolately turreted, with about 30 whorls, suture excavated and not much inflated, sometimes flattened in the middle, based strongly angulated. Sculptured with two strong spiral striations on the earlier whorls, others absolutely granulated, more or less with about 10 uniform spiral ridges, colored yellowish brown with vertical brown stripes and blotches.

**Habitat:** Intertidal zone on sandy beach.

### 43. Turritella turritella

Description: - Shell is stout, heavy and turbunately turreted i.e., the whorls placed one on another and tapering from a broad base to the apex. The whorls are distinctly keeled in the middle. Whorls about 18 and each whorl appear too conical with abroad base. Umbilicus absent, first few whorls angulated with several sub-equal keels, later whorls angulated with two or three prominent keels, others disappearing or becoming obsolete. The length of the shell is frilly about three to four times the maximum width if the body whorl.

**Habitat:** Intertidal zone on sandy beach.

**Family STROMBIDAE**

**Winged Shells or Conch Shells**

Shell is solid and small to large. It exhibits different shapes but has an enlarged body whorl and a low conical to turretiform spire. Aperture is long and narrow, with anterior and posterior canals. The most distinguishing features of the shell are the development of a large, flaring and thickened outer lip and the presence of a U-shaped notch or indentation on the edge of the lip near the end. It is referred as a ‘stromboid notch and facilitates the protrusion of right eye. Outer lip may be digitate and some time with inner plications. Umbilicus is lacking. Shell surface may be smooth or may have axial and spiral threads, and varices. Operculum is long, sharp, strong, chitinous and claw-like with terminal nucleus. It assists in the leaping and jumping locomotion and serves as a defensive weapon to ward off predators.
Head bears long and muscular eye peduncles, each one of which gives rise to a small short tentacle a little below its distal end. Eyes are well developed and have colorful irises. Foot is narrow, very muscular and is divided into an anterior perpodial sole and an elongate posterior metapodium bearing the operculum. Mantle bears pallial tentacles and is cavity consists of a long narrow osphradium. Proboscis is long and thin. Radula is taenioglossate and short. Digestive system consists of long and thin salivary glands and a crystalline style in the stomach.

Sexes are separate and sexually dimorphic, the shell in males being slightly smaller than in the females and differently sculptured. Male possesses a long, open-grooved penis. Female has as open gonoduct. The animals congregate at the time of spawning. Eggs are laid in long, jelly-like coiled tube. Larva is planktotrophic.

Winged shells are usually shallow water inhabitants common in the intertidal zone or beyond the low water limit associated with algal-rich coral reefs. They may occur as epifauna on the coral boulders or burrow into the sand in the reef area. They are either herbivores or detritus feeders.

44. *Tibia curta* (Sowerby, 1842)

Description: - Shell very large, up to 97 mm in height, uniform and slender, whorls 15 to 16, upper part of each whorl concavely slanting and then rounded. Aperture rather small, columella arched and with callus, posterior canal short and curved, flanked by parietal columellar ridge, anterior canal very long and slender, outer lip with six digitations, posterior most of peculiar shape not projecting and bordering the posterior canal, the one below it grooved at the base bearing a tooth like swelling. First eight whorls with very closely set fine axial ribs, crossed by faint spiral striae giving an indication of beaded appearance, the rest of the whorls smooth, body-whorl with spiral striae at its base, color cream or pale brown, columella fulvous brown, outer lip dark purple brown between the digitations.

**Habitat:** In the intertidal zone or beyond the low water limit.
Family **CYPRAEIDAE**

**Cowries**

These are most popular with man from times immemorial and are known as the jewels of the sea. Unlike other gastropods, cowries have a dome-shaped and almost hemispherical shell, which is small to large, up to 50 mm in length. Juvenile shell is strikingly different from that of an adult. A spiral shell is present in the early stage but on maturity the outer lip turns in, thickens and teeth develop on it and the inner lip (columella). Adult shell is ovate pyriform, domed, globular or hemispherical. Spire is very much reduced and cannot be easily noticed as in other gastropods. Surface is smooth, highly polished with attractive colors. It has an elongate aperture on its base and generally beset with teeth on the inner and upper lip. Posterior and anterior canals are mere extensions of the aperture. Fossula is distinct, with the anterior margin edged by a rib. Operculum is absent.

Mantle is also as colorful as the shell. It is bilobed and when the two lobes extended covers the entire surface of the shell. The meeting point of the two lobes is indicated by a sinuous line on the dorsum of the shell. The margins of the mental are fringed and its surface may be smooth or decorated with tubercles, papillae or branched filaments. When disturbed the mantle is completely retracted inside.

There is a pair of long, filiform cephalic tentacles bearing eyes at their outer bases. Foot is broad and extensible. Mantle cavity contains an arched cteninium with several lamellae, a triradiat osphradium and a large hypobranchial gland. Radula is long and taenioglossate (2-1-1-1-2).

Sexes are separate and often can be distinguished on the basis of shell characters. Male has a penis and the shell is usually smaller than in female. Eggs are laid in capsules embedded in more or less circular gelatinous mass deposited on hard substrate. Some species have the habit of protecting their eggs within the mantle. Development may be direct eggs hatch in about one or two weeks releasing free-swimming veliger larvae.
45. *Cypraea arabica* (Linnaeus, 1758)

Description: - Shell of medium size, up to 48 mm in length, subcylindrical to cylindrical, heavy, broad with flattened base; dorsal sulcus plain, dorsum bluish-white, decorated with a hieroglyphic pattern of axial brown lines interrupted by gaps or reticulations, margins with strong callus, white cream or pale brown; base creamish, no dark blotch on the columella, teeth large, outwardly extended on to the base, pale or dark brown.

**Habitat:** In the rocky intertidal zone.

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Family **NATICIDAE**

**Moon Shells**

Shell usually is small to moderately large in size, occasionally up to 80 mm in length. It is ovate-conic to globose, with a depressed or moderately elevated spire. Body whorl is large and often inflated. Surface is smooth or polished, may have obsolete axial or spiral sculpture. Shell is variously colored and some of the species can be identified on the basis of their coloration. It has large, ovate to semilunate aperture, with usually oblique outer lip. Columell usually has a callus deposit. The most distinguishing feature of the shell is the presence of a funicle in the umbilicus, which may be open or closed. Funicle is a rib-like structure that grows from the little bulge of the callus on the siphonal canal, operculum in paucispiral with an excentric nucleus, corneous or calcareous.

Head bears a pair of small tentacles situated wide apart, with a little developed of reduced eyes. Foot is highly developed and it can be extended and spread to an enormous size by its water tube system. When expanded the anterior propodium of the foot folds back and covers much of the head. In the genus *Sinum* the foot can be six to seven times larger than the shell posterior part of the foot envelops much of the shell when the animal is active. During this time a slit on the right side permits the circulation of water into the mantle cavity. Foot is used as a spade to dig, as a plough to move through the substratum in search of the prey and to hold and chock its prey.
A boring gland situated on the ventral side of the mouth assists in making holes in the bivalves. Mantle cavity consists of a large ctenidium and a narrow osphradium. Buccal mass is protrusible and possesses cornaceous jaw plates.

Alimentary system consists of a taenioglossate radula (2-1-1-1-2), a well developed foliated gland in the esophagus and a caecum in the stomach. Sexes are separate and in many can be differentiated externally by their shells. Male has a penis on the right side. In the females there is a long, coiled oviduct, a large albumen gland and mucous gland. Eggs are laid in a jelly-like mass mixed with sand rolled in the form of a ribbon and because of the shape the egg masses are called sand dollars. Eggs hatch in about two to three weeks releasing free-swimming veliger larvae.

Moon shells are burrowing forms, moving active on sandy or muddy shores along the coast. They plough through the substrate with their massive foot in search of their prey that includes many soft bottom families of bivalves, especially venerids, tellinids and lucinids, and gastropods. The prey is enmeshed in the mucous strands and held firmly by its foot, the special boring gland then softens the shell, the radula grinds through the shell and makes a hole, and finally the proboscis is inserted and the liquidised meat is sucked in. The feeding in naticids involves both mechanical and chemical acts. A number of bivalves washed ashore on a sandy beach can be found with the holes made by naticids.

Subfamily POLINICINAE

46. Polinices didyma (Roeding, 1798)

Description: - Shell moderately large, up to 13.5 mm in length, thick, body whorl large and inflated, broader than high with a depressed spire, surface smooth and glossy. Aperture large and semiovate, columella with a large transversely expanded curved callosity divided into two by a transverse groove, posterior portion large and fuses with the body whorl covering the umbilicus, anterior part smaller and free, funicle overlapped by the callosity, umbilicus a wide excavated angular opening, surface uniformly pale brownish or grayish, callosity and interior of aperture deep chestnut.
**Habitat:** In the intertidal zone in sandy beach.

**Subfamily NATICINAE**

47. *Natica vitellus* (Linnaeus, 1758)

Description: - Shell of medium size up to 9 mm in length globose thick with rounded whorls and a short spire. Aperture lunar ovate, columella with polished callus posteriorly fusing with the body whorl and covering partly the umbilical depression leaving it anteriorly open, callosity without a spiral groove, funicle inconspicuous an fuses with the umbilicus wall. Color white with two broad, brown spiral bands on the body whorl, apex reddish brown, operculum with four grooves parallel to the margin.

**Habitat:** In the intertidal zone in sand and mud some time occurs in estuaries.

**Family RANELLIDAE**

Triton Shells

Shell size ranges from 29.5 mm in height, thick, fusiform or ovate -ventricose. Protoconch is large and smooth with five to six whorls. Tritons are distinguished by their thick, hairy or fibrous periostracum. Body whorl is large with a rounded aperture. Outer lip is thickened with undulate outer margin and denticulate inner margin, columella has parietal callus that obscures the umbilicus. Anterior siphonal canal is short to long, wide or narrow and often recurved; anal canal is obsolete or absent. Sculpture is characterized by strong, raised spiral ribs, heavy knobs and varices. Operculum is of various shapes, thick and corneous with acentric nucleus.

Head bears two filiform tentacles, which have eyes on their outer bases. Foot is short and truncated posteriorly. Mantle cavity consists or a monoprectinate ctenidium and a bipectinate osphradium. Mantle edge bears a papilla, an anterior incumbent siphon and a posterior excurrent siphon. Proboscis is stout and extrusive. Digestive system consists of a hypobranchial gland, taenioglassate radula (2-1-1-1-2), a pair of acid secreting salivary glands, and a style sac.
Sexes are separate. Male possesses a large, flattened penis and as open pallial gonoduct, female have a closed pallial oviduct, albumen and capsule gland. Eggs are laid in large capsules. There is free-swimming veliger stage. Tritons occur on sandy or rocky habitats from shallow intertidal zone to deep sea of tropical regions. These are carnivore feeding on other snails, clams, starfishes and sea urchins.

Subfamily **RANELLINAE**

48. *Gyrineum natator* (Roeding, 1798)

Description: - Shell of medium size, up to 29.5mm in length, dorso-ventrally compressed, thick and coarse looking, spire elevated and conical. Aperture round and small, outer lip with strong varix and seven, widely spaced ridge-like teeth, columella with spiral cords, ten on the body whorl, four on spire whorls, axial ribs an fine threads with rounded nodules on the intersections, a pair of carices one on each side of the body whorl forming continuous crest-like ridge from apex to the basal part of the shell, color grayish brown with dark brown bands and nodules, varices brown and white, aperture interior white, a white band around the body whorl.

**Habitat:** On sandy or rocky habitats from shallow intertidal zone to deep sea.

Subfamily **CYMATIINAE**

49. *Cymatium nicobaricum* (Roeding, 1798)

Description: - Shell moderately large, up to 50 mm length, spire high and elevated body whorl expanded. Aperture oval and small, outer lip with strong varix and seven pairs of elongate teeth on the interior, columella lirate, siphonal canal more elongate than in *C.pileare*, sculptured with nodulose spiral ribs and fine threads in the interspaces, with strong varix three to five large knobs between the varices on the shoulder. Ash colored with red markings and indistinct cream bands, aperture orange yellow, outer lip and teeth white, varix dark gray and white.

**Habitat:** On sandy or rocky habitats from shallow intertidal zone to deep sea.
Family **Bursidae**

**Frog Shells**

The common name ‘Frog shell’ is due to its resemblance to a warty toad or a tree frog. Shell is small to very large in size, ranging from 12 mm to 76 mm in height. It is ovate, ventriciate to flatly compress and generally does not have a periostracum. It has an irregularly ovate aperture. Frog shells can be easily differentiated from other related families by the presence of a distinct posterior anal canal, which acts as an outlet for the discharge of wastewater. Anterior siphonal canal at the base of the aperture is generally small, but often may be elongate a twisted. Outer margin of outer lip is thickened and its inner margin denticulate. Columella is generally with a parietal shield that obscures the umbilicus, and beats plications on its margin. Sculpture consists of strong spiral and axial cords or threads and varices bearing knobs, which sometimes develop into spines. Operculum is thin or thick. It may be orange yellow or brown with a marginal or terminal eccentric nucleus.

Head bears two filiform tentacles, which have small eyes on their outer bases. Foot is short but strong. Mantle has papiooae on its edge and possesses two short siphons, one for drawing in water (incurrent) and the other to act as an outlet for the waste (excurrent), which corresponds to anterior siphonal and anal canals respectively seen on the shell. Mantle cavity has a monopectinate ctenidium and a bipectinate osphradium. The snails are carnivores and to help in the capture of prey they possess a very long, slender and pleurembolic proboscis. Digestive system consists of a taenioglassate radula (2-1-1-1-2), bulky and somewhat leaf-like salivary glands and a style sac. Anus opens half way in the mantle cavity.

Sexes are separate. Male possesses a flattened penis and an open pallial gonoduct. Female has closed pallial gonoduct, albumen glands and capsule glands and capsule glands. The eggs are laid in a gelatinous mass. Veliger larva has a long planktonic life.
50. *Bursa echinata* (Link, 1807)

Description: - Shell large, up to 76 mm in length, spire high, body whorl elongate, higher than broad, whorls slightly angulated. Aperture narrowly ovate, outer lip edge frilled, with strong irregular transverse teeth, columella with obsolete lirations, siphonal canal small and shallow. Sculptured with spiral cords and strong, elongated, outwardly directed spines, four spines on the outer lip edge, two very long and two small, arranged alternately, color uniformly pale brown.

**Habitat:** On sandy or rocky habitats from shallow intertidal zone.

Order **NEOGASTROPODA**

Shell is solid and usually large. It is variously sculpture and has a prominent anterior siphonal canal. An operculum is present in many. Proboscis mainly is pleurembolic. Radula has a central and pair of lateral or marginal teeth. Mantle cavity contains a single monopectinate gill, one auricle and one kidney. Sexes are separate with a complex reproductive system. All occur in marine habitats with the exception of a few estuarine inhabitants. These are mainly carnivores or scavengers.

Family **MURICIDAE**

Shell is very small to large in size, measuring 5 mm to 300 mm in height. It is variable in shape, elongate or fusiform to club-shape or biconic. Spire is distinct and usually of medium height. Protoconch consists of a few whorls. Aperture is rounded to ovate. Columella is without folds but often may bear plicae. Outer lip may be dentate and sometimes may bear long processes. Anterior siphonal canal is short to long, narrowly open or entirely closed. Posterior canal is not distinct. Surface is scabrous or lamellose, or may bear simple, foliated or spiny varices. Axial sculpture may consist of one or a few ridges or knobs. Aperture is closed by a thin or thick operculum. It is unguiculate, ovate or rounded.

Cephalic tentacles are pointed bear eyes at their outer bases. Foot is moderately long and bears a special accessory-boring organ located on the midanterior ventral surface. There is a short to long siphon. Mantle cavity contains a
monopectinate ctenidium, a well-developed bipectinate, chemosensory osphradium and a hypobranchial gland that produces purple secretion. Proboscis is moderately long and extensible. Alimentary system has a pair of salivary glands, with a pair of smaller accessory salivary glands lying dorsal to the pharyngeal bulb. Oesophagus has a posterior valve or Leiblein. A true anal gland is present in the form of a canal outgrowth from the rectum. Radula is long and stenoglossate (1-1-1).

