

CHAPTER 35



Importance of Taxonomy and Identification in Shell Trade

The gastropods constitute a large and highly diversified class within the phylum Mollusca with 1,00,000 living species, of which the estimated number of valid marine species are around 50,000 to 55,000 (Mollusca Base, 2021). Gastropods encompass 80 % of living molluscs species. Gastropods are considered as the oldest known fossils with their shells being evolved in rocks 540 million years ago. Many gastropods possess a shell that protects the soft body of the animal. In most species, the coiled shell opens on the right-hand side (dextral). Rarely, right-hand coiled species will produce left-hand coiled (sinistral) shells and vice versa. Many species bear an operculum that assists to protect the animal in addition to the shell. About 5070 species have been reported from India belonging to 290 families and 784 genera which are recorded from Gulf of Mannar (428 species), Lakshadweep (424 spp.), Gulf of Kutch (350 spp.), Orissa coast (337 spp), West Bengal coast (425 spp.) and Andaman & Nicobar Islands (1434 spp). Nearly 3,370 species of molluscs are recorded from marine habitat (Venkataraman and Wafar, 2005). Among these, gastropods are the most diverse, followed by bivalves, cephalopods, polyplacophores and scaphopods. About 1900 marine species of gastropods are known to date.

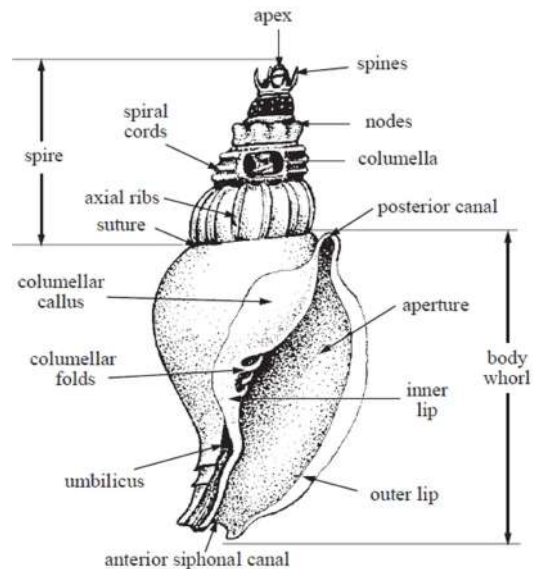
The marine gastropod resources in India comprise a variety of species and the resources are exploited regularly for various purposes. They are mainly exploited regularly for ornamental purposes and food. Very few species forms a regular fishery and most of them are obtained in smaller magnitude making them unnoticed. Even though these resources are smaller in magnitude compared to other fisheries, they play an important role as raw materials for the multi-million dollar 'SHELLCRAFT INDUSTRIES' world over. In southeast coast of India, where the most part of landings of marine gastropods are landed and considered a hub of shell craft industry. Gastropods are characterised by having single shell and an operculum and an active foot. Wide range in size and the shell has been modified enormously in many groups.

Major identifying features of Gastropods

- Structure of the radula (rhipidoglossan, docoglossan, taenioglossan, ptenoglossan, stenoglossan and toxoglossan)
- Structure of the operculum (Chitinous, calcareous, multispiral, paucispiral, unguulate, ovate).
- Character of the aperture

- Character of the columella (curvature, sculpture)
- Presence and character of umbilicus.

Morphometrics of a typical marine gastropod



Glossary of technical terms used in identification of gastropods

Anterior canal - expansion looking like a groove or a tube

Aperture - opening in gastropod shells.

Apex - extremity of a gastropod shell opposite to the anterior region.

Body whorl - most anterior whorl of the gastropod shell, last and largest whorl.

Callus - thickening of the shell, usually secreted on the parietal region of the columella.

Columella - column or pillar located on the centre of a gastropod shell.

Cord - element of gastropod shell sculpture, usually spirally oriented, thicker than line.

