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RESEARCH ARTICLE

Ornamental shell craft industry: documentation of processes and products from the Southeast Coast of India

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Abstract

Shell craft industries encompass activities involving the processing, preservation and trade of whole molluscan shells; the conversion of molluscan shells into utility articles, ornaments and showcase objects. The entire processes in the shell industry could be categorized into four stages; collection of raw materials, processing, production of shell crafts and marketing. Large numbers of shell processing units are located along the Tamil Nadu coast. Many of the coastal inhabitants are actively involved in shell collection and supply them to the shell craft industries. A total of 94 species of marine ornamental gastropods are presently involved in the trade. A total of 10 species were found to be imported from other countries for trade.

Keywords: Molluscan Handicrafts; Marine Gastropods, Indian Seashell trade; Trawl by-catch; Tamil Nadu.

1. Introduction

Molluscs are very important from ancient times as they have been commonly used as ornaments, utility articles and medicines, in India they are deeply connected with mythology and tradition. Ornamental shells are those shells that are completely utilized for shell craft and are highly priced among shell collectors as well as conchologists due to their rarity and decorative value (Wells, 1989). They can also be defined as shells which are usually collected by the shell craft industries as whole or for making various types of ornaments or other household and utility articles. The demand for shells as well as articles made from them has led to the growth of shell-craft industry in several parts of the world which undertakes activities like processing, preservation and trade of whole molluscan shells, alteration of molluscan shells into utility articles, ornaments and display items for trade. The expertise in producing ornaments and other useful articles from polished shells cut as per requirement or in whole is called shell craft (Jegadis, 2000). The shell products can be categorized into shell crafts and finished whole shells. Numerous fishermen families are engaged in the collection and trade of shells for this industry (Rao, 2003). Women in coastal villages form a major workforce in industry, apart from collecting the shells from the coastal areas, they decorate and convert the cleaned and polished shells into the final product. The major suppliers in the international trade of shells are the Philippines followed by Mexico, India, Singapore, Haiti, Fiji, Indonesia, Sri Lanka and Vanuatu and the major buyers are the United States, Japan, United Kingdom, Netherlands, France, Germany, Italy, Taiwan and Canada (Venkatesan, 2010).

Among gastropods, turban shells (*Turbo murmurata*), top shells (*Trochus niloticus*) and chanks (*Xancus pyrum*) are the species in demand owing to their huge size and glittering surfaces while polishing (Nair et al., 1976). Commonly found shells in the market include *Lambis chiragra*, *Lambis lambis*, *Babylonia sp*., *Fasciolaria trapezium*, *Tonna dolium*, *X. pyrum*, *Conus spp*., *Hemifusus pugilinus*, *Chicoreus ramosus*, *Murex brunneus*, *Donax spp*., *Pterocas lambis* and *Vasum turbinellum* (Nair et al., 1976; Babu et al., 2011; Mohanraj et al., 2011). *Cassis cornuta* was the favourite of shell collectors among helmet shells, a single large shell fetched a price of about Rs. 150/- (Nair et al., 1976). The ornamental artifacts made out from the shells consist of lamp shades, table lamps, flower vases, fantasy flowers, sculptures of Gods and Goddesses, ashtrays, agarbathi stands, door hangings, shell screens of doors, window curtains, necklaces, rings, ear drops, beads, bangles and hair pins (Natarajan et al., 1988; Rao, 2003). The sinistral sacred chanks and pearls from pearl oysters are connected with the Hindu religion as well as mythology (Narasimham, 2005). The commercially important shells which are widely collected by the shell craft industries of Rameswaram and Keelakarai are *X. pyrum, H. pugilinus, L. lambis, Arca spp, Umbonium vestiarium, Tibia spp, Cypraea spp, Oliva spp, Conus spp, C. ramosus, Murex haustellum, Cymbium melo, Harpa spp, Cypraea talpa, Fusinus spp., Strombus spp., Babylonia spp., Dentalium spp.,* and *Cymatium spp.* (Venkatesan, 2010).