Sexes are separate. Penis is situated just behind the right tentacles. It is wide, blunt and dorso-ventrally flattened, with a flagellum at the tip. Development usually is direct and a few species have pelagic larva. Eggs are laid in capsules that form a cluster and are attached to shells or seaweeds. A cluster may consist of 25 to 80 capsules and each capsule may contain about 19 to 700 eggs. Some of the eggs develop into embryos while some serve as nurse 3 eggs.

Muricids have worldwide distribution and are abundant in intertidal zone of rocky coast and reef ecosystem. Majority of the species occur in littoral and sublittoral zones while a few extend to a depth of about 1900 m. Muricids are carnivores mainly feeding up on barnacles, other molluscs, polychaetes, crustaceans, small fish etc.

Subfamily THAIDINAE

Shell is solid and heavy, spire moderately low, sculpture either with tubercles or knobs, aperture large, columella pustulose, outer lip either dentate or lirate, canal short.
This is another large subfamily after Muricicae and often treated as a family by some. The subfamily is represented by seven genera and 29 species in the Indian seas. These are common on the intertidal rocky coasts.

51. *Thais blanfordi* (Melvill, 1893)

Description: - Shell is small, up to 20 mm in length, ovately fusiform, spire high and acute, consists or four angular whorls, body whorl large with a distinct angulation at the shoulder. Aperture ovate, anal sulcus bordered by a ridge, outer lip with eight lirations arranged in pairs on the interior, inner lip smooth, slightly twisted
on the anterior end. Sculpture with six and four major spiral threads above and below the shoulder respectively, axial sculpture consists of eleven to twelve low, sometimes inconspicuous tubercles. Color generally light brown.

Remark: - Shell bears some resemblance to that or *Thais tissoti* but differs in the absence of deep bisulcate transverse grooves and arrangement of denticles on the outer lip.

**Habitat:** In intertidal zone of rocky shore.

**52. Thais lacera** (Born, 1778)

Description: - Shell moderately large, up to 23.5 mm in length, ovate, spire acute, consists of four angulated whorls, body whorl strongly shouldered. Aperture large, ovate, outer lip finely crenulated, interior lirate, columella smooth, callose with partly closed umbilicus. Sculptured with flat and smooth, callouse, mainly scabrous transverse striations, two rows of tubercles on the upper part of the body whorl, sometimes developed into spines, color ashy brown, aperture light brown.

Remark: - This species is highly variable in size, sculpture and shape of the aperture. The snails live attached to jetties, rocks, boulders etc., in the river mouths and backwaters.

**Habitat:** In intertidal zone of rocky shore.

**53. Thais bufo** (Lamarck, 1822)

Description: - Shell moderately large, up to 45 mm in length, solid heavy and globlse, spire acute, not much elevated, consists of three to four rounded whorls, body whorl large and slightly angulated. Aperture large, ovate, outer lip crenulated and with lirations on the interior, columella smooth and with callous extending up to and even beyond the shoulder region, anal sulcus deep, siphonal canal short and broadly open, sculpture with three to four rows of tubercles that become gradually obsolete towards the anterior end and with spiral cords, aperture creamy white, outer lip margin chocolate brown, columella creamy yellow.

**Habitat:** In intertidal zone of rocky shore.
54. **Thais tissoti** (Petit, 1852)

Description: - Shell small, up to 27 mm in length, spire elevated, body whorl large and oblong. Aperture narrowly ovate, outer lip margin and interior crenulated, columella smooth with placations on the anterior end, a ridge on the posterior end, umbilicus small and almost closed, sculptured with four thick spiral ridges separated by bisulcate grooves, with dark brown tubercles.

Remark: - It occurs along with Thais blanfordi on the rocks in the intertidal zone and bears some similarity to its shell. However, it can be distinguished from that species in possessing four strong spiral ridges and deep bisulcate grooves.

55. **Cornia contract** (Reeve, 1846)

Description: - Shell of medium size, up to 14.5 mm in length, fusiform, spire elevated and acuted, with six subangulated whorls, body whorl large. Aperture large, elongately ovate, outer lip finely calculated, with five to six denticles on the interior, inner lip smooth, with three to four plications on the anterior part, canal short, broadly open, sculptured with eight to ten prominent axial ribs with one to two low rounded avarices, and numerous fines, scabrous spiral threads. Color chestnut brown to dark brown, aperture white to pinkish white.

**Habitat:** In intertidal zone of rocky shore.

56. **Cornia konkanensis** (Melvill, 1893)

Description: - Shell small, up to 14.5 mm in length, pyramidally fusoid, spire high and acute, with five to six rounded whorls, large. Aperture elongately ovate, lip thick with crenulated margin and five teeth leading to raised lines on the interior, inner lip smooth with two to three plicae above short canal, sculpture with axial ridges bearing six to tubercles, color chocolate brown, tubercle and spiral scabrous cords in between the rows of tubercles. Color chocolate brown, tubercle and spiral cords white, aperture light violet with chocolate coloured margin.

**Habitat:** In intertidal zone of rocky shore.
57. *Morula nodicostata* (Pease, 1868)

Description: - Shell small, up to 13 mm in length, broadly ovate, spire high and consists of five subangulate whorls, suture obscure. Aperture narrowly ovate, outer lip margin thick, four to five denticles on the interior, inner lip smooth, with three light plicae on the anterior end, canal short, sculptured with four to five rows of rounded nodules that decrease in size from anterior to the posterior, three to four scabrous spiral cords between the nodular rows. Color light chocolate brown, nodules white, purplish brown spiral bands, aperture light violet with a broad white band on the interior, columella with a dark brown blotch on the posterior end.

**Habitat:** In intertidal zone of rocky shore.

58. *Morula granulate* (Duclos, 1832)

Description: - Shell small, up to 20.5 mm in length, broadly spindle shaped, spire acute and elevate with four to five tuberculated whorls, body whorl large and angulated. Aperture narrowly ovate, outer lip thick, margin crenulated, interrior with four teeth, inner lip smooth with two to three pustules above short and open canal. Sculpture with prominent spiral rows of tubercles two on spire whorls and four on the body whorl with fine scabrous threads in between, tubercles more prominent near the shoulder. Color dark gray to black, base of tubercles white, aperture violet, outer lip teeth bluish white, columella with a dark brown patch on its posterior end.

**Habitat:** In intertidal zone of rocky shore.

59. *Morula marginata* (Blainville, 1832)

Description: - Shell small up to 25 mm in length, pyramidally fusoid, spire acute and consists of four angulated whorls, suture distinct. Aperture narrowly ovate, outer lip margin thick and crenulated, interior with four prominent teeth leading to raised lines, inner lip smooth, but plicated in the middle, canal short and broad. Sculptured with longitudinal ribs broken to squarrose tubercles by the revolving scabrous cords, deep pits in the interstices, body whorl possesses four to five rows and each spire whorl with two rows or spiral cords. Color grayish white with white
horizontal lines on the centre of the body whorl, aperture light violet marked with dark chocolate brown lines inside, teeth white, outer lip margin chocolate brown.

Remark: - Shell bears some resemblance to those of *M. granulata* and young ones of *Thais hippocastanum*. It differs from the former in having deep pits in the interstices and a broader aperture and from the latter in the presence of deep pits and absence of spinose tubercles.

**Habitat:** In intertidal zone of rocky shore.

60. *Mancinella bufo* (Lamarck)

Description: - Shell moderately large, up to 35 mm in length, solid heavy and globose, spire acute, not much elevated, consists of three to four rounded whorls, body whorl large and slightly angulated. Aperture large, ovate, outer lip crenulated and with lirations on the interior, columella smooth and sulcus deep, siphonal canal short and broadly open, sculpture with three to four rows of tubercles that become gradually obsolete towards the anterior end and with spiral cords, aperture creamy white, outer lip margin chocolate brown, columella creamy yellow.

**Habitat:** In intertidal zone of rocky shore.

61. *Thais hippocastanum* (Linnaeus, 1758)

Description: - Shell moderately large, up to 63 mm in length, spire high and consists of four angulated whorls. Aperture ovately narrow, outer lip crenulated with four to five prominent teeth on the interior leading to ridges, columell smooth, slightly folded anteriorly. Sculpture with four spiral rows of spines on the body whorl and four to seven spiral threads in between the rows of spines. Colour chocllate brown with vertical bands and dark brown spines, aperture bluish white and margin tinged with brown, denticles and ridges chocolate brown.

**Habitat:** In intertidal zone of rocky shore.
62. *Thais echinata* (Blainville, 1832)

Description: - Shell of medium size, up to 34 mm in length, ovate, spire a little high, consists of three to four tuberculated whorls, periphery ovate, outer lip crenulated, with seven to eight teeth leading to ridges, inner lip bordered by a ridge, sculptured with five rows of prominent blunt spines, scabrous spiral ridges. Colour light brown, aperture white with yellowish margin.

**Habitat:** In intertidal zone of rocky shore.

Subfamily *MURICINAE*

Shell is small to very large in size, fusiform or globose, ornamented with simple foliated or spinose varices, axial sculpture with one to a few ridges or knobs, the inner side or outer lip dentate or lirate or rarely smooth, siphonal canal may be ling, narrow and tubular or road and short or partly sealed in some. Operculum is unguiculate, marginally thick with a central depression and a terminal or subterminal nucleus.

63. *Murex carbonnieri* (Jousseaume, 1881)

Description: - Shell large, up to 100 mm in length, club shaped, spire elevated, acut, consists of 7 to 9 whorls, suture deep, simple, crossed by growth lamellae, aperture ovate, outer lip margin crenulated, small labial tooth on the lower part, inner lip partly adherent posteriorly but detached anteriorly, siphonal canal tubular, straight, narrowly open. Body whorl large, with three prominent varices bearing long spines, shoulder spine longest and open, sculpture consists of several primary and secondary spiral cords, color creamy white to light brown. Spiral cords with lighter nodes enclosing elongated brown spots in between aperture with brown spots on notches.

**Habitat:** In intertidal zone of rocky shore.

64. *Drupella concatenate* (Lamarck, 1822)

Description: - Shell small, up to 37 mm in length, ovately elongate, spire acute and high, with five rounded whorls, body whorl large, suture impressed. Aperture narrowly ovate, outer lip thick with crenulated margin bearing six teeth on the
interior, inner lip smooth with three plicae on the anterior end, canal short and open. Sculpture with four to five rows of rounded tubercles and two to three scabrous spiral ridges in between. Color white, tubercles orange colored, aperture white with cream or orange interior.

**Habitat:** In intertidal zone of rocky shore.

**Family** **BUCCINIDAE**

**Whelks**

Shell is small to large in size, strong and thick, globose or ovate conical to fusiform. Protoconch consists of many whorls, with a fairly large body whorl and a somewhat tapering spire. Aperture is large and narrow to wide. Outer lip may be thickened and generally smooth often bearing placations on the inner margin. Columella is usually smooth and sometimes thickened bearing a reflected callosity. A fasciole may be present at the base. Anterior canal is well developed, short to long and narrow to wide. Posterior canal is not distinct. Surface of the shell is smooth or sculpture with axial ribs and spiral cords or threads without strong varices. Operculum is ovate, thin, corneous brown with either apical or subcentral nucleus.

There are two cephalic tentacles bearing eyes at their outer bases. Foot is large, broad and anteriorly truncate. Siphon is well developed. Mantle cavity contains a monopectinate ctenidium, a bipectinate osphradium and often mucus secreting hypobranchial gland. Proboscis is strong, long and pleuremblic. Alimentary system consists of a stenoglossate radula (1-1-1 or 1-0-1) with milticuspid laterals, a pair of salivary glands with long ducts, well-developed oesophagus, stomach with caecum, and Leiblein and anal glands. Sexes are separate. Male bears a broad, blunt and dorso-ventrally flattened penis. Female has a seminal receptacle. Eggs are laid in capsules and some eggs act as nurse cells. Development may be direct or indirect.
Subfamily **BUCCININAE**

**65. Bobylonia spirata** (Linnaeus, 1758)

Description: - Shell large, up to 41 mm in height, solid and heavy, ovate, body whorl inflated, spire high and elongate, suture deep and channeled. Aperture large, ovate, outer lip sharp and smooth, strongly fleshed at top, columella smooth with heavy callus and a single thick ridge extending spirally inwards on the posterior side, umbilicys broad and deep, often obscured by the callus, a wide fascioe, anterior canal in the form of an oblique notch, posterior canal well developed, bordered by parietal callus, surface smooth, white with prominent light brown blotches, oblique streaks and spots; aperture, outer lip and columellar callus white, fasciole orange brown, nuclear and post nuclear whorls purple.

**Habitat:** In intertidal zone of rocky and sandy shore.

**66. Engina zea** (Melvill)

Description: - Shell of medium size, up to 40 mm in length, tiny, elegant shell from shell sand. Trans- spiral ribs on body whorl well developed. Crossing of spiral, trans-spiral ribs forms strong nodules on the surface, straw yellow with tiny brown nodules and prominent white spiral band on body whorl.

**Habitat:** In intertidal zone of rocky shore.

**Family COLUMBELLIDAE**

**Dove Shells**

Shell is small to medium, solid and fusiform, whorls are many with a small to large body whorl and high acute spire. Aperture usually is long and narrow. Siphonal canal is very short. Outer lip is thin or thickened and often with denticulations on the interior margin. Columellar margin is smooth or weakly denticulate. Surface usually is smooth but sometimes with axial and spiral cords. Operculum, when present, is small, horny and oblong. Nucleus is either terminal or on the external border.

Cephalic tentacles are long and slender bearing eyes at their outer bases. Foot is large and narrow. Siphon is long and fleshy. Mantle cavity contains a
hypobranchial gland. Proboscis is pleurembolic with a distal buccal cavity. Radula is rachiglossate (1-1-1 or 1-0-1). There is a posterior pyriform valve or Leiblein in the anterior oesophagus. A small gland of Leiblein is present. Sexes are separate. Male has a large, tapering and tubular penis enclosed in a pouch. Eggs are laid in hemispherical capsules on hard substrata. Development is indirect.

Dove shells occur in warm temperate and tropical seas from the intertidal zone to 200 m. The family is divided into two subfamilies namely Columbellinae and Pyreninae.

Subfamily **COLUMBELLIAE**

Shell small, up to 15 mm in height, ovate and acuminate, body whorl more than half the length of the shell. Aperture broad, flexuous, outer lip thickened with denticles on the interior, columella with denticles on the interior, canal short and acuminate. Sculptured with fine axial ribs, interstices finely striated, color dark brown.

**67. Anachis terpsichore** (Sowerby)

Family **NASSARIIDAE**

**Mud Snails, Dog Whelks**

Shell is small to medium in size ranging up to 40 mm in length. It is broad and ovately rounded to slender and narrowly elongate with numerous whorls and an elevated spire. Aperture is contracted, and rounded to narrow. Anterior canal is very short and usually fissured. Posterior canal usually is in the form of a notch. Outer lip is thick and either smooth or lirate on the interior. Columella is twisted and develops callus which in some grows into a broad shield often covering the entire ventral surface. Size of the columellar shield is variable and it depends on the developmental stage of the individual, columella is either smooth or with denticles. Umbilicus is covered. Surface of the shell is sculptured with spiral and axial striae or ribs, often being obsolete on the last two whorls. Sometimes nodules may develop or there may be many rows of tiny granules or tubercles. Operculum is variable, small and of different shapes, irregularly ovate, subtrigonal or claw-like and rarely serrate.
Tentacles are moderately large bearing eyes at their outer bases. Foot is long and broad, rather narrow and pointed, sometimes bifurcated posteriorly. Siphon is long and conspicuous. Mantle cavity consists of a monopectedinate ctenidium, bipectinate osphradium and hypobranchial gland. Proboscis is long and pleurembolic with a terminal buccal cavity. Radula is stenoglossate (1-1-1). Alimentary system consists of a small gland of Leiblein in the oesophagus and a crystalline style in the stomach.

Sexes are separate. Male has a tubular penis and a prostate gland. In the female there is an accessory oviductal opening in the mantle cavity, a bursa copulatrix, capsule gland, seminal receptacle, ingesting gland and gonopericardial duct. Eggs are laid in capsules. Veliger has a long duration of life.

The family has representatives in brackish water and from shallow intertidal region to depths of the sea. The snails prefer soft substrata like mud or sand. A few are herbivores but majority are carnivores or scavengers feeding on carrion. Mud snails can be seen clustering around a dead animal.