Cordlet - narrow cord, thicker than line.

Crenulations - notches, or wrinkles that are small and delicate.

Denticles - features of sculpture elements looking like small teeth-like projections.

Fold / Plication - ridge spiralling on columella.

Granulated - surface covered with minute grains, pustules, or beads.

Growth lines - lines on shell surface indicative of alternating periods of growth and rest;

Incised lines - features of shell sculpture represented by cuts or narrow grooves on the shell surface.

Indentation - cut or notch on shell edge or parietal region.

Knob - large nodule, rounded projection.

Lamella - thin plate or blade-like projection.

- Lip** - edges of the outer surface of the aperture in the gastropod shell.
- Nacreous** - characteristic of being iridescent, like mother-of-pearl.
- Nodules** - projections that are rounded as tubercles.
- Notch** - cut or depression on any margin, canal, or on the gastropod aperture.
- Opalescent** - characteristic of being whitish, but with nacreous luster.
- Operculum** - plate which closes the aperture of gastropod shells
- Outer lip** - edge of the external part of the aperture away from the shell axis.
- Parietal** - region of the internal part of the aperture
- Periostracum** - layer of the outside part of the shell. It is horny and sometimes hair-like.
- Peristome** - aperture rim or periphery.
- Plication** - same as fold.
- Protoconch** - larval shell remaining on the apex of well-preserved gastropod shells.
- Radial** - structures that are directed away from the apex toward the shell margin, in limpets.
- Ribs** - structural elements forming a well-defined, narrow ridge in gastropod shells.
- Serrated** - resembling tiny saw teeth.
- Septum** - partition found in the internal side of gastropod shells; characteristic of slipper-shells.
- Shoulder** - angled region of the whorls of gastropod shells.
- Siphonal canal** - projection of the anterior region shell in tubular form protecting the anterior siphon.
- Spire** - series of successive whorls in a gastropod shell, with exception of the last one.
- Striation** - fine, repeated lines or furrows on shell surface.
- Suture** - line or region of junction between two adjacent whorls in the gastropod shell.
- Umbilicus** - cavity at base of gastropod shells.
- Varix** - axial sculptural element that is more prominent than a costa, and usually more widely spaced;
- Ventral** - region of the animal opposed to the dorsal region; region of the foot in gastropods.
- Whorl** - a complete turn or coil of the gastropod shell.

Commercially important gastropod families

The class Gastropods consists of as many as 39 families (FAO,1998), represented by numerous species. In order to have a broader understanding on the taxonomy of this group the following most commercially valued families numbering 26 have been considered citing the important representative key species. A mention is also made for better understanding on the key contrasting species under the same family which otherwise look different.

Bouchet and Rocroi (2005) use six main clades: Patellogastropoda, Vetigastropoda, Cocculiniformia, Neritimorpha, Caenogastropoda and Heterobranchia, which are generally recognized by researchers.

Patellogastropoda: This is a major group of marine gastropods that contains true limpets, traditionally called Docoglossa.

Vetigastropoda: This includes top shells, abalone, keyhole and slip limpets and several other families.

Cocculiniformia: This group includes white limpets that attach to organic matter in the deep ocean.

Neritimorpha: Includes some sea snails and deep water limpets.

Caenogastropoda: This group is highly diverse and has colonized almost all marine, freshwater, and terrestrial environments. This clade (large group) consist of about 60 % of extant gastropods and contains a large number of ecologically and commercially important marine families such as Muricidae, Volutidae , Mitridae, Buccinidae, Terebridae ,Conidae , Littorinidae, Cypraeidae, Cerithiidae , Calyptraeidae, Tonnidae , Cassidae , Ranellidae , Strombidae and Naticidae .

Heterobranchia: This group includes pulmonates (comprises more than 20,000 species) and opisthobranchs includes sea hares, sea slugs and bubble shells. This group includes the gastropod groups positioned by Thiele's taxonomic scheme into the 'Opisthobranchia' and 'Pulmonata', as well as some 'prosobranch' groups.