Indian shell artifacts are well accepted in numerous Western countries and the most important export market for India is the United States (Jegadis, 2000). Large, polished shells like ear shell (*Haliotis sp.*), five fingered shell (*Lambis spp.*), *Pinna sp*., beggar's bowl (*Cymbium sp.*) and *Strombus sp.* are very common exhibits in household showcases, restaurants and hotels. Large shells are polished, often imprinted with good wishes and greetings and are marketed as paperweights, tiny shells form pendants, garlands and key chains (Nair et al., 1976). Several shells are gathered for mother of pearl production, which is utilized in attractive inlay work (Rao, 2003).

Natarajan et al (1988) brought the entire activities in the shell industry under three stages namely, (1) collection of raw material (2) processing as well as production of ornamental shells and (3) marketing of the products. The present study aims to document the different stages in shell processing. An attempt is also made to list the ornamental shell products marketed along the southeast coast of India.

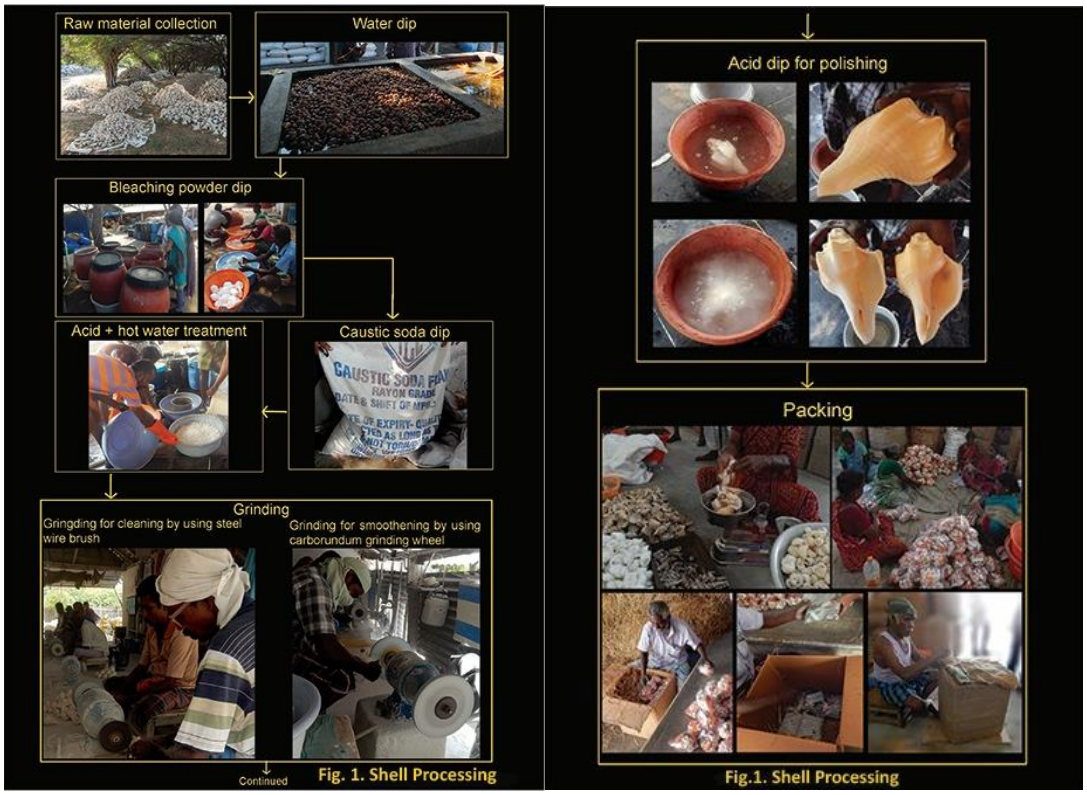

Figure 1. Different steps (Figure left to right) in shell processing.