Subfamily DORSANIINAE

68. Nassarius stulatus (Gmelin, 1791)

Description: - Shell is small, up to 10 mm ovately conical with inflated body whorl, pointed spire, whorls overlapping at the suture. Aperture ovate with a small apical notch, outer lip thickened, backed by a varix, extending above up to half of the penultimate whorl, with six to seven denticles on the interior, columella calloused with five to six dentivles and laminations anteriorly, sculptured with axial ribs, almost obsolete on the dorsal side of body whorl and in the form of nodules below suture, spiral grooves prominent at the base or the body whorl. Color yellowish-white with three broad chestnut spiral bands also seen through the aperture.

Habitat: Found mainly mid tide to high tide level on soft substrata like mud or sand.
69. *Nassarius sp*

Description: - Shell small, up to 12.5 mm in height, elongately ovate. White or cream color, body and spire whorls with orange-brown bands, teleoconch of 3-4 whorls, whorls, protoconch of 2-3 finely carinate, glossy embryonic whorls, sculpture with thin axial ribs continuous at the back of outer lip, aperture narrow; columellar callus partly spreading on to the body whorl; outer lip denticulate within; siphonal and anal canal distinct.

Remark: - The species is the inhabitat of mud, grey and clean coral sand.

**Habitat:** Found mainly mid tide level to high tide level on soft substrata like mud or sand.

70. *Nassarius pullus* (Linnaeus, 1758)

Description: - Shell small, up to 20 mm in height, solid, body whorl longer than the spire. Aperture small, outer lip strongly thickened and lirated on the interior, columellar callus large covering totally the ventral part of the body whorl, with three or four denticles, a strong fold at the base, a thick parietal ridge bordering the short deep posterior canal, anterior canal short, deep and forked, sculpture with a humped callosity on the dorsum, early whorls ribbed, slender axial ribs throughout except on the left of the dorsal bump, two to four granulose spiral cords on the base of the body whorl, incised line below the suture. Colour olive or brown with a narrow white line on the body whorl in some, columellar callus creamy white.

**Habitat:** Found mainly mid tide level to high tide level on soft substrata like mud or sand.

71. *Nassarius dorsatus* (Roeding, 1798)

Description: - Shell large, up to 24.5 mm in height, solid and elongate. Aperture large, outer lip thickened supported by a prominent varix, with weak lirations on the interior and three to eight weak denticles on the margin, columella calloused and finely denticulate, sculpture with axial ribs and suture nodules on the apical whorls, body whorl smooth with 8 to 10 oblique cords at the base, color variable, steel gray with obsolete brown bands, occasionally tan or dark brown, interior of aperture purple brown.
**Habitat:** Found mainly mid tide level to high tide level on soft substrata like mud or sand.

72. *Nassarius olivaceus* (Bruguiere, 1798)

Description: - Shell of medium size, up to 29.5 in height, thick, body whorl longer than the spire. Aperture small, outer lip thickened and slanting, with varix behind and denticles on the inner edge, columella concave and calloused, with denticles, anterior canal well-developed and shallow, anal canal short and bordered by a parietal ridge, sculptured with oblique axial ribs on the early whorls, later smooth, body whorl smooth with spiral grooves at the base, conspicuous on the ventral side and towards the varix of the outer lip. Color tan to dark brown, often with yellow band at the shoulder of the body whorl, interior of aperture purple-brown.

**Habitat:** Found mainly mid tide level to high tide level on soft substrata like mud or sand.

73. *Nassarius jacksonianus* (Quay & Gaimard, 1833)

Description: - Shell small, up to 15 mm in length, ovately conical, spire acute and longer than the aperture. Outer lip with a varix externally and with four to six elongated denticles on the interior, columellar callus strongly laminated on the body whorl, with four to six denticles anterorly. Sculptured with widely spaced axial ribs, 12 to 13 on the penultimate whorl, six to eight on the body whorl, on the latter 12 to 15 overriding spiral cords, obsolete on the dorsum, remains of nodules just below the suture, color cream with brown spiral bands, outer lip white, aperture white with a purplish band in side.

**Habitat:** Found mainly mid tide level to high tide level on soft substrata like mud or sand.

74. *Nassarius sp*

Description: - Shell small, up to 15 mm in length, elongated, spire acute and longer than the aperture. Outer lip with a varix externally, columellar callus strongly laminated on the body whorl, Sculptured with widely spaced axial ribs, obsolete on the dorsum, remains of nodules just below the suture, color cream with whitish-brown spiral bands, outer lip white, aperture white with a purplish band on the upper side.
**Habitat:** Found mainly mid tide level to high tide level on soft substrata like mud or sand.

75. *Nassarius vittatus* (Linnaeus, 1767)

Description: - Shell moderately large, up to 13 mm in length, elongately turreted, protoconch of three smooth whorls, aperture wide, outer lip thin, columella smooth, anterior siphonal notch very wide, sculptured with spiral grooves separated by wide interspaces, three rows of beaded spiral cords just below the sutures, olor livid brown.

Remark: - It mainly a species of continental shores where it prefers surf beaten intertidal zone. It has a massive foot with the help of which it quickly burrows into the sand.

76. *Nassarius Nodifera* (Powys, 1835)

Description: - Shell small, up to 28.5 mm in height, with convex whorls, body whorl inflated. Aperture broadly oval, outer lip with 10 to 11 denticles, thickened axial ribs on the back, columella calloused forming shield on the body whorl, columellar margin with irregular denticles, anterior and posterior canals broad, the latter bordered by parietal ridge, with a fasciole. Sculptured with widely spaced coarse axial ribs, 13 to 18 on the spire whorls, 22 on the body whorl, ribs constricted a little below suture forming nodules, strong spiral cords at the base of the body whorl. Color brown, ornamented with pale and narrow spiral bands, columella, outer lip white, aperture purple-brown with band.

**Habitat:** Found mainly mid tide level to high tide level on soft substrata like mud or sand.

77. *Nassarius spendidulus* (Dunker, 1832)

Description: - Shell small, up to 5-12 mm, elongately ovate. Cream or fawn in color, faintly or prominently banded, few species with some brown suture spots, teleoconch of 4-6 convex whorls, whorls, protoconch of 2½-3 glossy embryonic whorls. Sculpture with either fine or coarse nodules arranged in axial ribs and presence of bisecting spiral grooves, aperture moderately broad; columellar callus
narrow or spreading up to the body whorl; outer lip denticulate – lirate, perculum brown and serrate at margin, occasionally with 1-2 denticles on margins.

Remark:- The species is the inhabitant of coralline and weedy sand and found from the intertidal zone.

78. Nassarius exilis (Powys)

Description: - Shell up to 11.5 mm, ovate and solid. Light brown to dark brown color two yellowish-white subsutural bands present on the body whorl and on the penultimate whorl respectively. Teleoconch of 4-5 convex whorls, protoconch of 2-3 embryonic whorls of which last whorl is carinate; spire acuminate, sculpture with strong axial ribs which become wide on the body whorl and numbered from 12-15 on body whorls, aperture moderate and variced; outer lip moderately thick and interior with 2-3 denticles.

Habitat: Found mainly mid tide level to heigh tide level on soft substrata like mud or sand.

79. Bullia melanoides (Deshayes, 1832)

Description: - Shell up to 24.5 mm in length, solid, narrowly elongate with slender spire, whors slightly inflated, sutures well defined, protoconch of abort three smooth whors, aperture small with a widely open notch of the anterior canal, outer lip thin. Surface distinctly latticed due to the intersection of axial ribs and fine spiral grooves, a single groove immediately below the sutures and below it two close-set grooves, color dark purplish gray with a whitish or pale brown glossy apex.

Habitat: Found mainly mid tide level to heigh tide level on soft substrata like mud or sand.

Family MELONGENAE

Crown Conches, Whelks

Family is medium to large and thick having a pyriform to fusiform shape. Whors are a few with a more or less flattened or elevated spire bearing a sizable protoconch. Shell is covered by brown or opaque perosstracum. Aperture is large and wide with a thickened and smooth outer lip. Columella is also smooth and without any plaits. Sculpture is not very conspicuous. There may be a few spiral cords at the
base and strong knobs or tubercles at the shoulder. Operculum is thick, horny and unguiculate with a terminal nucleus.

Head bears a pair of tentacles. Foot is large and powerful. Mantle cavity contains a large monoplectinate ctenidium, bipectinate osphradium and large hypobranchial gland. Proboscis is long, narrow tipped and pleurembolic with a distal buccal cavity. Radula is stenoglossate (1-1-1) or rarely may it be absent. Alimentary system consists of a pair of large salivary glands without accessory glands and a gland Leiblein in some. Melongenids do not have accessory boring organ and accessory salivary glands unlike muricids. Some malacologists are in favors of including melongenids in the family Buccinidae due to similarity in their radular and anatomical characteristics.

Sexes are separate. Male has a large penis on the right side and the female has a large capsule gland. The eggs are laid in clusters or strings. There is a free-swimming larval stage but frequently a crawling young may emerge out of the egg.

Melongenids feed on gastropods, bivalves, polychaetes, ascidians and carrion. Recent laboratory studies had shown that P. cochlidium feeds on bivalves such as Anadara granosa, perna viridis, Meretrix meretrix and Katelysia opima (= Marcia opima) and unidentified polychaetes (Benny et al., 1996; Siraimeetan et al., 1988), studied on other melongenids also revealed that they feed on bivalves. However, the feeding habits of a species may vary from place to place.

These are mainly carnivores or scavengers, occurring on muddy sand substrates in shallow water, where clams are also available. It is a small family with six genera and about 30 species. The genus Pugilina is common in the Indian Ocean. In India the genus is represented by three species, which occur in bays and backwaters.

80. Pugilina conhlidium (Linnaeus, 1758)

Description:- Shell large, up to 55.4 in height, almost pear shaped, shaped, solid and heavy, whorls angular, concave from suture to shoulder, shell less broad than in P. carnarium. Aperture narrow and elongate, outer lip with obsolete ridges, columella without any fold, anterior canal short and broadly open, very narrow and
shallow umbilicus, strong fasciole, sculptured with axial ribs on the spire whorls, body whorl with close set spiral ridges on the lower half and more or less smooth on the remaining part, a row of about eight strong compressed tubercles at the angular shoulder of the last two whorls, color reddish brown, interior of aperture brownish yellow.

**Habitat:** Found mainly mid tide level to high tide level on soft mud.

Family **MITRIDAE**

**Miters**

Description: - Shell is medium to large in size. It is solid and elongately ovate, cylindrical or fusiform. Spire usually is high with a multispiral protoconch. Aperture is more or less elongate with a distinct anterior siphonal canal. Posterior siphonal canal is indistinct or notched. Columella has 3 to 11 distinct, close set oblique folds and the first one is large and longer than the second one. Surface of the shell may be smooth or may bear axial ribs, spiral grooves, cords and granules. There is no operculum.

Head bears a pair of elongate tentacles with eyes at their outer bases. Foot is small and triangular. Proboscis is very long and has a peculiar epiproboscis, which serves as a vehicle for the salivary gland secretions. Alimentary canal is very distinctive type. A pair of salivary glands is present. Accessory salivary gland and Leiblein gland are absent. Midoesophagus is very short and not conspicuously glandular. Stomach often is with muscular gizzard, a modified style sac and without caecum. Radula is rachiglassate type with three teeth per each row (1-1-1) or one central (0-1-0) as in Cylinfromitrinae.

Sexes are separate. Rock and coral dwellers deposit eggs on the rock or coral boulders, whereas sand dwellers deposit them on weeds. Egg capsules are deposited in loose symmetrical clusters. Each cluster may contain about 15-100 capsules, and each capsule contains about 100-500 white or cream or yellow colored translucent eggs. The incubation period lasts for two weeks, after which a free-swimming veliger with operculum is released. Operculum however disappears in the adult.
The family has a cosmopolitan distribution. Majority of the species live in the crevices or holes of coral reefs. A few may occur on the rocky coasts, while a few are sand-burrowers. The rock and reef dwellers usually are detritus feeders but the sand dwellers are carnivores.

**Subfamily VEXILLINAE**

*81. Vexillum ebenus*

Description: - small or medium size 18.5mm rather than thin, elongated and multicolored foot. The distinct head has two long, thin tentacles, each with an eye near its base. The mantle siphon is short. The mantle cavity contains the gill, the osphradium and, in males, a long a curved penis. The radula is rachiglossan.

**Habitat:** Found mainly mid tide level to heigh tide level on sand.

**Family OLIVIDAE**

**Olive Shells**

Shell is variable in size, small to large but usually not more than 80 mm in height, rarely reaching up to 100 mm. It is cylindrical or subcylindric in shape, with spire being short or elevated an sutures grooved or channeled. Shell is smooth, hard and highly glossy. Aperture is elongate to ovate, with wide, deep and short anterior canal, indistinct posterior canal. Outer lip is thick and smooth. Columella is with callus and folds anteriorly and often obliquely plicate. Sometimes a faciole may also be present. Perostracum and operculum usually are absent. The shells display brilliant colors, which are highly variable within the species.

Cephalic region is small with reduced tentacles, which may or may not bear eyes. The animal has a powerful foot which exceeds the length of the shell when it actively crawls. It is divided into an anterior propodium and a voluminous posterior metapodium. The side is expanded (parapodia) and extends over the shell laterally. Mantle cavity consists of a monoplectinate ctenidium, bipectinate osphradium and a hypobranchial gland. Proboscis is plerembolic bearing distal buccal cavity. Radial is rachiglossate type (1-1-1). A gland of Leibein is present in the esophagus.
Sexes are separate. Male has a dorso-ventrally flattened penis and a closed pallial sperm duct. Female possesses a gonopenicardial duct, a distal bursa copulatry and an ingesting gland. Eggs are laid in capsules and the development has a pelagic veligar larva.

Olives are carnivorous and feed on living and dead tissue. They feed mostly on bivalves, crustaceans and other invertebrates. They usually are offshore forms with a few species occurring buried in intertidal zone if sandy beaches, lagoons and near coral reefs. The family is divided into four subfamilies that include a total of about 16 genera and 200 species.

Subfamily OLIVINAE

82. Oliva gibbosa (Born, 1778)

Description: - Shell moderately large, up to 60 mm in height, stout, thick elongately ovoid, spire short but acuminate, body whorl inflated, suture channeled. Aperture rather wide, with slit-like posterior canal, columella with thick callus extending over to the penultimate whorl, anteriorly with oblique close-set ridges and posteriorly smooth, fasciole strong. Color pale yellowish brown with a prominent yellow band at the base, mottled or straked with black spots, sometimes whitish with zigzag transpire brownish bands, columella yellowish-white, aperture bluish-white.

Habitat: Found mainly mid tide level to high tide level on sand.

83. Oliva oliva (Linnaeus, 1758)

Description: - Shell of medium size, up to 37.5 mm in height, thick, polished, spire very short, suture groove narrow and deep, aperture narrow, columella with callus on the anterior two thirds and with oblique, uneven plaits. Color highly variable, creamy white, brown, black or yellow, white or pink.

Habitat: Found mainly mid tide level to high tide level on sand.
Family **CANCELLARIIDAE**

**Nutmegs**

Shell is small to medium in size, which usually is between 20 and 50 mm in height. Shape is elongate ovate to irregularly subtrigonal with a bulged protoconch of a few whorls. Spire is rather elevated with a pointed apex. Aperture usually is ovoid with an indistinct posterior sinus and distinct anterior canal. Outer lip is thickened and bears denticulations on the inner margin. Columella has a well-developed callus and bears three distinct folds. Sculpture consists of axial ribs and spiral cords giving the shell cancelated surface. There is no operculum but has the capacity to close the aperture by secreting mucus and entangling sand grains.

Head bears a pair of tentacles with eyes on swellings at outer bases. Foot is small to large. Proboscis is pleurembolic. Radula consists of a blade like central without marginal or laterals. There is a pair of salivary glands and a Leiblein gland and valve. Sexes are separate. Male has a large penis.