Major gastropod species in shell trade

Haliotidae: Shell ear-shaped, depressed and loosely coiled. Spire eccentric. A spiral row of holes on body whorl. Operculum absent.

Haliotis varia Linnaeus, 1758 : Ear shell

Moderately large, thick and broadly ovate shell. Outer surface coarse looking with flat spires. The aperture is large and the inner surface smooth and lustrous. Body whorl with 4-5 perforations near the margin. Olive green with white mottling/ dull greyish brown with green tinge.



Trochidae: Shell conical to globose, often with a flattened base. Aperture without a siphonal canal, nacreous within. Operculum corneous, nearly circular

Trochus radiatus Gmelin, 1791 : Radiate Topshell

Moderate sized top shaped shells. Moderate to well-developed spires. Surface sculptured by spiral rows of tubercles, upper rows of tubercles are larger and pearly inner. Columella is smooth and not denticulated. Ground colour white to pale, uninterrupted axial reddish streak. Aperture white in colour.



Umbonium vestiarium (Linnaeus, 1758) : Button shell

Small solid rounded shells (up to 2 cm). Smooth, highly polished surface. Spire is depressed. Body whorl broad and more or less flattened. Aperture is flattened and 'D' shaped. Colour pattern polymorphic and highly variable in exterior.



Turbinidae: Shell varies greatly in shape and size from orbicular, rounded, top shaped, elongately ovoid or even conical. Body whorl is always enlarged and moderately inflated. Pearly within. Thick calcareous operculum.

Turbo bruneus (Roding, 1798): Brown dwarf turbon

More or less top shaped shell with well- developed spire and rounded whorls, lower surface is rounded or inflated and never flattened. Three to four whorls on the flat inner surface, outer one is rounded, smooth and sculptured. Largest ridge in the middle ends at the margin of outer lip as a distinct tooth. Umblicus narrow and deep with a keel around. Inner lip shiny. Dark greenish brown, irregular yellow blotches. Thick calcareous operculum, with nearly central nucleus.



Turritellidae: shell elongate, sharply conical, with numerous whorls and a small aperture. Whorls sculptured with spiral ribs or keels. Siphonal canal absent. Operculum corneous, rounded.

Turritella duplicata (Linnaeus 1758): Duplicate turret

Shell is large and thick without an umbilicus, often very tall and slender with more or less numerous whorls and usually with spiral sculpture. Aperture is small, rounded or angular and margin unbroken by canals, outer lip distinctly sinuate. Two sharp ridges in the middle of each whorl. This sharp angle tends to disappear in larger specimens but is retained in the top five or six whorls.



Architectonidae: Shell wider than long, with a large, rather flat base. Umbilicus broadly open, within which can be seen the inverted larval shell. A nodular spiral rib bordering the umbilicus. Aperture without a siphonal canal. Operculum corneous, with a tubercle internally.

Architectonica perspectiva (Linnaeus, 1758): Perspective sundial

The shell is moderately large and thick with a broad, flattened base and expressly conical spire and resembles a winding staircase. There is a distinct spiral rib near the lower edge of each whorl. The ground colour is pale brown; the raised band at the bottom of each whorl is spotted alternatively with white and dark brown. Immediately below the suture there is a white spiral band bounded above and below by dark brown spiral bands.



Potamididae: Shell high-conical, with many spire whorls. Sculpture generally coarse. Aperture relatively small, with a short siphonal canal. Outer lip often flaring. Operculum rounded, corneous, with many spiral coils.

Pirenella cingulata (Gmelin, 1791): Girdled horn shell

Small, moderately elongate, solid shell with flat sided whorls and deep suture. The surface of each whorl bears four distinct spiral ridges. The tubercles on the ridges are so arranged as to form regular transpiral rows. The anterior canal is represented by a deep notch. Dark brown coloured shell with two or three white lines per whorl.