2. Material and method

A survey was conducted in the shell processing industries located along the southeast coast of India. The areas selected for the study are the coastal areas of Mandapam, Rameswaram, Tuticorin and Kanyakumari. Individuals involved in the shell craft industry like the fishermen supplying trawl by-catch, shell collectors, shell craftsmen as well as traders of ornamental shell products were surveyed by personal interview to obtain primary data on the industry. The survey was based on a comprehensive, pretested questionnaire specifically developed for the purpose (Kothari, 1990). The questionnaires were designed to collect data on different species of gastropods used in the industry, places of collection, species-wise price, details of the articles made and their production cost and information on marketing through retail as well as wholesale outlets. During the survey, three shell processors allowed documentation of the activities. However, photo documentation was permitted only in one unit (Rameswaram). To understand the different products, the survey also extended to shell shops which are located in coastal town areas.

3. Result

3.1. Shell processing

The shell processing industry can be regarded as a network, connecting people of different expertise like shell collectors, wholesalers of raw materials, buyers/suppliers, skilled craftsmen and wholesalers as well as retailers of finished products. Many people are engaged in each stage of the shell processing industry which includes collection of raw materials, processing, and production of shell crafts and marketing (Figure 2). Shell collection is a part-time avocation that offers earnings to the coastal inhabitants and thereby delivers raw material to the industry. The shells go through an elaborate procedure in order to retain their inherent qualities prior to modification to the final product.

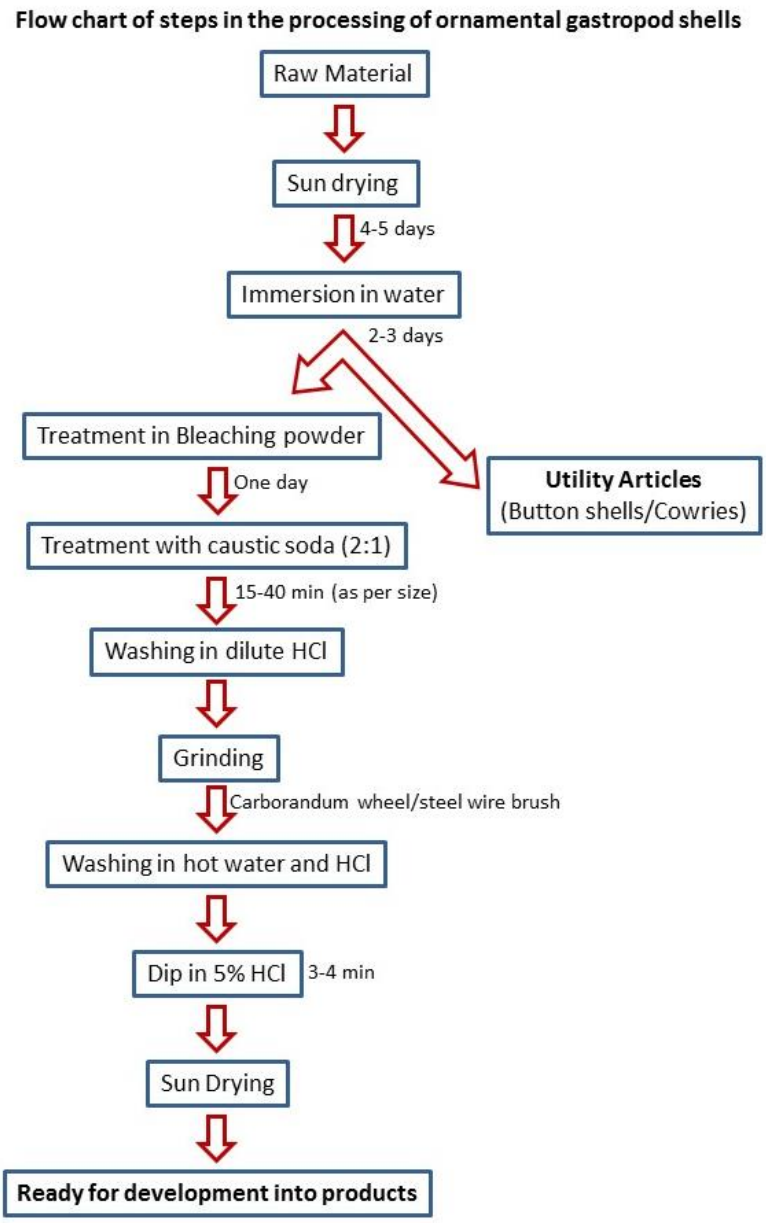

Figure 2. Flow chart of steps in the processing of shells.