**Subfamily CANCELLARIINAE**

Description:- Shell of medium size, up to 30 mm in height, spire short, sort, somewhat stepped up whorls with suture ramp. Aperture narrow and obliquely oval, outer lip thick and lirate within, columella with callus bearing three oblique folds, base of columella recurved towards aperture bordering the short siphonal canal, umbilical groove partly covered but e columellar callus. Sculpture with fewer, stronger axial ribs separated by fairly broad interspaces, body whorl with nine axial ribs forming crenulations at the shoulder, weak, spiral striae cross the ribs. Color variable, but usually pale brown, white between shoulder and suture, often with a white spiral band at the middle or the body whirl, columella and edge of outer lip white, aperture lirate with brown.
84. *Cancellaria costaifera* (Sowerby)

Family **CONIDAE (Cones)**

Shell is small to large in size, often attaining a maximum height of 100 mm. It is solid, cone shaped and often heavy. Spire is generally depressed or low, pointed and in some may be highly elevated. Aperture is long and narrow extending along the whole length of the body whorl. Inner and outer lips run almost parallel to each other and the latter is smooth bearing no denticles. A distinct posterior sinus may exist. Surface of the shell is covered by thin or thick periostracum, which may be yellowish, often obscuring the actual color of the shell there is great variability in color pattern but it is generally specific. Operculum with a terminal nucleus is usually present. It is small, ovate to elongate with an unguiform shape.

Cephalic region bears a tubular rostrum and a pair of tentacles bearing eyes on their distal outer surfaces. Foot is long and narrow. Mantle cavity consists or an incur rent siphon and a ctenidium. Proboscis is intraembolic or polyembolic. Radula is toxoglossate, generally with lateral teeth and rarely with a central. Marginal teeth are modified into harpoon-like structures with poison. Oesophagus does not bear any valve of Leiblein. Sexes are separate a conspicuous tubular verge is present in the male. Females deposit eggs in pouch-like capsules and some are capable of depositing several thousand eggs at one sitting. Pelagic larvae emerge out of the capsules and can survive for variable durations. The specimens majority live in the intertidal zone between the reef and the reef and the shore, in the rock and coral crevices and in sandy habitats in the reef. These are carnivorous feeding on molluscs (molluscivorous), on worms (herbivorous) and small fishes (piscivorous).

85. *Conus figulinus* (Linnaeus, 1758)

Description: - Shell moderately large, up to 43 mm in height, heavy, pyriform with elevated spire, color uniformly light brown encircled with may dark brown spiral lines, a pale tan band at shoulder, spire dark brown, aperture white, periostracum thick and dark brown.

**Habitat:** In the intertidal zone between the crevice and rock.
Family **TURRIDAE**

Shell is of minute to very large size, 1 mm to 170 in height. It has variable shapes but generally fusiform with spire. Protoconch may be smooth or elaborately sculptured. Anterior siphonal canal may be very long and narrow or short and truncate. Columella usually is smooth or rarely noduloes or indistinctly plicate. Anal sinus is in the form if an indistinct slit to deep perfound turrid notch situated at various distances between the sutures and periphery on the outer lip. Sculpture is highly variable. It may consist of spiral cords, nodules, gemmules or spines. Operculum is corneous and small, which may be leaf-shaped or lanceolate with a terminal nucleus, or ovate to subovate with a medio- lateral nucleus. It may be often vestigial or absent.

Cephalic tentacles are widely separated bearing eyes at their bases. Proboscis is long and intraembolic or polyembolic. There are no jaws, but a poisonous venom gland is present. Radula may be more or less rachiglossate and nondetachable or toxoglossate with only marginal and detachable. There is no valve of Leiblin. Sexes are separate.

86. *Turricula javana* (Linnaeus, 1767)

Description: - Shell large, up to 75 mm in height, spire high, slightly shorter than the body whorl, aperture broad, with a wide posterior sinus extending from shoulder to suture, siphonal canal short and often twisted. Sculptured with obliquely set and axially elongate nodules on the shoulder, two narrow spiral ridges below suture, strong spiral threads on the lower half of the body whorl from shoulder to the base of siphonal canal, color brownish yellow with nodules being lighter.

**Habitat:** In the rocky intertidal zone.

Order **ARCHAEOPELMONATA**

These are primitive pulmonates with a dextrally coiled spiral shell having no operculum. Aperture has strong folds or teeth projecting into it. Tentacles ate cylindrical bearing eyes at their bases. Radial has numerous teeth with denticulate
central, lateral and narrow marginals. An osphradium is absent. Respiratory opening is present at posterior end of the mantle. Reproductive system is of primitive type with separate genital openings.

Family **ELOBIIDAE**

Shell is small to moderately large in size, up to 60 mm in height. It is thin to thick, ovate to cylindrical in shape. Body whorl is large with a short spire. Aperture is elongate with a thick outer lip, often reduced in size by the presence of teeth. Columella is with folds or teeth. Outer lip is with one to several teeth. Surface usually is smooth or with striations.

Animal can totally retract into the shell. There is a pair of retractile and rounded tentacles bearing eyes at their bases. Radula has numerous teeth. A small respiratory orifice, pneumatophore, is present on the posterior edge of the mantle. Foot has a small transverse furrow. Sexes are united with separate genital pores. Penis is retractable and has a chitinous stylet.

Subfamily **ELLOBIINAE**

**87. Cassidula nucleus** (Gmelin, 1791)

Description: - Shell small, up to 8.5 mm in height, thick and ovate, with a short spire and convex body whorl being angular at the shoulder, aperture narrow and longer than the spire, columella with callus and two fold, outer lip thickened, absolutely denticulate and ungulate. Surface with irregular spiral striae, fawn colored. **Habitat:** In the intertidal zone some time found on stons in estuarine and backwater.

Order **SYSTELLOMMATOPHORA**

A shell is absent. Animal are slug like with an elongately ovate body. They vary in size from microscopic to 100 mm in length. Mantle is thick forming a nostrum dorsally and extending anteriorly down over the head and laterally along the length of the body. There are two pairs of tentacles on the head, the upper ones contractile and bear eyes, the lower ones are tactile. The respiratory pore and anus are located at the
posterior and behind the foot. Radula possesses unicuspid teeth. Two separate genital openings are present; the male opening lies anteriorly on the right side of the head and the female opening is midway on the right side or near the anus.

Family **ONCHIDIIDAE**

Animal usually are slug-like, large and shell less. Dorsal surface is covered by thickened mantle. It usually is uneven with papillae or tubercles and accessory eye like structures. The mantle has repugnatorial glands, which release repulsive secretions. Head has a roof like frontal shield. The body is divided into dorsal notum separated from the lateral hyponotum or girdle-like border by a groove called perinotum. Foot is large and broad with a median sole. Radula is broad with a tricuspid central tooth and numerous lateral and marginal teeth.

Sexes are united, with a posteroily located female genital pore and an anteriourly situated male gonopore. The penis has an accessory gland. A coiled shell is present in the embryonic stage. A pelagic veliger larva is present.

**88. Onchidium tenerum** (Stoliczka, 1869)

Description: - Animal of miderate size, 35 mm in length and 25 mm in width, orate-elongate, flabby. Mantle not tough, greenish grey, ornamented with dark spots and fine granules, eye pedicles with swollen base and distinctly swollen granular tips, eyes black and located in transverse folds. Anus pulmonary orifice and female genital pore located at the posterior end of the mantle on the ventral side.

**Habitat:** In the mid tide level to heigh tide livel rocks, some time found on stons in estuarine and backwater.

**89. Onchidium tigrinum** (Stoliczka, 1869)

Description: - Animal small, 26.5 mm in length and 24 mm in width, ovate, with hard cariaceous mantle, body pale greenish with irregular spots, surface with large black-tipped tubercles enclosing granules in between, head and tentacles dark green, tentalcesst out at the base, thin in the middle and slightly thickened at the tip
bearing black eyes. Anus, pulmonary orifice and female genital pore located at the posterior end on the ventral surface.

**Habitat:** In high tide livel mark, some time on stons in estuarine and backwater also on mangrove trees.
SYSTEMATIC LIST
MARINE GASTROPODS MOLLUSCS

Class  **GASTROPODA**
Subclass  **PROSOBRANCHIA**
   Order  **ARCHAEOGASTROPODA**
      Superfamily  **TROCHIDEA**
         Family  **TROCHIDAE** Rafinesque, 1815
         Subfamily  **TROCHINAE** Rafinesque, 1815
            1)  *Trochus radiatus* (Gmelin)

         Subfamily  **COLLIOSTOMATINAE**
            2)  *Coliostoma speciosa* (A. Adams, 1854)

         Subfamily  **MARGARITINAE**
            3)  *Euchelus atratus* (Gmelin, 1791)

         Subfamily  **UMBONIINAE**
            4)  *Umbonium vestarium* (Linnaeus)
            5)  *Monilea warnefordi* (Linnaeus)

      Family  **TURBINIDAE**
         Subfamily  **TURBINIDAE**
            6)  *Turbo brunneus* (Roeding)
         Subfamily  **ASTRAEINAE**
            7)  *Astralium semicastata* (P.Fischer, 1880)

Superfamily  **NERITOIDEA**
Family  **NERITIDAE**
   Subfamily  **NERITINAE** (Rafinesque, 1815)
8) *Nerita albicilla* (Linnaeus, 1758)

9) *Nerita oryzarum* (Recluz, 1841)

10) *Nerita plicata* (Linnaeus, 1758)

11) *Nerita squmulata* (Le Guillous, 1841)

12) *Clithon aualaniensis* (Benson)

13) *Clithon meticularis* (Benson)

14) *Clithon reticularis* (Benson)

15) *Dostia violacea* (Gmelin)

16) *Nerita plaospria* (Anton, 1839)

17) *Nerita grayana* (Recluz, 1843)

18) *Nerita chameleon* (Linnaeus, 1758)

Family **LOTTIIDAE**

Subfamily **PATELLOIDINAE**

19) *Potamacmaea fluviatilis* (Blanford. 1868)

Family **PATELLIDAE** Rafinesque, 1815

Subfamily **NACELLINAE**

20) *Cellana radiata* (Born, 1778)

Order **MESOGASTROPODA**

Superfamily **LITTOINOIDEA**

Family **LITTORINIDAE** (Gray, 1840)

Subfamily **LITTORINIDAE**

21) *Littorina scabra* (Linnaeus, 1758)

22) *Littoria undulata* (Gray, 1839)

23) *Nodilittorina melanostoma* (Gray, 1839)

24) *Nodilittorina vidua* (Gould, 1859)

Superfamily **CERITHIOIDEA**

94
Family PLANAXIDAE

25) *Planaxis sulcatus*  (Born, 1780)
26) *Planaxis nicobarica*
27) *Planaxis sp*

Family CERITHIIDAE

Subfamily CERITHINAE

28) *Clypeomorous betilliiformis* (Habe & Kosuge, 1966)
29) *Clypeomorous bitasciata* (Sowerby, 1855)
30) *Clypeomorous spp*
31) *Cerithium traillii* (Sowerby, 1855)
32) *Cerithium spp*
33) *Cerithium gennesi* (Fischer and Vignal, 1901)
34) *Rhinoclavis sp.*
35) *Cerithium bifaciata* (Sowerby, 1855)
36) *Cerithium sp*

Family POTAMIDIDAE

Subfamily POTAMIDINAE

37) *Telescopium telescopium* (Linnaeus, 1758)
38) *Cerithidea cingulata* (Gmelin, 1791)

Family TURRITELLIDAE

39) *Turritella bucilum* (Kiener)
40) *Turritella duplicata* (Linnaeus, 1758)
41) *Turritella attenuata* (Reeve, 1849)
42) *Turritella columnaris* (Kiener, 1840)
43) *Turritella turritella*
Superfamily **STROMBIDEA**

Family **STROMBIDAE**

44) *Tibia curta* (Sowerby, 1842)

Superfamily **CYPRAEOIDEA**

Family **CYPRAEIDAE**

45) *Cypria arabica* (Linnaeus, 1758)

Superfamily **NATICIOIDEA**

Family **NATICIDAE**

Subfamily **POLINICINAE**

46) *Polinices didyma* (Roeding, 1798)

Subfamily **NATICINAE**

47) *Natica vitellus* (Linnaeus, 1758)

Superfamily **TONNOIDEA**

Family **RANELLIDAE**

48) *Gyranium natator* (Roeding, 1798)

49) *Cymatium nicobaricum* (Roeding, 1798)

Family **BURSIDAE**

50) *Bursa echinata* (Link, 1807)

Order **NEOGASTROPODA**

Suborder **MURICOIDEA**

Family **MURICIDAE**

Subfamily **THAIDINAE**

51) *Thais blanfordi* (Melvill, 1893)

52) *Thais lacera* (Born, 1778)

53) *Thais bufo* (Lamarck, 1822)
54) *Thais tissoti* (Petit, 1852)
55) *Cornia contract* (Reeve, 1846)
56) *Cornia konkanensis* (Melvill, 1893)
57) *Morula nodicostata* (Pease, 1868)
58) *Morula granulata* (Duclos, 1832)
59) *Morula marginata* (Blanville, 1832)
60) *Mancinella bufo*
61) *Thais hippocastanum* (Linnaeus, 1758)
62) *Thais echinata* (Blainville, 1832)

**Subfamily MURICINAE**

63) *Murex carbonnieri* (Jousseaume, 1881)
64) *Chicoreus kilbami*

**Family BUCCINDAE**

**Subfamily BUCCININAE**

65) *Babilonia spirata* (Linnaeus, 1758)
66) *Engina zea* (Melvill)

**Family COLUMBELLIDAE**

**Subfamily COLUBELLINAE**

67) *Anachis terpsichore* (Sowerby)

**Family NASSRIIDAE**

**Subfamily DORSANIINAE**

68) *Nassarius stulatus* (Gmelin, 1791)
69) *Nassarius* sp.
70) *Nassarius* (Linnaeus, 1758)
71) *Nassarius dorsatus* (Roeding, 1798)
72) *Nassarius olivaceins* (Bruguier, 1798)
73) *Nassarius jacsonianus* (Quoy & Gaimard, 1833)
74) *Nassarius sp*
75) *Nassarius vittatus* (Linnaeus, 1767)
76) *Nassarius nodifera* (Powys, 1835)
77) *Nassarius spendidulus* (Dunker, 1832)
78) *Nassarius exilis* (Powys)
79) *Bullia melamoides* (Deshues, 1832)

Family **MELONGENIDAE**

80) *Hemifusus cochlidium* (Linnaeus, 1758)

Family **MITRIDAE**

Subfamily **VEXILLINAE**

81) *Vexillum ebenus*

Family **OLIVIDAE**

Subfamily **OLIVINAE**

82) *Oliva gibbosa* (Born, 1758)
83) *Oliva oliva* (Linnaeus, 1758)

Superfamily **CANCELLARIOIDEA**

Family **CANCELLARIIDAE**

Subfamily **CANCELLARIINAE**

84) *Cancellaria costaifera* (Sowerby)

Superfamily **CONOIDEA**

Family **CONIDAE**

85) *Conus figulinus* (Linnaeus, 1758)
Family **TURRIDAe**

86) *Turricula javana* (Linnaeus, 1767)

Order **APLYSIOMORPHA**

Subclass **PULMONATA**

Order **BASOMMATOPHORA**

Suborder **ELLOBIOIDEA**

Family **ELLOBIIDAE**

Subfamily **ELLOBIINAE**

87) *Cassidula nucleus* (Gmelin, 1791)

Subclass **GYNOMORPHA**

Order **SYSTELLOMMATOPHORA**

Suborder **ONCHIDIDIDOIDEA**

Family **ONCHIDIIDAE**

88) *Onchidium tenerum* (Stoliczka, 1869)