Strombidae: shell thick and solid, with a relatively large body whorl. Aperture with a well-marked siphonal canal. A distinct notch along the anterior margin of the outer lip. Operculum corneous, claw-like

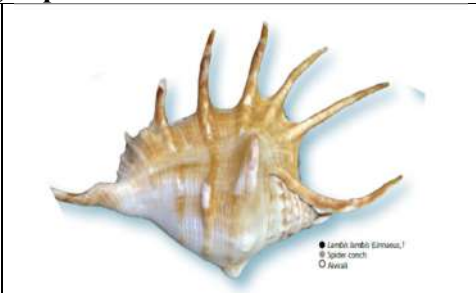
***Laevistrombus canarium* (Linnaeus, 1758) : Dog conch**

Large, thick and heavy shell. Spire very small compared with globus, pear shaped body whorls. Thick wide incurved lip extending length of body whorl. Body whorl much broader than the height of the shell. Columellar callus well developed. White or cream with fine wavy network of brown lines. Aperture white.



***Lambis lambis* (Linnaeus, 1758): Spider conch**

Shell very large with thick callus zone. Outer lip bears 7 fingers like channelled processes. Anterior canal long and pointed. Shell covered with horny periostracum. Shoulder angular and strongly nodulated near suture. Chestnut or cream yellow with brown markings. Callus and inner part smooth white or cream in colour.



Naticidae: shell globular to ovate-conical. Outer surface smooth or with reduced sculpture. Aperture large, semicircular. Siphonal canal absent. Umbilicus open or closed, sometimes with an internal rib. Operculum corneous or calcified.

***Neverita didyma* (Roding, 1798): Bladder moon shell**

Shell quite large, globular in shape and decidedly wider than long. Spire short, poorly protruding, with slightly convex whorls and shallow sutures. Outer surface of shell smooth apart from fine lines of growth. Umbilical callus with a deep median groove. Operculum corneous. Colour bluish grey to light brown or fawn. Whitish on base and umbilicus, and sometimes with faint spiral banding. Operculum yellowish brown.



Cypraeidae: Shell ovate or oblong, Spire concealed under body whorl. Surface highly polished, smooth. Aperture long and narrow channelled at both ends. Both lips with teeth. No operculum.

***Cypraea tigris* (Linnaeus, 1758): Tiger cowry**

Shell, glossy, solid, heavy and inflated. Dorsum elevated and dome shaped. Dorsal surface profusely ornamented with large rounded blackish brown spots of various size on white base. Both the lips are dentate and curved inside, giving the aperture a slit like appearance. Base flat or slightly concave. Dorsal side inflated with an unbranched, linear mantle groove.



***Monetaria annulus* (Linnaeus, 1758) :Ring cowry**

Ovate,humped shell with coarse teeth. Dorsum creamy bluish with clear golden yellow ring where dorsum meets marginal calluses. Margins base and teeth mushroom.



Cassidae:Shell thick and solid, with a large body whorl and rather small, conical spire. Sculpture variable, axial varices sometimes present. Aperture elongate, with a short siphonal canal, recurved dorsally. Outer lip thickened. Inner lip with a shield-like callus. Operculum quite small, corneous.

***Phalium glaucum* (Linnaeus, 1758) :Grey bonnet**

Shell moderately large, ovate to globular with short pointed spires. Spiral rows of blunt or sharp tubercles on spire. Outer lip thickened with short teeth along inner edge and three or four sharp spines projecting basally from outer edge. Broad columella shield flared and crossed by numerous strong and irregular ridges. Dark grey with orange or brownish blotches on varices. Aperture dark brown pinkish on outer lip.