Table 1. Important Ornamental Gastropods and products.

Sl.No.	Items made/Species used	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1.	*Trochus radiatus*	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	√	–	–	–
2.	*Pseudominolea nedyma*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–
3.	*Umbonium vestiarium*	√	√	–	–	–	√	–	√	√	√	√	–	–	√	–	–	√	–	√	–	–	√	–
4.	*Turbo intercostalis*	–	–	–	–	–	–	–	–	√	√	√	–	–	–	–	–	–	√	–	√	√	–	–
5.	*Planaxis sulcatus*	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	√	–	√	–	–	–
6.	*Cerithideopsilla cingulata*	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7.	*Nerita polita*	–	–	–	–	–	–	–	–	–	√	√	–	–	–	–	–	–	–	–	–	–	–	–
8.	*Turritella duplicata*	–	–	√	–	–	√	–	–	√	√	√	–	–	–	–	–	–	–	–	–	–	–	–
9.	*Cypraea tigris*	–	–	–	√	√	√	–	–	–	–	–	√	–	–	–	–	–	–	√	–	–	–	√
10.	*Cypraea lynx*	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–
11.	*Erosaria ocellata*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
12.	*Monetaria annulus*	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	√	–	–	√	–	–	√
13.	*Monetaria caputserpentis*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√	–	√	–	√
14.	*Monetaria moneta*	–	–	–	–	–	–	–	–	√	–	–	–	–	√	–	–	√	–	–	–	–	–	√
15.	*Mauritia arabica*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
16.	*Erosaria helvola*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–
17.	*Lyncina vitellus*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
18.	*Lyncina carneola*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
19.	*Ficus variegata*	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–
20.	*Ficus gracilis*	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–
21.	*Natica vitellus*	√	√	–	–	–	–	–	–	√	–	√	–	–	–	–	–	–	–	–	–	–	–	√
22.	*Notocochlis tigrina*	√	–	–	–	–	–	–	–	√	√	–	–	√	√	–	–	–	–	√	–	–	√	–
23.	*Polinices mammilla*	√	–	–	–	–	–	–	–	√	√	√	–	–	–	–	–	√	–	–	–	–	–	–
24.	*Polinices peselephanti*	√	–	–	–	–	–	–	–	√	–	√	–	–	–	–	–	–	–	√	–	–	–	–
25.	*Tibia curta*	–	–	–	–	–	–	–	–	√	–	√	–	–	–	–	–	–	–	–	–	√	–	–
26.	*Dolomena sibbaldi*	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–
27.	*Lambis lambis*	–	–	–	–	–	–	–	–	√	√	–	–	–	–	–	–	–	–	√	–	–	–	√
28.	*Lambis truncata*	–	–	–	–	√	–	√	–	√	√	–	–	–	–	–	–	–	–	√	–	–	–	–
29.	*Strombus canarium*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√	–	–
30.	*Strombus mutabilis*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
31.	*Neverita didyma*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	√	–	–	–	–
32.	*Bufonaria crumena*	–	–	–	–	–	–	–	√	√	√	–	–	–	–	–	–	–	–	–	–	–	–	√
33.	*Bufonaria echinata*	–	–	–	–	–	–	–	–	√	–	√	–	–	–	–	–	–	–	–	–	–	–	√
34.	*Bursa granularis*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–
35.	*Phalium glaucum*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
36.	*Semicassis bisculata*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
37.	*Lotoria perryi*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
38.	*Tonna dolium*	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–
39.	*Cantharus tranquebaricus*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	√	–	√	–	–
40.	*Anachis terpsichore*	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
41.	*Filifusus filamentosus*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√	–	√
42.	*Pleuroploca trapezium*	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
43.	*Volegalea carnaria*	–	√	√	–	–	–	√	–	–	√	√	–	–	–	–	–	–	–	–	–	√	–	–
44.	*Volegalea cochlidium*	–	√	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
45.	*Bullia tranquebarica*	–	–	–	–	–	√	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
46.	*Billia vittata*	–	–	–	–	–	–	–	–	√	–	√	–	–	–	–	–	–	–	–	–	–	–	–