89) *Onchidium tigrinum* (Stoliczka, 1869)
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<tr>
<th>Sr. no</th>
<th>Name of the species</th>
<th>Length in mm</th>
<th>Width in mm</th>
<th>O.L in mm</th>
<th>O.W in mm</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Morula nodicostata (Pease, 1868)</td>
<td>13.00  7.50  8.50  3.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>58</td>
<td>Morula granulata (Duclos, 1832)</td>
<td>20.50  10.50  11.50  6.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Morula marginatra (Blanville, 1832)</td>
<td>25.00  14.00  17.00  9.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Mancinella bufo</td>
<td>35.00  20.00  21.00  16.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>61</td>
<td>Thais hippocastanum (Linnaeus, 1758)</td>
<td>17.00  9.00  10.00  6.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Thais echinata (Blainville, 1832)</td>
<td>34.00  19.00  25.00  16.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>63</td>
<td>Murex carbonnieri (Jousseaume, 1881)</td>
<td>67.00  24.00  49.00  13.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Chicoreus kilburni Houart and Pain, 1982</td>
<td>37.00  16.50  19.50  10.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Babilonia spirata (Linnaeus, 1758)</td>
<td>41.00  25.00  29.00  17.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Engina zea (Melvill)</td>
<td>20.00  9.50  12.50  5.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Anachis terpsichore (Sowerby)</td>
<td>16.50  7.50  8.50  2.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>Nassarius stutilus (Gmelin, 1791)</td>
<td>10.00  40.00  40.00  2.50</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>69</td>
<td>Nassarius sp.</td>
<td>12.50  5.50  6.50  4.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>Nassarius pullus (Linnaeus, 1767)</td>
<td>15.00  7.50  7.50  3.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>71</td>
<td>Nassarius dorsatus (Roeding, 1798)</td>
<td>24.50  11.00  12.00  6.00</td>
<td></td>
<td></td>
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<tr>
<td>72</td>
<td>Nassarius olivaceins (Bruguier, 1798)</td>
<td>29.50  18.50  15.00  7.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>Nassarius jacsonianus (Quoy &amp; Gaimard, 1833)</td>
<td>14.50  7.00  8.50  3.50</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>74</td>
<td>Nassarius sp</td>
<td>15.00  7.50  7.50  3.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>Nassarius vittatus (Linnaeus, 1767)</td>
<td>13.00  5.00  6.50  3.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>Nassarius nodifera (Powys, 1835)</td>
<td>28.50  14.00  16.00  9.00</td>
<td></td>
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<tr>
<td>77</td>
<td>Nassarius spendidulus (Dunker, 1832)</td>
<td>12.00  6.00  7.00  2.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>Nassarius exilis (Powys)</td>
<td>11.50  5.5  6.5  2.5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>79</td>
<td>Bullia melanoides (Deshues, 1832)</td>
<td>24.50  9.50  9.50  5.50</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>80</td>
<td>Hemifusus cochlidium (Linnaeus, 1758)</td>
<td>55.40  43.50  73.00  27.00</td>
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<tr>
<td>81</td>
<td>Vexillum ebenus</td>
<td>18.50  6.50  7.50  2.50</td>
<td></td>
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<td></td>
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<tr>
<td>82</td>
<td>Oliva gibbosa (Born, 1758)</td>
<td>55.50  27.00  47.00  10.50</td>
<td></td>
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</tr>
<tr>
<td>83</td>
<td>Oliva oliva (Linnaeus, 1758)</td>
<td>37.50  17.50  31.50  5.50</td>
<td></td>
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<tr>
<td>84</td>
<td>Cancellaria costafera Sowerby</td>
<td>19.00  9.00  11.00  4.40</td>
<td></td>
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<tr>
<td>85</td>
<td>Conus figulinus Linnaeus, 1758</td>
<td>43.00  22.00  38.5  4.4</td>
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<tr>
<td>86</td>
<td>Turricula javana (Linnaeus, 1767)</td>
<td>53.50  17.00  28.00  7.00</td>
<td></td>
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</tr>
<tr>
<td>No.</td>
<td>Species</td>
<td>Diameter (mm)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>87</td>
<td><em>Cassidula nucleus</em> (Gmelin, 1791)</td>
<td>8.50 6.00 5.50 2.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88</td>
<td><em>Onchidium tenerum</em> (Stoliczka, 1869)</td>
<td>35.00 25.00 - -</td>
<td></td>
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<td></td>
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<tr>
<td>89</td>
<td><em>Onchidium tigrinum</em> Stoliczka, 1869</td>
<td>26.50 24.00 - -</td>
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</table>
SELECTION OF STUDY LOCALITIES:

Description of the localities as shown in the Map 2, molluscan habitats screened and species occurrence on the coast of Raigad district are given below.

1. Harihareshwar: (Lat. 17°59.568” North and Long. 073°01.187” East). The rocky shore, about 05m area exposed during the low tide, along hill there is one rocks flat platform, in the rocks pits gastropods diversity were more than bivalve species, village about ½ kms on the north-eastern side from the high tide mark, by one small canal domestic discharge occurence from the village which is meets to the sea beside study localities.

Bivalves: *Crassostrea cutuckensis*: found on rocks, *Saccostrea cucullatea*: found on rocks, size 2-4cm.


Mangroves: Not found.

2. Lada: (Lat. 18°01.686” North and Long. 073°01.752” East). The backwater muddy region, there is exposed inter-tidal mudflat about 20 m during low tide, sea water flows is circular shape (3 side land and 1 side influx of sea water), in scatter large
mangrove trees of *Sonneatia alba* J.Smith, *Ceriops tagal* (Perr.) (Robinson). Aprox - 2km area occupies by oysters beds spread over on the boulders, no domestic water discharged.

**Bivalve:** *Arca granosa*: Population density 3-4m², *Crassostrea cutuckensis*: Population density 7-8m², *Saccostrea cucullata*: found on the rocks, *Meretrix meretrix*: Population density 5-6m².


**Mangrove:** *Sonneatia alba, Ceriops tagal*.

3. Shrivardhan: (Lat. 18°02.556” North and Long. 073°00.598” East). The open fine sandy beach, north and south side rocks were present; tide influx result in deposit of sand in rock crevices, intertidal shore was about 15m. Bivalve species *Donax incarnatus* (Gmelin), *Donax cuneatus* (Linnaeus) and gastropod *Umbonium vestarium* (Linnaeus) were found at this locality during high tide mark during low tide. Due to close situation of this village to sea with convavient travel by road and fine sandy beach they are attracted and there is direct domestic discharge to the sea.

**Bivalve:** *Sunetta scripta*: Population density 1-2m², *Donax incarnatus*: Population density 2-4m², *Donax cuneatus*: Population density 2-3m².

**Gastropod:** *Umbonium vestarium*: Population density 50-60m², *Turritella duplicata*: Population density 1-2m².

**Mangrove:** Not found.
4. **Jivanabander:** (Lat. 18°03.062" North and Long. 072°59.944" East). The rocky shore (surf beaten), about 05-10 m intertidal area exposed during low tide, village is about 60-70m far away from high tide mark on the eastern side, fishing activity is going on by boat, there one cement constructed jetty for the purpose of landing the fish catch, there is domestic discharge occurrence.

**Bivalve:** *Crassostrea cutuckensis*: found on rocks planty of numbers. *Saccostrea cucullatea*: found on rocks planty of numbers, *Modiolus metacalfi*: Population density 5-6m², *Gafarium divaricatum*: Population density 3-4m², *Dosinia Prostata*: Population density 1-2m²,


**Mangrove:** Not found.
5. Kondvil: (Lat. 18°06.158” North and Long. 072°59.080” East). The open rocky shore, towards the North and south side black rocks with pebbles and crumbly rocky area was present, no fishing activity, no oil discharged, there is no domestic discharged, no mangrove species recorded.

**Bivalve:** *Crassostrea cutuckensis*: found on rocks planty of numbers. *Saccostrea cucullatea*: found on rocks planty of numbers, *Modiolus metacalfei*: Population density 5-6m², *Gafrarium divaricatum*: Population density 2-3m².


**Mangrove:** Not found.

6. Bharadkhol: (Lat. 18°08.381” North and Long. 072°58.942” East). The open rocky shore, about 05-10m area open during the low tide, the village is about 30-40m far away from the high water mark on the eastern side, one cement constructed jetty
was there for the purpose of landing fish catch, in rocky crevices Planaxis sp abundantly found, due to transit of mechanized fishing boats there is oil discharged, due to nearest village there is domestic discharged, no mangroves species recorded.

**Bivalve:** *Crassostrea cutuckensis:* found on rocks planty of numbers. *Saccostrea cucullata:* found on rocks planty of numbers, *Gafraarium divaricatum:* Population density 3-4m².


**Mangrove:** Not found.

7. **Diveagar:** (Lat. 18°19.631” North and Long. 072°59.298” East). The open fine sandy beach, tidal zone about 20-30 m open during low tide, village is on about 50-60 m far away from high tide mark on the eastern side, it has one beautiful sandy beach that fascinate towards to tourist from India and also out of India, north side fine sand
and south rocky area, deepest tide occurred influx in the white sandy granule, domestic water discharged occurrence, no fishing activities, no mangrove species.

**Bivalve:** *Donax cuneatus*: Population density 3-4m².

**Gastropod:** *Umbonium vestarium*: Population density 50-60m².

**Mangrove:** Not found.

8. **Velas:** The open fine sandy beach, tidal zone expose about 10 to 20 m 10-20 m area open during the low tide, in dense climbing mangrove plant *Ipomoea pes-caprae* (L.) Sweet., spread over on beach just above high water mark.

**Bivalve:** *Donax cuneatus*: Population density 1-2m².

**Gastropod:** *Umbonium vestarium*: Population density 40-50m², *Vexillum ebenus*: Population density 1m².

**Mangrove:** *Ipomoea pes-caprae*.

9. **Sarve:** (Lat. 18°14.175” North and Long. 072°56.582” East). The shore open rocky, one is the special thing for this locality even rocky shore in scatter small trees mangrove trees of *Bruguiera sexangula* (Lour.) Poir., adapted very well from high water mark to till mid water mark, no domestic water discharged occurrence, no fishing activities.

**Bivalve:** *Crassostrea cutuckensis*: found on rocks planty of numbers. *Saccostrea cucullata*: found on rocks planty of numbers, *Modiolus metacalfei*: Population density 5-7m², *Gafrarium divaricatum*: Population density 1-2m².

scabra: Population density 10-12m², Cerithium gennesi: Population density 20-30m², Cerithium spp: Population density 25-30m², Trochus radiatus: Population density 4-6m², Nerita squamulata: Population density 10-12m², Nerita albicilla: Population density 6-7m², Nerita grayana: Population density 10-12m², Nerita oryzarum: Population density 6-7m², Nerita plicata: Population density 4-5m², Nerita chameleon: Population density 4-5m², Clypeomorous betillraeiformis: Population density 20-30m², Clypeomorous bitasciata: Population density 13-15m², Cerithium traillii: Population density 7-8m², Gyranium natator: Population density 12-14m², Thais tissoti: Population density 12-14m², Thais lacera: Population density 8-9m², Mancinella bufo: Population density 14-16m², Thais bufo: Population density 3-4m², Morula marginatra: Population density 12-14m², Cellana radiata: Population density 12-14m², Cypria arabica: Population density 1-2m².

Mangrove: Bruguiera sexangula.

10. Dighi: (Latitude 18°14.009” North and Longitude 073°01.156” East). The backwater soft muddy region, there is exposed inter-tidal mudflat about 5-10m during low tide, on the south side village is about 50-60 m away from the high water mark, the scattered small trees of mangroves species Rhizophora mucronata (Lamarck), Ceriops tagal (Perr.) (Robinson) were found, oysters were spread on the rock and pebbles, the village is about 40 to 50 m far away from the high water mark, domestic water discharged as well as due to fishing activities by boats oil discharged.

Bivalve: not found.

Gastropod: Clithon reticularis: Population density 7-8m², Dostia violacea: Population density 6-7m², Cassidula nucleus: Population density 6-8m².

Mangrove: Rhizophora mucronata (Lamarck), Ceriops tagal (Perr.) (Robinson).
11. **Turbadi**: (Lat. 18°14.469”North and Long. 073°01.156”East). The backwater soft muddy regions, there is exposed inter-tidal mudflat about 40-50m during low tide, in dense large mangroves trees were present like *Rhizophora mucronata* (Lamarck), *Ceriops tagal* (Perr.) (Robinson), *Avicennia alba* Blume with associated bivalve species *Crassostrea cutuckensis* (Newton & Smith), *Saccostrea cucullatea* (Born) were present during low water mark at high water mark to till low water mark, locality is about 100-150 m away from the village on the western side, there was one small natural protected jetty on the rock basement for the landing fish catch, during second survey whole muddy platform fulfill by stones granules and brick of Pisces, domestic water discharged occurred.


**Mangrove**: *Rhizophora mucronata, Ceriops tagal, Avicennia alba*.

12. **Waral**: (Lat. 18°12.111”North and Long. 073°03.176” East). The back water soft muddy region, there is exposed inter-tidal mudflat about 5-10m during low tide, the locality is on eastern side away from the village about 150-200m, so there is domestic discharge occurrence, in dense large mangroves trees were present like *Avicennia alba* Blume, and *Sonneatia alba* J.Smith.
Bivalve: *Arca granosa*: Population density 2-3m², *Saccostrea cucullata*: found on the rocks.


**Mangrove:** *Avicennia alba, Sonneatia alba*.

13. **Mendadi:** (Lat. 18°11.036” North and Long. 073°02.999” East). The back water swamp muddy region, there is exposed inter-tidal mudflat about 40-50m during low tide, the locality about 10-15m away from the village on the southern side, dense large mangroves trees *Sonneratia alba* J. C. Smith were dominant, oysters were present on the black rocks, the village is attached to the locality due to there is domestic discharged, no fishing activates.


**Mangrove:** *Sonneatia alba, Acanthus ilicifolius.*
14. Pabhara: (Lat. 18°09.617” North and Long. 073°05.804” East). The back water soft muddy region, there is exposed inter-tidal mudflat about 5-10m during low tide, on western side far away from the village the locality is about 100-150m, in dense small mangroves trees *Sonnetia alba* J.Smith., were present with pebbles in the soft mud, due to the nearest village ther is domestic discharge occurred, fishing activities were occurred by boat.

**Bivalve:** *Arca granosa*: Population density 2-3m², *Crassostrea cutuckensis*: Population density 7-8m², *Saccostrea cucullata*: found on the rocks.


**Mangrove:** *Sonnetia alba*.

15. Nigadi: (Lat.18°10.391”North Long. 073°05.263”East). The back water swampy muddy, there is exposed inter-tidal mudflat about 10m during low tide, region opens with in dense large mangroves trees *Avicinia marina* (Forsk.) Vierh., during the low tide, pebbles were present in the mud, there is no domestic discharge occurred, no fishing activities were occurred.

**Bivalve:** *Arca granosa*: Population density 2-3m², *Crassostrea cutuckensis*: Population density 10-15m², *Saccostrea cucullata*: found on the rocks.

**Gastropod:** *Clithon reticularis*: Population density 12-16m², *Dostia violacea*: Population density 6-7m², *Nerita plaospria*: Population density 6-8m², *Cerithidea*
cingulata: Population density 40-50m², Nassarius olivaceins: Population density 2-3m², Nassarius jacsonianus: Population density 10-11m², Onchidium tenerum: Population density 2-3m², Onchidium tigrinum: Population density 2-3m², Cassidula nucleus: Population density 6-8m².

Mangrove: Avicinia marina.

16. Tamhane: (Lat. 18°12.111” North and Long. 073°03.176” East). The back water, swampy muddy region, there is exposed inter-tidal mudflat about 20 m during low tide, on the southern side far away from the village is about 100-120 m, in dense large mangrove trees Avicinia marina (Forsk.) Vier have were dominant, one about 30m long jetty was there for landing the fish catch, pebbles were present at the high water mark, due to the nearest village there is domestic water discharge occurred, due fishing activities there is oil discharged occurred.

Bivalve: Arca granosa: Population density 2-3m², Crassostrea cutuckensis: Population density 14-16m², Saccostrea cucullata: found on the rocks,

Gastropod: Clithon reticularis: Population density 6-8m², Dostia violacea: Population density 6-7m², Nerita plauosria: Population density 6-8m², Cerithidea cingulata: Population density 40-50m², Nassarius olivaceins: Population density 2-3m², Nassarius jacsonianus: Population density 12-14m², Onchidium tenerum: Population density 2-3m², Onchidium tigrinum: Population density 2-3m², Cassidula nucleus: Population density 6-8m².

Mangrove: Avicinia marina.

17. Varal: The back water swampy muddy region, there is exposed inter-tidal mudflat about 8-10 m during low tide, on the western side far away from the village about 30-40m, in dense large mangrove trees of Avicinia marina (Forsk.) Vier were present at
the above mid tide, there is domestic water discharge, no fishing activities that’s why no oil discharged.