Ficidae: Shell thin, pear-shaped, drawn out anteriorly into a long, tapered and gracefully curved siphonal canal. Operculum absent

***Ficus ficus* (Linnaeus, 1758) : Common Fig shell**

Thin shell somewhat pear-shaped with a long narrow aperture. Large body whorl with tiny spire. Spiral ribs and longitudinal striations less distinct and give a reticulated outer surface. Shell surface finely serrated. The inside is orange and there is no operculum. Shell brownish in colour with narrow interrupted lines of dark brown and a few broader whitish lines interrupted with larger patches of dark brown.



Bursidae: Shell ovate, often slightly dorso ventrally compressed, with 2 strong axial varices per whorl. Periostracum obsolete. Aperture with a short siphonal canal and a distinct posterior canal. Operculum corneous.

***Bufoaria crumena* (Lamarck, 1816): Purse frog shell**

Shell moderate sized; broad, ovate; apex pointed; sculpture composed of nodulose spiral threads; Body whorl with rows of short sharp nodes; remaining whorls with single spiral row of tubercles. Two fin-like varices on both sides; varices with sharp nodes at regular intervals. columella denticulate at the base; Siphonal canal short and twisted; colour light brown; with dark brown spots close to the nodes; aperture and lips white with slightly orange tinged.



Tonnidae: Shell thin, globose, with a short spire very inflated body whorl. Sculpture only spiral. Siphonal canal short. Operculum absent.

***Tonna dolium* (Linnaeus, 1758) : Spotted tun**

Shell is thin, ovate-globose and ventricose. The spire is generally short, of six whorls, slightly flattened. The body whorl is large and very convex. All the whorls are encircled by wide and distant ribs, slightly convex, ornamented with alternate white/red spots, often also orange, numbering ten upon the body whorl. Very large aperture chestnut colored. The outer lip is thin, notched, canaliculated within, and its edge is white and undulated.



Muricidae: shell variably shaped, generally with a raised spire and strong sculpture with axial varices, spines, tubercles or blade-like processes. Periostracum absent. Aperture with a well-marked siphonal canal. Operculum corneous.

***Chicoreus ramosus* (Linnaeus, 1758) : Branched Murex**

Shell large, thick and heavy. Spire short; body whorl slightly inflated; sculptured with thick foliaceous spines on varices. Aperture whitish with light rose pink colour along the aperture margin. Outer lip crenulate and with a prominent tooth-like process anteriorly, siphonal canal moderately long and broad



***Chicoreus virgineus* (Roding, 1798): Virgin murex**

Shell moderately large in size. Spire acute; body whorl large and inflated. Varices prominent on each whorl. Sculpture composed of four rounded varices ornamented with 6 to 7 strong spiral cords alternating with a few minor cords. Aperture large; ovate; anal sulcus not deep; outer lip thick, coarsely denticulate with a conspicuous tooth on the lower part. Colour pale brown with a slight pinkish band on middle of body whorl. Aperture white, margin of aperture pinkish white



***Rapana rapiformis* (Born, 1778) : Turnip shell**

Large, thick and heavy shell. Shape globose. Spires low and grooved. Surface finely striated with weakly developed or blunt spines. Siphonal canal very short. Colour chestnut.



Buccinidae: shell with a fairly high spire and large body whorl. Outer surface smooth or with sculpture, without axial varices. Siphonal canal rather short. Operculum corneous.

***Nassaria coramandelica* (E.A. Smith, 1894) : Indian phos**

Shell small, fusiform; spire high; Body whorl half the length of total height; Sculpture formed of narrow axial ribs and thin spiral ribs inter crossing to form nodules at junctions. Surface nodulose, interspaces seen between strong spiral cords with fine spiral thread. Aperture narrow with lirations within, outer lip thick and margined by a varix. Colour half white or dull brown with white aperture.