47.	*Nassaria coromandelica*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
48.	*Nassarius nodifer*	–	–	–			–	–	–	–	–	–	–	–	√	–	–	–	–	–	–		–	–
49.	*Nassarius olivaceus*	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50.	*Nassarius stolatus*	–	–	–	–	–	√	–	√	–	√	–	–	–	√	–	–	–	–	√	–	–	–	–
51.	*Scalptia scalariformis*	–	–	–	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–
52.	*Turricula javana*	–	–	–	–	–	√	–	–	√	√	√	–	–	–	–	–	–	–	√	–	–	–	–
53.	*Turricula tornata fulminata*	–	–	–	–	–	–	–	–	√	–	√	–	–	–	–	–	–	–	–	–	–	–	–
54.	*Funa tayloriana*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
55.	*Conus amadis*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
56.	*Conus bayani*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	√	–	–
57.	*Conus betulinus*	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
58.	*Cons biliosus*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
59.	*Conus figulinus*	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√	–	–
60.	*Conus inscriptus*	–	–	–	–	–	–	–	–	–	√	√	–	–	–	–	–	–	–	√	–	√	–	–
61.	*Conus monile*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
62.	*Conus lividus*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
63.	*Unedogemmula indica*	–	–	–	–	–	–	–	–	√	√	√	–	–	–	–	–	–	–	–	–	–	–	–
64.	*Turris bipartita*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
65.	*Babylonia spirata*	√	√	–	–	–	–	–	√	√	√	√	–	√	√	–	–	√	–	√	–	√	–	–
66.	*Babylonia zeylanica*	√	–	–	–	–	–	–	√	√	√	√	–	–	–	–	–	√	–	–	–	–	–	–
67.	*Babylonia areolata*	√	–	–	–	–	–	–	–	√	–	√	–	–	–	–	–	–	–	√	–	–	–	–
68.	*Harpa major*	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	√
69.	*Marginella sp.*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–
70.	*C. ramosus*	–	-	√	–	–	–	–	–	–	√	√	–	–	–	–	–	–	–	–	–	–	–	–
71.	*Purpura bufo*	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–
72.	*Purpura persica*	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–
73.	*Indithais lacera*	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	√	–	–	√	–
74.	*Rapana rapiformis*	–	–	√	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–
75.	*Harpulina lapponica*	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
76.	*Ancilla ampla*	–	–	–	–	–	–	–	–	√	–	–	–	√	√	–	–	–	√	–	–	–	–	–
77.	*Mancinella alouina*	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–
78.	*Agaronia gibbosa*	–	–	–	–	–	–	–	–	–	√	√	–	–	–	–	–	–	–	–	–	√	–	–
79.	*Agaronia nebulosa*	–	–	–	–	–	–	–	–	–	√	√	–	√	–	–	–	–	–	–	–	√	–	–
80.	*Oilva irisans*	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–
81.	*Oliva todosina*	–	–	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–
82.	*Oliva vidua*	–	–	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	√	–	–
83.	*Vexillum rubricatum*	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
84.	*Turbinella pyrum*	√	–	–	–	–	–	√	–	–	√	–	√	–	–	√	√	–	–	–	–	–	–	√
85.	*Pyrnesp*	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
86.	*Melo melo*	–	–	–	–	–	–	√	–	–	√	–	–	–	–	–	–	–	–	√	–	–	–	√
87.	*Hydatina zonata*	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
88.	*Cassis cornuta*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
89.	*Lambis chiragara*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
90.	*Turbinella angulata*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
91.	*Busycon contrarium*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
92.	*Chicoreus virgineous*	–	√	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–
93.	*Turbo operculum*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	√
94.	*Faunus ater*	–	–	–	–	–	–	–	–	√	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Legend of Table 1 - Common products made out of ornamental gastropod shells.