**Bivalve:** *Arca granosa*: Population density 3-4m², *Crassostrea cutuckensis*: Population density 12-14m², *Saccostrea cucullata*: found on the rocks,


**Mangrove:** *Avicinia marina, Sonneatia alba, Acanthus ilicifolius.*

18. Washi: (Lat.18°13.921”North and Long. 073°04.681”East). The back water soft muddy region, there is exposed inter-tidal mudflat about 20 m during low tide, the locality on the western side far away from the village about 300-400m, in the dense small mangroves trees of *Rhizophora mucronata* (Lamarck) and *Ceriops tagal* (Perr.) (Robinson) were present with oysters *Crassostrea cutuckensis* (Newton & Smith), *Saccostrea cucullata* (Born) were present on rock and pebbles were present in the swampy mud, local peoples everyday used to take out oysters from this locality for the eating propose, one small canal meets to the locality after coming eastern side, there is no domestic discharged, no fishing activities that’s why no oil discharged.


**Gastropod:** *Clithon reticularis*: Population density 10-12m², *Dostia violacea*: Population density 6-8m², *Nerita plaospria*: Population density 6-8m², *Cerithidea*
116

cingulata: Population density 40-50m², Nassarius olivaceins: Population density 2-3m², Nassarius jacsonianus: Population density 10-12m², Onchidium tenerum: Population density 2-3m², Onchidium tigrinum: Population density 2-3m², Cassidula nucleus: Population density 6-8m².

Mangrove: Rhizophora mucronata and Ceriops tagal.

19. Khamade: (Lat.18°15.966"North and Long.072°02.582"East). The swampy muddy region, on the eastern side far away from the village about 20-30m, there is exposed inter-tidal mudflat about 10m during low tide, oyster bed were found on the small rocks and pebbles during low tide, in scattered small mangrove trees of Bruguiera sexangula (Lour.) Poir. Were present at the mid tide to till high tide mark, it is beside the hill that’s why black rock were dominant in the muddy area, due nearest situated village there is domestic discharge, small transit non mechanized fishing boats are there that’s why no oil discharged.

Bivalve: Anadara granosa: Population density 12-14m², Arca granosa: Population density 2-3m², Crassostrea cutuckensis: Population density 12-14m², Saccostrea cucullata: found on the rocks.

Gastropod: Clithon reticularis: Population density 6-8m², Dostia violacea: Population density 6-7m², Nerita plaospria: Population density 7-8m², Cerithidea cingulata: Population density 40-50m², Nassarius olivaceins: Population density 2-3m², Nassarius jacsonianus: Population density 10-12m², Onchidium tenerum: Population density 2-3m², Onchidium tigrinum: Population density 2-3m², Cassidula nucleus: Population density 6-8m².

Mangrove: Bruguiera sexangula.

20. Tokekhor: (Lat.18°16.670"North and Long. 072°59.201"East). The backwater soft muddy region, on the southern side far away from the village about 300-400m,
there is exposed inter-tidal mudflat about 20 m during low tide, in dense small and large mangroves trees like *Acanthus ilicifolius* L., *Sonnetia alba* J.Smith, *Ceriops tagal* (Perr.) (Robinson), *Rhizophora mucronata* (Lamarck), oysters were present on the small rocks and pebbles where present in the muddy region, due to far away from village there is no domestic discharged, no fishing activities that’s why no oil discharged.


**Mangrove:** *Acanthus ilicifolius*, *Sonnetia alba*, *Ceriops tagal*, *Rhizophora mucronata*.

**21. Usadi:** (Lat.18°16.589”North and Long.072°59.442”East). The soft muddy region, there is exposed inter-tidal mudflat about 20-30m during low tide, dense small mangroves trees of *Acanthus ilicifolius* L., *Ceriops tagal* (Perr.) (Robinson), *Rhizophora mucronata* (Lamarck), the bivalve species *Crassostrea cutuckensis* (Newton & Smith), *Saccostrea cucullatea* (Born) were dominantly present on the rocks and pebbles which were present in the muddy region, there is no domestic water discharged, no fishing activities that’s why no oil discharged.


Mangrove: *Acanthus ilicifolius, Ceriops tagal, Rhizophora mucronata.*

22. Nandala: (Lat.18°17.110”North and Long. 072°59.887”East). The backwater soft muddy region, there is exposed inter-tidal mudflat about 10m during low tide, on the eastern side far away from the village about 200-250m, in dense large and small mangroves trees of *Acanthus ilicifolius* L., *Ceriops tagal* (Perr.) (Robinson), *Rhizophora mucronata* (Lamarck). *Crassostrea cutuckensis* (Newton & Smith), *Saccostrea cucullatea* (Born) these oysters were present on the boulders and pebbles, everyday local peoples used to take out oysters from this locality for the eating propose, there is no domestic discharged and no fishing activity that’s why no oil discharged.


Gastropod: *Clithon reticularis*: Population density 7-8m², *Dostia violacea*: Population density 6-7m², *Nerita plaospria*: Population density 7-8m², *Cerithidea cingulata*: Population density 60-70m², *Nassarius olivaceins*: Population density 2-

**Mangrove:** *Acanthus ilicifolius, Ceriops tagal, Rhizophora mucronata.*

23. **Hajina:** (Lat. 18°17.257”North and Long. 72°59.391”East). The open rocky shore. rocky cliffs at both side eastern and western side rocky boulders and pebbles were present, in rocky crevices *Planaxis sulcatus* (Born) species were abundantly found, about 30-40m away on the western side from village that’s why there is domestic discharged, during the second survey government occupy this place for the purpose of port rocky area fulfill by stones and boulders, no fishing activities no oil discharge occurred.

**Bivalve:** *Crassostrea cutuckensis*: found on rocks planty of numbers. *Saccostrea cucullata*: found on rocks planty of numbers, *Modiolus metacalfei*: Population density 4-6m², *Gafriarium divaricatum*: Population density 2-3m².

14-16m²  *Thais bufo*: Population density 3-4m², *Morula marginatra*: Population density 12-14m², *Cellana radiata*: Population density 14-16m².  

**Mangrove**: Not found.

**24. Khokadi**: (Lat. 18°18.032” North and Long. 072°57.755” East). The open rocky shore, at eastern and western side rocks, boulder and pebbles were present, in rocky crevices *Nodilittorina (Nodilittorina) vidua* (Gould, 1859), *Planaxis sulcatus* (Born, 1780) were found abundantly, there is no domestic water discharged, no fishing activities no oil discharge occurred.

**Bivalve**:  *Crassostrea cutuckensis*: found on rocks planty of numbers.  *Saccostrea cucullata*: found on rocks planty of numbers, *Modiolus metacalfei*: Population density 4-6m², *Gaffarium divaricatum*: Population density 2-3m².


**Mangrove**: Not found.
25. Rajpuri: (Lat. 18°18.093” North and Long. 072°58.409” East). The open fine sandy beach, tidal zone about 10-20m area open during the low tide, on the northern side from the study locality village situated about 30-40m far away from high water mark, that’s why there is direct domestic discharge to the sea, due to mechanized and non mechanized boats fishing activities going on so oil spread over on the water surface.

Bivalve: *Donax incarnatus*: Population density 4-5m², *Donax cuneatus*: Population density 3-4m², *Donax scortum*: Population density 1-2m².


Mangrove: Not found.

26. Murud: (Lat. 18°22.763” North and Long. 072°55.956” East). The fine sandy beach, due to the Murud- Jajira fort, and Khanderi, Underi island this location is very famous in Maharashtra, India some tourist use to come out of the India, about 30-40m area open during the low tide, on the north-eastern side from the study locality, village is on about 10-20m far away from high water mark, there is direct domestic descharge occurrence to the sea, due to mechanized and non mechanized boats fishing activities going on so oil spread over on the water surface, no mangrove species.

Bivalve: *Sunetta scripta*: Population density 1-2m², *Donax incarnatus*: Population density 3-4m², *Donax cuneatus*: Population density 2-3m².

**Mangrove:** Not found.

**27. Vihur:** The rocky shore, 10-15m area open during the low tide, on the north-eastern side from the study site village is on about 40-50m far away from high tide mark, also on this locality mangrove species is adapted very well, scattered small mangrove trees *Bruguiera sexangula* (Lour.) Poir. survive in the cleft of the black rocky platform, there is domestic discharged from the village in to the sea, no fishing activities.

**Bivalve:** *Gafrarium divaricatum:* Population density 2-3m², *Dosinia Prostata:* Population density 2-3m², *Crassostrea cutuckensis:* found on rocks planty of numbers. *Saccostrea cucullatea:* found on rocks planty of numbers.


**Mangrove:** *Bruguiera sexangula.*
28. Sarvey: (Lat. 18°25.990”North and Long. 072°54.405”East). The rocky shore, about 30-40m area open during the low tide, black large rounded pebbles and rocks were extended. Due to no nearest any village there is no domestic discharged, no fishing activities that’s why gastropod and bivalve diversity is rich, especially *Trochus infundibulum* Gmelin, recorded in maximum number with refuge attached to the rocks and in the crevices of big stones.

**Bivalve:** *Crassostrea cutuckensis*: found on rocks planty of numbers. *Saccostrea cucullata*: found on rocks planty of numbers, *Modiolus metacalfei*: Population density 4-5m², *Gafrarium divaricatum*: Population density 1-2m².


**Mangrove:** Not found.

29. Kashid: (Lat. 18°27.279”North and Long. 072°54.004”East). The open fine sandy beach, rocks and pebbles were present one side. one is the developing location of the
Raigad district in the point of view of tourist, charming silver sandy beach and beautiful cypress trees fascinated to the tourist not from only India but out of the India tourist is coming in large number, as per demand of tourist crowd facilities increasing like food stall, cold drinks, coconut stall etc., 10-20m area open during the low tide, there isn’t domestic discharge occurance, no fishing activities, no mangrove species.

**Bivalve:** *Donax incarnatus*: Population density 2-4m², *Donax cuneatus*: Population density 2-3m².


**Mangrove:** Not found.

**30. Barshiv:** (Lat. 18°28.879”North and Long. 070°54.105”East). The rocky shore, about 30-40m area open during the low tide, pebbles as well as black rocks were extended, there is no domestic discharged, no fishing activities that’s why gastropod and bivalve diversity is rich, especially *Trochus radiatus* Gmelin, *Cellana radiate*
(Born, 1778), Clypidina (Clypidina) notata Linnaeus, 1758 with refuge attached to the rocks and in the crevices.

**Bivalve:** Gafrarium divaricatum: Population density 2-3m², Crassostrea cutuckensis: found on rocks, Saccostrea cucullatea: found on rocks.

**Gastropod:** Clypeomorous betillraeformis: Population density 20-30m², Clypeomorous bitasciata: Population density 13-15m², Cerithium trailli: Population density 7-8m², Gyranium natator: Population density 12-14m², Thais tissotii: Population density 12-14m² Thais lacera: Population density 8-9m², Mancinella bufo: Population density 14-16m² Thais bufo: Population density 3-4m², Morula marginatra: Population density 12-14m², Cellana radiata: Population density 12-14m², Littoria melanostoma: Population density 60-70m², Nodilittorina vidua: Population density 40-50m², Planaxis sulctus: Population density 40-50m², Littorina scabra: Population density 10-12m², Cerithium gennesi: Population density 20-30m², Cerithium spp: Population density 20-30m², Trochus radiatus: Population density 4-6m², Nerita squumulata: Population density 10-12m² Nerita albicilla: Population density 6-7m², Nerita grayana: Population density 10-12m², Nerita oryzarum: Population density 6-7m², Nerita plicata: Population density 4-5m², Nerita chameleon: Population density 4-5m².

**Mangrove:** Not found.

**31. Borli:** (Lat. 18°30.612”North and Long. 072°54.686”East). The rocky shore, about 10-20m area open during the low tide, on the south-west side village is about 30-40m away, due the nearest village there is domestic discharged, mechanized and non mechanized fishing activities were there so oil discharge occurred. No mangroves species.
**Bivalve:** *Perna viridis*: Population density 4-5m², *Crassostrea cutuckensis*: found on rocks, *Saccostrea cucullata*: found on rocks.


**Mangrove:** Not found.

**32. Korlai:** (Lat. 18°32.069”North and Long. 072°55.612”East). The rocky shore on the mouth of estuary, kundalika is biggest river of the Raigad district, after coming from the Himalayas meets to the Arabian Sea, 05-10m area open during the low tide, in scattered small mangrove trees of *Bruguiera sexangula* (Lour.) Poir., were recorded in the small rounded pebbles and little but sand were present, no domestic water discharged from the village in to the sea, no fishing activities.

**Bivalve:** *Perna viridis*: Population density 6-8m², *Crassostrea cutuckensis*: found on rocks, *Saccostrea cucullata*: found on rocks.

**Mangrove:** *Bruguiera sexangula*.

33. **Roha:** The rocky shore, the Kundalika River comes from Himalayas, about (33km) interior part from the Sea, about 05-10m area open during the low tide, city is connected to the locality at the south side, there is domestic discharged, no fishing activities and no mangroves species.

**Bivalve:** Not found.

**Gastropod:** *Dostia violacea*: Population density 4-5m², *Cassidula nucleus*: Population density 8-10m².

**Mangrove:** Not found.

34. **Wave:** (Lat. 18°29.260”North and Long. 073°08.172”East). The creek soft muddy region, there is exposed inter-tidal mudflat about 5-10m during low tide, on the northern side village is about 200-250m far away from locality, in scattered small
mangroves trees of *Aegiceros corniculatam* (L.) Blanco, *Acanthus ilicifolius* L., were present due to nearest village there is domestic discharged, gastropod species *Dostia violacea* (Gmelin) were present, there is no fishing activities.

**Bivalve**: Not found.

**Gastropod**: *Dostia violacea*: Population density 6-8m², *Cassidula nucleus*: Population density 10-12m².

**Mangrove**: *Aegiceros corniculatam* (L.) Blanco.

35. **Sanegaon**: The creek soft muddy region there is exposed inter-tidal mudflat about 5-10m during low tide, in dense small mangroves trees of *Aegiceros corniculatam* (L.) Blanco., were present, due to village there is domestic discharged, no fishing activities,

**Bivalve**: Not found.

**Gastropod**: *Dostia violacea*: Population density 4-5m², *Cassidula nucleus*: Population density 8-10m².

**Mangrove**: *Aegiceros corniculatam*.

36. **Agrav**: (Lat. 18°33.2841”North and Long. 072°56.905”East). The creek swampy muddy region, there is exposed inter-tidal mudflat about 30-40m during low tide, in dense small mangroves trees *Avicinia marina* (Forsk.) Vierh., were present in the swampy area, village is about 40m away from high water mark on the northern direction, there is domestic water discharged, fishing activities there were.

**Bivalve**: *Arca granosa*: Population density 3-4m², *Saccostrea cucullata*: found on the rocks.

**Gastropod**: *Dostia violacea*: Population density 4-6m², *Cassidula nucleus*: Population density 10-12m².
Mangrove: *Avicinia marina*.

37. **Revdanda**: (Lat.18°32.571”North and Long.072°55 981”East). The estuary swampy muddy region, this is a part of estuaries mouth of big kundalika river after coming from Himalayas meets to the sea. there is exposed inter-tidal mudflat about 10-20 m during low tide, about on the distance 20m from high water mark village is on the south-northern side Cement constructed jetty were present for the landing fish catch after fishing. Beside the jetty comes swampy area extended towards on the eastern side, in dense large mangrove trees of *Avicinia marina* (Forsk.) Vierh, *Avicinia marina* var. acutissima Stapf & Mokdenke ex Moldenke, *Avicennia alba* Blume, *Avicennia officinalis* L., were present, but *Avicinia marina* (Forsk.) Vierh was dominant, due to nearest village there is domestic water discharged in to the estuarine water, due to fishing activities there is oil discharged.


Mangrove: *Avicinia marina, Avicinia marina var. Avicennia alba, Avicennia officinalis.*

38. Nagaon: (Lat.18°36.647”North and Long. 072°58.627”East). The open fine sandy beach, this is longest sandy beach of the Raigad coast, attractive coastal area inviting to the tourist Maharashtra, India some tourist use to come out of the India, bivalves *Solen brevis* Gray, 1842, *Cultelus cultelus* (Linnaeus) were present at mid water mark, while gastropods *Umbonium vestarium* (Linnaeus) found during low tide at mid water mark to till low water mark, nearby 40-50m area open during the low tide, about 200 - 250m village is on northern side from the high tide mark, no domestic discharge, no fishing activities.

**Bivalve:** *Sunetta scripta*: Population density 1-2m², *Cultelus cultelus*: Population density 1-2m² *Donax incarnatus*: Population density 2-4m², *Donax cuneatus*: Population density 2-3m², *Donax scortum*: Population density 1-2m².