Babyloniidae: Shell with a fairly high spire and large body whorl. Outer surface smooth or with sculpture, without axial varices. Siphonal canal rather short. Operculum corneous

***Babylonia spirata* (Linnaeus, 1758) : Spiral Babylon**

Body whorl inflated, spire high and elongate, sutures deep and channelled. Shoulders prominent; whorls inflated; columella smooth and heavily calloused; umbilicus broad, deep, and heavily calloused. Aperture large, ovate, outer lip sharp and strongly flexed at the top, interior of aperture smooth and thickened; Colour white with prominent light brown blotches, oblique streaks and spots; aperture ,outer lip and columellar callus white, fasciole orange brown, tip of apex and aperture tinged blackish;



***Babylonia zeylanica* (Bruguiere) : Indian Babylon**

Shell fusiform, less solid and with less inflated whorls, body whorl narrower than in *Babylonia spirata*, sutures not canaliculated. Spire high ending in dark purple apex. Aperture dark, outer lip sharp and smooth, but not flexed at top, columella smooth with heavy broad callus posteriorly but narrow anteriorly. Surface smooth, colour white with large brown blotches.



Melongenidae: shell pear-shaped to fusiform, nodular to spiny on the shoulder. Aperture anteriorly narrowing into an open siphonal canal. Columella smooth. Operculum corneous.

***Volegalea cochlidium* (Linnaeus,1758) : Spiral melongina**

Whorls strongly and angularly shouldered. Shoulder bears strong tubercles which are fewer and more widely separated. Spiral ridges prominent, except on body whorl. Sutures sunk in deep, narrow grooves. Aperture elongated and rectangular, anterior canal wider. Colour dark reddish brown. Columella pale yellow brown. Periostracum brown.



Olividae: shell elongate-ovate, with a short spire, a large body whorl and channeled sutures. Surface smooth, highly polished. Aperture elongate, with a short siphonal canal. Inner lip calloused, with oblique grooves anteriorly. Operculum absent.

***Agaronia gibbosa* (Born I von, 1778): Gibbosus olive**

Shell moderately large, stout, thick upto 60mm in height , fusiformly ovoid, surface smooth and highly polished; spire rather short, but acuminate, apex pointed, lower part of body whorl is generally sharply demarcated from the upper by an oblique spiral line. Anterior canal in the form of a semilunar notch. Colour pale yellowish brown with a prominent yellow band at the base, mottled with black spots, sometimes whitish with zig zag transspiral brownish bands, spire and columella yellowish white, aperture bluish white



Turbinellidae: Shell thick and heavy, biconical to fusiform, often nodulose to spinose on shoulder. Periostracum conspicuous. Siphonal canal present. Inner lip with strong folds. Operculum corneous.

***Turbinella pyrum* (Linnaeus, 1767): Sacred chank**

Shell large, thick and heavy with large anterior canal. Three or four prominent columellar plicae present. Spire well elevated. Whorls with feebly developed shoulders. It is usually pure white under a heavy brown periostracum, but it can also be a pale apricot color. It can sometimes be dotted with dark brown.



Harpidae: Shell ovate, with an inflated body whorl and a small conical spire. Surface glossy, with strong axial ribs. Inner lip covered by a smooth, large callus. Columella without folds. Siphonal canal short and wide. Operculum absent.

***Harpa major* (Roding , 1798) : Large/Major harp**

Shell medium to large in size; broad, oval; solid; body whorl inflated; with a heavily calloused spire, not much elevated. Aperture large and widely ovate; outer lip arcuate. Body whorl ornamented with twelve axial ribs ending in spines on subsutural ramp; interspaces provided with fine axial striae ; colour pinkish, space between ribs coloured white; columellar region dark chestnut brown in colour The columella, or the lower portion of the inside coil, has dark brown coloring.



Volutidae: shell variable in shape, often glossy and brightly coloured. Aperture long, with a short siphonal canal. Inner lip with strong folds, weaker posteriorly. Operculum horny, often absent.

***Melo melo* (Lightfoot, 1786): Bailer shell**

The notoriously large shell of *Melo melo* has a bulbous or nearly oval outline, with a smooth outer surface presenting distinguishable growth lines. The outside of shell colour is commonly pale orange, sometimes presenting irregular banding of brown spots, while the interior is glossy cream, becoming light yellow near its margin. The columella has three or four long and easily distinguishable columellar folds. It has a wide aperture, nearly as long as the shell itself, yet this species is known to have no operculum.



Turridae: shell generally fusiform, with a high spire. Siphonal canal well marked. A characteristic notch along the posterior part of the outer lip reflected in the growth lines. Operculum corneous.

***Unedogemmula indica* (Roding, 1798) :Indian turrid**

The fusiform shell is somewhat less ridged and striated and has a long siphonal canal. The shoulder angle is very slight, the central ridge forming a carina. The other revolving ridges are smaller and closer than other species in this genus. The whole surface is covered with close, raised revolving lines, of which two or three below the carina are more prominent. The color of the shell is whitish with minutely numerous brown-spots and with usually a row of larger spots below the suture.



Conidae: shell cone-shaped, with a low spire and a well-developed body whorl tapering towards the narrow anterior end. Aperture very long, with a short siphonal canal. Operculum corneous, quite small.

***Conus (Dendroconus) betulinus* (Linnaeus, 1758) : Betulline cone**

Large, thick and heavy and elegant cone. Spire almost flat and slightly elevated at the last few whorls. Body whorl slightly globular. Basal portion slightly threaded. Trans-spiral plates or growth lines can be seen. The color of the shell is yellow or orange-brown, with revolving series of spots, and short lines of chocolate upon narrow white bands. The spire is radiated with chocolate.



***Conus geographus*(Linnaeus,1758) : Geography cone**

The ground color of the shell is pink or violaceous white, occasionally reddish. It has a mottled appearance, clouded and coarsely reticulated with chestnut or chocolate, usually forming two very irregular bands. This intricately brown-and-white pattern is highly prized by shell collectors. Wide, violaceous white or pink aperture and numerous shoulder ridges or spines. The shell is covered with thread-like revolving striae, usually nearly obsolete except at the base. The flattened spire is striated and coronated.



***Conus virgo* (Linnaeus, 1758) : Virgin cone**

Moderately large to large pale yellowish brown tinged with violet at the base, solid to heavy. Last whorl conical; outline slightly convex at apical fourth, straight below. Shoulder angulate. Spire low, outline slightly concave to slightly convex. Last whorl with weak to obsolete spiral ribs near base; widely spaced fine ribs and wrinkled threads between may extend to centre or beyond.



Operculum – Gate way of Marine gastropod snails

The most gastropods are born with hard, horny or shelly plates attached to the upper surface of the foot that close the shells when the soft parts of the animals are retracted. These plates are known as operculum. It is often round, or more or less oval in shape. The operculum serves as a sort of trapdoor-like devices to close the aperture of the shell when the animal is retracted.

Operculum are of four types.

- Multispiral or polygyrous with numerous turns and a central nucleus
- Paucispiral or oligogyrous with few turns

- Concentric
- Calcareous operculum

Turns/pattern on the dorsal surface of both multispiral and paucispiral opercula are spiral *i.e.* a shape of continuous, curving lines or arcs which is in a continuous and gradually widening around a nucleus and nucleus of these opercula can be formed either internally or marginally or terminally. Pattern/turns on the dorsal surface of concentric opercula are concentric *i.e.* a shape made up of circles or rings shares the common centre wherein the larger often completely surrounding the smaller ones forming a concentric pattern. Calcareous operculum is strongly calcified externally, its inner layer corneus, usually showing spiral coiling with a subterminal or central nucleus. Rotation of opercula varies in dextral and sinistral gastropods for the outside spiral pattern – clockwise in dextral and counter clockwise in sinistral forms.