**Note:** on this beach found *Turritella bucillum* species which is introduce first time from India. This species identified from ZSI, Kolkata.

**Mangrove:** *Ipomoea pes-caprae.*

39. Raiwadi: The open fine sandy beach, about 20-30m area opens during low tide, in dense climbing mangrove plant *Ipomoea pes-caprae* (L.) Sweet., spread on beach just above the high water mark, about 90 - 100m village is on northern side from the high tide mark, no domestic discharge, no fishing activities.
**Bivalve:** *Sunetta scripta:* Population density 1-2m², *Solen brevis:* Population density 2m², *Donax incarnatus:* Population density 2-4m², *Donax cuneatus:* Population density 2-3m², *Donax scortum:* Population density 1-2m².


**Mangrove:** *Ipomoea pes-caprae.*

40. Akshi: (Lat. 18°37.772” North and Long. 072°53.890” East). The open fine sandy beach, this is long sandy beach of the Raigad district coast, attractive coastal area inviting to the tourist Maharashtra, India some tourist use to come out of the India, nearby 20-30m area opens during the low tide, in dense climbing mangrove plant *Ipomoea pes-caprae* (L.) Sweet. spread on shore, about 300 - 400m village is on northern side from the high tide mark, due to nearest village there is domestic discharge occurrence, fishing activities is going on by boats.

**Bivalve:** *Sunetta scripta:* Population density 1-2m², *Solen brevis:* Population density 2m², *Cul telus cul telus:* Population density 1-2m², *Donax incarnatus:* Population density 2-4m², *Donax cuneatus:* Population density 2-3m², *Donax scortum:* Population density 1-2m².


**Mangrove:** *Ipomoea pes-caprae.*
41. Alibag: (Lat. 18°39.537”North and Long. 072°51.322”East). The open fine sandy beach, this location is very famous because of the Kulaba fort which is situated on the small island, from India and also out of the India tourist use to come for visiting at this fort, also beautiful sandy beach is there, nearby 10m area opens during the low tide, basically this is sandy beach but with the help of stones and cement construction made very nicely for sitting place, every evening many people use to sit here, about 30 - 40m town is on northern side from the high water mark, due to nearest village there is domestic discharge occurrence, fishing activities is going on by boats , no mangrove species.

**Bivalve:** *Donax incarnatus*: Population density 2-4m², *Donax cuneatus*: Population density 2-3m².


**Mangrove:** Not found.

42. Warsoli: (Lat. 18°39.537”North and Long. 072°51.322”East). The open sandy fine beach tidal zone about 30-40m sandy area open during the low tide, about 10m before the high tide mark stones were put like stone wall, about 100-200m town is on northern side from the high water mark, in dense climbing mangrove plant *Ipomoea pes-caprae* (L.) Sweet. spread on beach, due to nearest village there is domestic discharge occurrence, no fishing activities.

**Bivalve:** *Donax cuneatus*: Population density 2-3m².

Mangrove: *Ipomoea pes-caprae*.

43. Chalmala: The open fine sandy beach, there is exposed inter-tidal mudflat about 5-10m during low tide, about 50 - 60m village is on northern side from the high tide mark, in dense climbing mangrove pnalt *Ipomoea pes-caprae* (L.) Sweet was spread on the beach, due to the nearest village there is domestic discharge occurrence, no fishing activities.

Bivalve: *Donax incarnatus*: Population density 2-3m², *Donax cuneatus*: Population density 2-4m², *Donax scortum*: Population density 1-2m².


Mangrove: *Ipomoea pes-caprae*.

44. Thal: (Lat. 18°41.907”North and Long. 072° 51.469’East). The open fine sandy beach, there is exposed inter-tidal mudflat about 5-10m during low tide, about 50 - 60m village is on northern side from the high tide mark, in dense climbing mangrove pnalt *Ipomoea pes-caprae* (L.) Sweet was spread on the beach, due to the nearest village there is domestic discharge occurrence, no fishing activities.

Bivalve: *Donax cuneatus*: Population density 1-2m².


Mangrove: *Ipomoea pes-caprae*. 

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45. Kiheem: (Lat.18°43.460’N Longi.072° 51.857’E). The open fine sandy beach, from coastal line there are two island is there we can see i.e. Khanderi and Underi which is famous in the India as well as in the world because of island tourist use to come always, on rocky hard substratum having lot of oysters beds which were present, there is no domestic discharge, no mangroves species.


Mangrove: Not found.

46. Awaas: (Lat. 18°46.068”North and Long. 072°51.817’East). The open fine sandy shore, about 15-20m area opens during the low tide, in dense climbing mangrove plant *Ipomoea pes-caprae* (L.) Sweet., spread on shore, village is about 30-40m away from high tide mark on the northern side, due nearest village domestic water discharged, no fishing activities.


2m², *Babilonia spirata*: Population density 1-2m², *Oliva oliva*: Population density 1-2m².

**Mangrove:** *Ipomoea pes-caprae*.

47. **Sasvane:** (Lat. 18°47.159” North Long. 072°51.760” East). The combination of open sandy beach and rocky shore, about 40-50m rocky area exposed during low tide, in dense climbing mangrove plant *Ipomoea pes-caprae* (L.) Sweet., spread on shore, village is about 50-60m away from high tide mark on the northern side, due nearest village domestic water discharged, on rocks lot of oysters bed were found, during low tide many people use to take out oysters for the eating purpose, due to nearest village there is domestic discharge occurrence.

**Bivalve:** *Donax cuneatus*: Population density 2-3m², *Donax scortum*: Population density 1-2m², *Donax incarnatus*: Population density 2-4m², *Solen brevis*: Population density 1-2m².


**Mangrove:** *Ipomoea pes-caprae*.

48. **Kolgaon:** (Lat. 18°48.197” North Long. 072°52.660” East). The open fine sandy beach tidal zone, about 10-20m sandy area exposed during low tide, about 30-40m town is on southern side from the high water mark, due to nearest village there is domestic discharged, no fishing activities, and no mangrove species.

**Bivalve:** Not found.

**Note**: especially on this beach during the low tide, on the mid water mark, near by one km *Hemifusus cochlidium* species were spread in hundred numbers.

**49. Mandva**: (Lat. 18°48.324” North and Long. 072°52.967” East). The open fine sandy beach, about 10-20m sandy area exposed during low tide, in the sandy beach some rocks were present, in scattered small mangrove trees of *Bruguiera sexangula* (Lour.) Poir., were present, about 20-30m town on southern side from the high tide mark, due to nearest town there is domestic discharged, fishing activities is going on by boat.

**Bivalve**: *Saccostrea cucullata*: found on the rocks.


**Mangrove**: *Bruguiera sexangula*.

**50. Kopropli**: (Lat. North 18°47.669”and Long. 072°54.305”East). The soft muddy region, there is exposed inter-tidal mudflat about 20-30m during low tide, some rocks and boulders were present, one gastropod species *Cerithidea cingulata* (Gmelin, 1791) were present dominantly,there is no any nearest village because of that no domestic water discharged, no fishing activities.

**Bivalve**: *Arca granosa*: Population density 2-3m², *Crassostrea cutuckensis*: Population density 12-14m², *Saccostrea cucullata*: found on the rocks.

**Mangrove:** Not found.

**51. Revas:** (Lat. 18°49.801”North and Long. 072°56.801”East). The estuary swampy muddy region, the big Amba river after coming from the western ghat meets to the Arabian sea at Revas, there is exposed inter-tidal mudflat about 10-20 m during low tide,, on the both side of the border of the creek, in dense small and large mangrove trees of *Avicinia marina var. acutissima* Stapf & Mokdenke ex Moldenke, *Avicinia marina* (Forsk.) Vierh., *Avicennia officinalis* L., *Avicennia alba* Blume, *Acanthus ilicifolius* L., *Aegiceros corniculatum* (L.) Blanco, *Sonnetia alba* J.Smith, *Rhizophora mucronata* (Lamarck), *Ceriops tagal* (Perr.) (Robinson)., at the intertidal zone there was cement constructed jetty, peoples can go easily approximately within an half hour from Revas to karanja (Uran) by boat, so many people used to go by this way, there is no domastic discharged.


**Gastropod:** *Clithon reticularis:* Population density 6-8m², *Dostia violacea:* Population density 6-7m², *Nerita plaospria:* Population density 6-8m², *Cerithidea cingulata:* Population density 40-50m², *Nassarius olivaceins:* Population density 2-3m², *Nassarius jacsonianus:* Population density 10-12m², *Onchidium tenerum:*
Population density 2-3m², *Onchidium tigrinum*: Population density 2-3m², *Cassidula nucleus*: Population density 6-7m².

**Mangrove:** *Avicinia marina var.* *Avicinia marina, Avicennia officinalis, Avicennia alba, Acanthus ilicifolius* L., *Aegiceros corniculatam, Sonneatia alba, Rhizophora mucronata, Ceriops tagal*.

**52. Dharamtar:** (Lat. 18°41.795”North and Long. 072°01.754”East). The creek soft muddy region, there is exposed inter-tidal mudflat about 5-10m during low tide, there is steel industry about 200-300m on the eastern side from the high tide mark, fishing activities going on, in dense small and large mangroves tress of *Acanthus ilicifolius* L., *Sonneatia alba* J.Smith, *Rhizophora mucronata* (Lamarck), *Ceriops tagal* (Perr.) (Robinson), *Excoecaria agallocha* L., *Avicennia alba* Blume, *Avicennia officinalis* L. were present on the both side.

**Bivalve:** *Crassostrea cutuckensis*: Population density 14-16m², *Saccostrea cucullata*: found on the rocks.


**Mangrove:** *Acanthus ilicifolius* L., *Sonneatia alba, Rhizophora mucronata, Ceriops tagal, Excoecaria agallocha* L., *Avicennia alba, Avicennia officinalis* L.
53. Dadar: (Lat. 18°48.857”North and Long. 073°01.475”East). The the creek muddy region, there is exposed inter-tidal mudflat about 5-10m during low tide, about 30-40m far away on the southern side there were 3 houses from the high tide mark, in dense large mangrove trees of *Avicinia marina* (Forsk.) Vierh., *Sonnetia alba* J.Smith were present, locality just on the eastern side of the cement constructed bridge, there is domestic discharged, due to fishing activities there is oil discharged.

**Bivalve:** *Perna viridis*: Population density 4-6m², *Arca granosa*: Population density 2-3m², *Crassostrea cutuckensis*: Population density 12-14m², *Saccostrea cucullata*: found on the rocks.


**Mangroves:** *Avicinia marina, Sonnetia alba*,

54. Pirawadi: (Lat. 18°51.267”North and Long. 072°55.088”East). The rocky open shore, about 10-20m black rocky area opens during low tide, small rounded black pebbles were present above high water mark, on the northern side far away from the high tide mark village is about 50-60m, in scattered small mangroves trees of *Bruguiera sexangula* (Lour.) Poir. were recorded, due to nearest village there is domestic water discharged, no fishing activities, no oil discharged.

**Bivalve:** *Crassostrea cutuckensis*: found on rocks planty of numbers. *Saccostrea cucullata*: found on rocks planty of numbers, *Modiolus metacalfei*: Population density 4-6m², *Gafarium divaricatum*: Population density 2-4m², *Dosinia Prostata*: Population density 2-4m².

**Mangrove:** *Bruguiera sexangula,*

**55. Karanja:** (Lat. 18°50.791”North and Long. 072°56.990”East). The rocky open shore, about 10-20m crumbly rocky area open during low tide, pebbles were present above high tide mark, on the northern side far away from the high water mark village is about 10m, there was one cement constructed jetty for the purpose landing of the fish catch, also from Karanja to Revas we can got by passenger boat, due to nearest village there is domestic water discharged, due to fishing activities oil discharged, no mangroves species.

**Bivalve:** *Modiolus metacalfei:* Population density 4-6m², *Gafrarium divaricatum:* Population density 2-3m², *Crassostrea cutuckensis:* found on rocks planty of numbers. *Saccostrea cucullata:* found on rocks planty of numbers.

**Mangrove:** Not found.

56. **Nagaon:** (Lat. 18°51.994” North and Long. 072°56.355” East). The rocky open shore, about 10m rocky area open during low tide, black pebbles were present at the above high water mark, in scattered small mangroves trees of *Bruguiera sexangula* (Lour.) Poir. were recorded, on the eastern side away from the high water mark town is about 20-30m, due to nearest village there is domestic water discharged, no mangroves species.

**Bivalve:** *Gafrarium divaricatum*: Population density 3-4m², *Dosinia Prostata*: Population density 2-3m², *Modiolus metacalfei*: Population density 4-6m², *Crassostrea cutuckensis*: found on rocks planty of numbers. *Saccostrea cucullata*: found on rocks planty of numbers.

**Mangrove:** *Bruguiera sexangula,*

**57. Kegaon:** (Lat. 18°52.995” North and Long. 072°54.704” East). The rocky open shore, about 10-20m rocky area open during low tide, pebbles were present at the above high water mark on the western side, on the rocky pits and crevices two scattered mangroves trees of *Bruguiera sexangula* (Lour.) Poir., *Sonnetia alba* J.Smith., were recorded from mid tide to till high tide mark, on the northern side away from the high tide mark town is about 30-40m, due to nearest village domestic water discharged, no fishing activities.

**Bivalve:** *Gafrarium divaricatum:* Population density 2-3m², *Dosinia Prostata:* Population density 2-3m², *Crassostrea cutuckensis:* found on rocks planty of numbers. *Saccostrea cucullata:* found on rocks planty of numbers.

Mangrove: Bruguiera sexangula, Sonneatia alba.

58. Mora: (Lat. 18°54.676” North and Long. 072°55.445” East). The rocky open shore, about 10-20m on the rocky shore slightly mud mixed, small pebbles were present at the above of high water mark, in dense large mangroves trees of Sonneatia alba J.Smith, Avicinia marina (Forsk.) Vierh. were recorded, on the southern side away from the high tide mark town is about 10-20m, due to nearest village there is domestic discharged, due to fishing activities oil discharged.

Bivalve: Perna viridis: Population density 4-6m², Gafrarium divaricatum: Population density 1-2m², Crassostrea cutuckensis: found on rocks planyt of numbers. Saccostrea cuculatea: found on rocks planyt of numbers.

**Mangrove:** *Sonnetia alba, Avicinia marina.*

**59. Panaje:** (Lat. 18°54.615” North and Long. 072°56.812”East). The rocky open shore, below high tide mark about 60-70m marshy area open during low tide, rocky and pebbles were present at the above of high tide mark, above mid tide mark in scattered mangroves trees *Bruguiera sexangula* (Lour.) Poir., were recorded, there is no domestic water discharged, no fishing activities oil discharged.

**Bivalve:** *Placenta placenta:* Population density 4-6m², *Crassostrea cutuckensis:* found on rocks planty of numbers. *Saccostrea cucullata:* found on rocks planty of numbers.

*betilliraeformis*: Population density 20-30\(m^2\), *Clypeomorous bitasciata*: Population density 13-15\(m^2\), *Cerithium traillii*: Population density 7-8\(m^2\), *Gyranium natator*: Population density 12-14\(m^2\), *Thais lacera*: Population density 8-9\(m^2\), *Thais bufo*: Population density 3-4\(m^2\).

**Mangrove**: *Bruguiera sexangula*.

**60. Sheva**: (Lat. 18°55.739” North and Long. 072°57.214” East). The rocky open shore, about 10-20m rocky and muddy area opens during low tide, big black stones and pebbles were present at the above of high tide mark, in scattered large mangrove trees of *Avicinia marina* (Forsk.) Vierh., were present, JNPT about 40-50m away on the northern side from the high tide mark, no domestic water discharged, no fishing activities.

**Bivalve**: *Saccostrea cucullatea*: found on rocks.

**Gastropod**: *Cerithidea cingulata*: Population density 50-60\(m^2\), *Nerita albicilla*: Population density 3-4\(m^2\).

**Mangrove**: *Avicinia marina*. 
LIST OF MANGROVE SPECIES FROM RAIGAD DISTRICT COAST

1. *Sonneratia alba* J.Smith
2. *Rhizophora mucronata* (Lamarck)
3. *Ceriops tagal* (Perr.) (Robinson)
4. *Acanthus ilicifolius* L.
5. *Aegiceros corniculatum* (L.) Blanco
6. *Excoecaria agallocha* L.
7. *Avicinia marina* (Forsk.) Vierh.
8. *Avicinia marina var.* acutissima Stapf & Mokdenke ex Moldenke
9. *Avicennia officinalis* L.
10. *Avicennia alba* Blume
12. *Ipomoea pes-caprae* (L.) Sweet
CLASSIFICATION OF MANGROVE SPECIES

1. *Sonneratia alba* (J.Smith)

Class : Dicotyledones

Sub class : Archichlamydeae

Order : Myrtilorae

Family : Sonneratiaceae

Genus : *Sonneratia*

Species : *alba*

**Vernacular name:** Kalvand. **Habit & Habitat:** Tree/Shrub growing along the seaward fringe, and inter-tidal areas under estuarine influence. **Aerial Roots:** Conical pneumatophores, many, corky. **Bark:** Smooth cream to brown. **Leaves:** Glabrous, simple opposite, oblong to obovate narrowed to short petiole at base, fleshy and brittle, rounded to emarginated leaf tip, 5-10cm long. **Flower:** White, terminal or branchlet, 1 to a few flowered cyme. **Patel:** White or lower half red, inside sepals red, linear. **Calyx:** 8 lobed, lobes obscure in flower, distinct in fruits, red and green, smith, calyx tube cup-shaped, completely reflexed and ribbed. **Stamens:** White numerous. **Fruit:** Obconical, with pointed style, smooth, green, calyx tube cup enclosing base of the fruit, calyx lobes spread or refluxed up to 200 seeds in a Fruit. **Uses:** Fruit extract is used for poultice in swellings and sprains. The wood is used as firewood. **Status:** Endangered. **Flowering and Fruiting:** March-January.
2. *Rhizophora mucronata* (Lamarck)

Class : Dicotyledones

Sub class : Polypetalae

Series : Calyciflorae

Order : Myrtales

Family : Rhizophoraceae

Genus : Rhizophora

Species : mucronata Poir.

**Common Name:** Long fruited stilted mangrove. **Habit & Habitat:** Trees growing in soft mud along the inter-tidal creeks and in sheltered mangroves under estuarine influence. **Aerial Roots:** Well developed stilt roots. **Bark:** Yellow orange in side with large bark scale on outside. **Leaves:** Simple, opposite, broadly elliptical, aristae (with an abrupt tooth-like tip), 15-20cm long, rolled bright green, cuneate at base, leathery, leaf lower surface yellowish green, black dots scattered. **Flower:** Axillary in axils of fresh leaves, 4-8 flowered, dichotomous came on slightly long slender peduncle, scented, cream colored. **Petal:** 4, white, hairy lanceolate, fleshy. **Calyx:** 4 lobed, ovate. **Stamens:** Up to 12, normally 8, style obscure or short (1mm long), stigma obscurely bifid, yellowish brown. **Fruit:** Viviparous, hypocotyl, slender, long 30-65cm, green to yellowish green, cotyle donary collar yellow when mature, warty surface. **Uses:** Bark extract is used as cure for elephantiasis, febrifuge and hematoma and also used as mosquito repellent. Hypocotyls used for human consumption in some countries. The extract of bark, flower, fruit, leaves and roots is used for treating hepatitis. Also the bark extract is used to cure ulcer and diabetes. **Status:** Endangered. **Flowering and Fruiting:** September-June.
3. *Ceriops tagal* (Perr.) (Robinson)  
(= *C.canollena* Arn; *C.timoriensis* Domin; *C.bioviniana* Tulasne)

**Class**: Dicotyledones  
**Sub class**: Polypetalae  
**Series**: Calyciflorae  
**Order**: Myrtales  
**Family**: Rhizophoraceae  
**Genus**: *Ceriops* Arnold  
**Specie**: *tagal* (Perr.) C.B.Robinson

**Common Name**: Yellow mangrove, **Habit & Habitat**: Tree/shrub growing at intertidal estuarine banks, and or dry and high saline areas, **Aerial Roots**: Buttress making stilt roots, **Stem**: Pyramidal base, **Leaves**: Simple, opposite, obviate, rounded leaf tip, cuneate at base, yellowish green, 4-10cm long. **Flower**: Axillary, hanging cyme, up to 10 flowered on long cylinder peduncle, white, resinous. **Petal**: 5, white to brown, with 3 clavate appendages. **Calyx**: 5 lobed, reflected, smooth green. **Stamen**: 10. **Anther**: Red and obtuse, present on long filaments protruding above petals. **Fruit**: Viviparous, hypocotyls green to brown, pointed apically, up to 25cm long Cotyledonary collar yellow when mature, warty throughout, ridged and grooved, terminally reddish purple, hanging down unlike *C. decandra*. **Uses**: The bark and root extracts are used to stop hemorrhages. The dye is used for preserving fishing nets and the bark decoction as cure for malaria. The wood is used as firewood. **Status**: Endangered. **Flowering & Fruiting**: September-June.
4. Acanthus ilicifolius L.

Class: Dicotyledones
Sub class: Gamapetalae
Series: Bicarpellatae
Order: Personales
Family: Acanthaceae
Genus: Acanthus L.
Species: ilicifolius L.

Common Name: Holly Mangrove. Habit & Habitat: Shrub up to 2m tall growing robustly along tidal swamps in sheltered mangrove areas, landward margins and back waters. Stem: Erect. Aerial Roots: Stilt roots. Leaves: Simple, opposite, lanceolate, narrowed at base, serrate margins armed with spines. Flowers: Sessile, 4cm long spike inflorescence, bracteolate, terminal, corolla light blue or violet. Fruit: Capsule, ovoid-oblong, up to 3cm long, compressed, apiculate, brown, shining. Uses: Fruit used for asthma, as aphrodisiac and blood purifier. Fruit, leaf, root used to cure diabetes, diuretic, dyspepsia, hepatitis and leprosy. Bark, fruit, leaf used to cure neuralgia, paralysis, ringworm, rheumatism, skin disease, stomach pains and snake bites. Status: Endangered. Flowering & Fruiting: March-November.
5. *Aegiceros corniculatam* (L.) Blanco

(*A. majus* Gaerth. *A. fragrans* Koenig; *Rhizophora corniculatum* L.)

**Class**: Dicotyledones  
**Sub class**: Gamopetalae  
**Series**: Heteromerae  
**Order**: Primulales  
**Family**: Myrsinaceae  
**Genus**: *Aegiceros* Gaertner  
**Species**: *corniculatam* (L.) Blanco

**Common Name**: River mangrove.  
**Habit & Habitat**: Shrub growing at sheltered inter-tidal areas, tolerant to high salinities.  
**Aerial Roots**: Not prominent.  
**Bark**: Smooth, alternate, leathery obviate to elliptical, leaf tip notched, cuneate at base, salt glands present, often pink red petiole.  
**Flowers**: White, fragrant, umbel, terminal on long red peduncle.  
**Petal**: 5, white, partly fused.  
**Calyx**: 5 lobed, green.  
**Fruits**: Cryptoviviparous, green to reddish in maturation, smooth, sharply curved.  
**Uses**: The extract of bark and leaf is used to cure asthma, diabetes and rheumatism. The seeds and barks are used as a fish poison. The wood is used as firewood.  
**Status**: Endangered.  
**Flowering and Fruiting**: December-August.
6. *Excoecaria agallocha* L.

**Class**: Dicotyledones  
**Sub class**: Archichlamydeae  
**Order**: Geraniales  
**Family**: Euphorbiaceae  
**Genus**: *Excoecara* L.  
**Species**: *agallocha* L.

**Common Name**: Blinding tree.  
**Habit & Habitat**: Latex-bearing, tree/shrub growing at fringes, landward hardy soil.  
**Latex**: Highly irritant to eyes, causing blisters on skin.  
**Aerial Roots**: Not prominent, sometimes snake-like roots.  
**Bark**: Grayish lenticelled.  
**Leaves**: Simple, alternate, elliptical, leaf tip acute, narrowed at base, greenish turning red before shedding, and 6-9cm long.  
**Petal**: Green and white.  
**Calyx**: Yellowish green.  
**Stamens**: 3, yellow.  
**Flower**: Unisexual, fragrant, catkin-like male spike up to 9cm long, female flowers in short racemes up to 4cm long, axillary in position.  
**Fruit**: Green depressed globose, 3 lobed, dehiscent.  
**Uses**: Leaf extract and sap of these plants are used for treating epilepsy and toothache and also used as purgative. The extract of stem, leaf and sap is used for treating conjunctivitis, haematuria and leprosy. The wood is used as firewood and also as float for fishing nets.  
**Status**: Vulnerable.  
**Flowering and Fruiting**: May-October.
7. *Avicinia marina* (Forsk.) Vierh.

(=*A Intermedia* Griff.; *A.mindanae* Elmer)

**Class**: Dicotyledones  
**Sub class**: Gamopetalae  
**Series**: Bicarpellatae  
**Order**: Lamiales  
**Family**: Avicenniaceae  
**Genus**: *Avicennia*  
**Species**: *marina*

**Common Name**: Gray mangrove.  
**Habit & Habitat**: Small tree/shrub growi in mangrove swamps, and in relatively dry, elevated salty area.  
**Aerial Roots**: Many pencil-like pneumatophores often hooked at apices with many lenticels, sometimes stilt like roots are also formed.  
**Bark**: Smooth, yellowish brown.  
**Leaves**: Simple, opposite, elliptical, leaf tip acute, petiolate, salt glands present, lower surface white to light grey, marginal leaf curling or rolling.  
**Inflorescence**: Terminal or axillary on long peduncle, up to 14 flowered, dense spike, orange yellow, sessile flowers; petals 4, lobes ovate-acute, yellow to orange; calyx 5 deeply lobed, hairy, tomentose; stamens 4.  
**Fruit**: Pericarp green, finely hairy surface, rounded fruit with a very short beak.  
**Uses**: Tender leaves used as cattle feed and the bark used as astringent. Stem extract is used as cure for rheumatism, small pox, ulcers. The wood is used for house construction and as firewood.  
**Status**: Endangered.  
**Flowering and Fruiting**: May-October.
8. *Avicinia marina* var. *acutissima* Stapf & Mokdenke ex Moldenke

**Class**: Dicotyledones

**Sub class**: Gamopetalae

**Series**: Bicarpellatae

**Order**: Lamiales

**Family**: Avicenniaceae

**Genus**: *Avicennia*

**Species**: *marina*

**Common Name**: Gray mangrove. **Habit & Habitat**: Small tree/shrub growing in mangrove swamps, and in relatively dry, elevated salty area. **Aerial Roots**: Many pencil-like pneumatophores often hooked at apices with many lenticels, sometimes stilt like roots are also formed. **Bark**: Smooth, yellowish brown. **Leaves**: Simple, opposite, elliptical, leaf tip acute, petiolate, salt glands present, lower surface white to light grey, marginal leaf curling or rolling. **Inflorescence**: Terminal or axillary on long peduncle, up to 14 flowered, dense spike, orange yellow, sessile flowers; petals 4, lobes ovate-acute, yellow to orange; calyx 5 deeply lobed, hairy, tomentose; stamens 4. **Fruit**: Pericarp green, finely hairy surface, rounded fruit with a very short beak. **Uses**: Tender leaves used as cattle feed and the bark used as astringent. Stem extract is used as cure for rheumatism, small pox, ulcers. The wood is used for house construction and as firewood. **Status**: Endangered. **Flowering and Fruiting**: May-October.
9. *Avicennia officinalis* L.  
(=*A. tomentosa* Willd.)

**Class**: Dicotyledones  
**Sub class**: Gamopetalae  
**Series**: Bicarpellatae  
**Order**: Rhizophorales  
**Family**: Avicenniaceae  
**Genus**: *Avicennia*  
**Species**: *officinalis*

**Common Name**: White mangrove  
**Vernacular Name**: Tiwar  
**Habit & Habitat**: Tall tree growing in mudflats, river bank, and or low saline areas.  
**Aerial Roots**: Many pencil-like pneumatophores often hooked at apices with many lenticels, sometimes stilt like roots are also formed.  
**Bark**: Smooth, grey to brown lenticellate, papery peeling.  
**Leaves**: Simple, opposite, ovate to elliptical, leaf tip rounded, tapering at base, salt glands present.  
**Fruit**: Pericarp greenish yellow. Densely hairy, wrinkled surface, heart-shaped fruit, larger than *A. marina* seed cryptoviviparous, 8-11 cm long.  
**Uses**: The extract of fruits and leaves used as aphrodisiac, cure for diuretic, hepatitis, bark extract for leprosy. Fruit extract used for relief from ulcers. The wood is used as firewood and for making pillers and frames. The leaf is used as fodder for cattle.  
**Status**: Endangered  
**Flowering and Fruiting**: April-August.
10. *Avicennia alba* (Blume)

(=*A. marina* (Forsk.) Vierh. Var. *alba* (Blume) Bakh.)

**Class:** Dicotyledones  
**Sub class:** Gamopetae  
**Series:** Bicarpellatae  
**Order:** Lamiales  
**Family:** Avicenniaceae  
**Genus:** *Avicennia* L.  
**Species:** *alba* Blume

**Common Name:** White mangrove  
**Vernacular Name:** Tivar

**Habit and Habitat:** Small tree growing in inter-tidal areas, dry areas, tolerant to high salinity. **Aerial Roots:** Pencil lime pneumatophores, spongy narrowly pointed relatively slender stilt roots. **Bark:** Dark, grey or even black. **Leaves:** Simple, opposite, lanceolate to elliptical, acute tip, cuneate at base, salt glands present, upper surface pale green, lower surface silver grey to white. **Inflorescence:** Scented, terminal or axillary on long peduncle, up to 30 flowered spike, style indistinct, petals 4 yellow to orange, calyx 5 lobed, stamens 4. **Fruit:** Cryptoviviparous, pericarp yellowish green, finely hairy surface, curved fruit with relatively long beak. **Uses:** Leaf and fruits used to cure antifertility, skin disease, tumors, ulcers and small pox. The bark sap used as contraceptive. The wood is used as firewood and for making pillers and frames. **Status:** Critically endangered.

**Class**: Dicotyledones  
**Sub class**: Polypetala  
**Series**: Calyciflorae  
**Order**: MyrtalesLamiales  
**Family**: Rhizophoraceae  
**Genus**: *Bruguiera* L.  
**Species**: *sexangula* (Lour.) Poir.

**Common Name**: Large-leafed orange mangrove  
**Vernacular Name**: Tivar.  
**Habit and Habitat**: Small tree growing in inter-tidal areas, dry areas, tolerant to high salinity. **Aerial Roots**: Pencil lime pneumatophores, spongy narrowly pointed relatively slender stilt roots. **Bark**: Dark, grey or even black. **Leaves**: Simple, opposite, lanceolate to elliptical, acute tip, cuneate at base, salt glands present, upper surface pale green, lower surface silver grey to white. **Inflorescence**: Scented, terminal or axillary on long peduncle, up to 30 flowered spikes, style indistinct, petals 4 yellow to orange, calyx 5 lobed, stamens 4. **Fruit**: Crypto-viviparous, pericarp yellowish green, finely hairy surface, curved fruit with relatively long beak. **Uses**: Leaf and fruits used to cure antifertility, skin disease, tumors, ulcers and small pox. The bark sap used as contraceptive. The wood is used as firewood and for making pillars and frames. **Status**: Critically endangered.
12. *Ipomoea pes-caprae* (L.) Sweet

**Class**: Dicotyledones  
**Sub class**: Gamopetalae  
**Series**: Bicarpellatae  
**Order**: Poemoniales  
**Family**: Convolvulaceae  
**Genus**: *Ipomoea* L.  
**Species**: *pes-caprae* (L.) Sweet

**Habit & Habitat**: Herb creeping, vine-Spreading on the sandy Coast. **Leaves**: Simple alternate, bilobed. **Flower**: Rose purple, trumpet-shaped, solitary, axillary. **Fruit**: Round capsule, brown, long ovoid. **Uses**: Leaf extract is used for jelly fish sting dermatitis and for treating rheumatism. **Status**: Not evaluated. **Flowering and Fruiting**: October-February, Sometime throughout the year.

During the study period seven families nine genus and twelve species recorded from Raigad district coast.
Fig. no. 1. Showing families, genus and species from 60 study localities.

Fig. no. 2. Showing gastropod families, genus and species from 60 study localities.

Fig. no. 3. Showing bivalve and gastropod species from 60 localities of Raigad district coast.