Multispiral



Paucispiral



Concentric



Calcareous

Scheduled marine gastropods

The large number of marine gastropods has been placed in the endangered list which is a major cause of concern (Table 1). An endangered gastropods are the species that is in danger of becoming extinct. In most cases species that are listed as endangered will become extinct in the very near future unless some positive action is taken. The collection, possession and trading of these scheduled molluscs or their products (live or dead) are prosecuted and will attract a punishment of severe imprisonment upto 7 years along with heavy fine under section 50, 51 of wildlife (Protection) Act 1972.




Table 1: List of scheduled marine gastropods from India

Family	Species
Conidae	<i>Conus milneedwardsi</i> Jousseaume, 1894
Cassidae	<i>Cassis cornuta</i> (Linnaeus, 1758)
	<i>Cypraecassis rufa</i> (Linnaeus, 1758)
Charoniidae	<i>Charonia tritonis</i> (Linnaeus, 1758)
Tudiclidae	<i>Tudicla spirillus</i> (Linnaeus, 1767)
Cypraeidae	<i>Staphylaea limacina</i> (Lamarck, 1810) (= <i>Cypraea limacina</i>)
	<i>Leporicypraea mappa</i> (Linnaeus, 1758) (= <i>Cypraea mappa</i>)
	<i>Talparia talpa</i> (Linnaeus, 1758) (= <i>Cypraea talpa</i>)
Fascioliariidae	<i>Pleuroploca trapezium</i> (Linnaeus, 1758) (= <i>Fasciolaria trapezium</i>)
Volutidae	<i>Harpulina arausiaca</i> (Lightfoot, 1786)
Strombidae	<i>Dolomena plicata sibbaldi</i> (G.B. Sowerby II, 1842) (= <i>Strombus plicatus sibbaldi</i>)
	<i>Ophioglossolambis digitata</i> (Perry, 1811) (= <i>Lambis crocea</i>)
	<i>Lambis millepeda</i> (Linnaeus, 1758)
	<i>Lambis scorpius</i> (Linnaeus, 1758)
	<i>Lambis truncata</i> ([Lightfoot], 1786)
	<i>Harpago chiragra</i> (Linnaeus, 1758) (= <i>Lambis chiragra</i>)
	<i>Harpago arthriticus</i> (Roding 1798) (= <i>Lambis chiragra arthritica</i>)
Tegulidae	<i>Rochia nilotica</i> (Linnaeus, 1767) (= <i>Trochus niloticus</i>)
Turbinidae	<i>Turbo marmoratus</i> Linnaeus, 1758

Uses of Operculum

The operculum of certain gastropods is in immense demand from various part of the world. The dried operculum is used as an important raw material by Chinese and Japanese incense makers. There is a huge international market for operculum trade with the price ranging from US \$ 10 to US \$ 185/kg. Operculum is traditionally treated with vinegar, alcohol and water to remove any fishy smell. The cleaned opercula are then ground to a powder and used as a scent fixative which is similar to the technique used in perfumes with certain plant resins. In some countries the operculum is rubbed with an alkali solution prepared from the plant bitter vetch to remove impurities and it is then soaked in fermented berry juice of the Caper shrub or strong white wine, in order to enhance its fragrance. India is one of the major exporter countries of dried high quality operculum. The operculum of certain species of Turbinidae is sometimes used as a very inexpensive organic "gemstone" in rings, bracelets, amulets etc.

These opercula are commonly known as "cats eye". Some of the major gastropod operculum exported are *Turbinella pyrum*, *Chicoreus ramosus*, *Lambis lambis*, *Laevistrombus canarium*, *Rapana rapiformis*, *Murex virgineus*, *Hemifusus cochlidium*, *Babylonia spirata* and *Babylonia zeylanica*. These operculum are exported to different countries the world over especially the eastern countries.

<i>Turbinella pyrum</i>	<i>Chicoreus ramosus</i>	<i>Chicoreus virgineus</i>
		
<i>Babylonia spirata</i>	<i>Lambis lambis</i>	<i>Rapana rapiformis</i>