1	Lamp shades	9	Models of birds/animals	17	Shell balls with stand
2	Wall hanging mirror clock	10	Sculptures of gods/goddess	18	Garlands
3	Flower vase and fantasy flowers	11	Shell Framed mirrors/Wall hanging Mirrors	19	Table lamps
4	Kumkum box	12	Paintings/carved picture on shells	20	Shell bracelets
5	Pen holder	13	Studs	21	Key chains
6	Paper weight	14	Hair clips	22	Replicas of monuments
7	Bathi stand	15	Bangles	23	Used as whole decorative items
8	Door hangings or curtains	16	Rings		

The process begins with drying of the collected shells in the backyard for 4 to 5 days in heaps. After which, they are stored in cement tanks filled either with seawater or fresh water for 2 to 3 days in order to remove the soft tissue. The water together with the decomposed flesh and dirt is drained and refilled periodically. The shells are then immersed in bleaching powder solution in cement tanks or jars for one day, washed and cleaned. The encrustations remaining on the shells are scraped off using a scalpel. Dense encrustations are removed on treatment with caustic soda; shells with encrustations are dipped in caustic soda at a ratio of 2:1 with sufficient quantity of water; progress is examined every 30-40 minutes in case of larger shells and 15- 20 minutes for smaller shells and more caustic soda (500 gms each) is added to accelerate the process if needed. The treatment is continued until the shell surface is clean. The shells are then washed with dilute Hydrochloric acid (HCl) and dried.

This is followed by the grinding, which is carried out either for smoothening the shell surface using a Carborundum grinding wheel or for cleaning the shell surface with a steel wire brush. The shells are dipped in hot water with a small quantity of HCl to enhance their natural colouration and make them glossy. Final polishing is achieved by immersing the shells in 5% HCl for few seconds to 3 to 4 minutes depending on the thickness and colour of the shells. Shells like *Cypraea moneta* are dipped in hot palm oil for 1 hour to remove the colour. The button shells are shiny and glossy and are not subjected to washing in HCl, instead, they are immersed in water for two days to remove the tissue remains, sun-dried and directly used for making utility articles. The steps in shell processing are summarized in Figure 1.

The finished products are moved to the packing area. The individual shells and smaller items were packed in small cardboard boxes while large corrugated cardboard boxes were used either as master cartons or for packing large-sized shells/ articles. Shells and products were wrapped in newspaper with their ends twisted before being placed in the carton box. One inch space was left free from the walls of the carton box which was later filled with crumbled newspaper to render the packed articles shock-free. The corners and box top were filled with paddy straw or crumbled newspaper before the final sealing of the box. The carton boxes after sealing were further put into used gunny bags. The boxes are loaded with a minimum of one-inch space between themselves to reduce the chances of damage to the products during transportation. Small shells were also packed in Polythene covers or nylon net bags after weighing and secured with a clip before packing in master cartons.

The present study recorded the occurrence of 94 marine ornamental gastropod species within 63 genera for making shell crafts while 10 species were used exclusively as whole showcase items. Important ornamental gastropods and products made out of them are included in Table 1. In addition to the above-mentioned species in the trade, a total of 10 species were found to be imported from other countries *viz*. *Cyprea caurica*, *Cypraea erosa, Cypraea annulus* and *Turbinella angulata* (Mexico), *Busycon contrarium*, Caligo pecten (*Pecten maximus*) (USA), *Lyropecten subnodosus* (Mexico), *Spondylis imperialis* (Mexico), *Pecten albicans* (New Zealand) and *Angaria atterata*.

4. Discussion

According to previously published reports, about 40-45 species of gastropods are utilized by the shell craft industries (Salim et al., 2017) in India. However, the present study shows the occurrence of 94 marine ornamental gastropod species within 63 genera for making shell crafts along with 10 imported species. Ornamental shell products are of two kinds, worked shell products and the shells used as whole. The popular ornamental shell products observed in the study were key chains, bathi stands, door hangings, fantasy flowers, flower vases, framed mirrors, hair clips, bangles, studs, rings, kumkum boxes, lamp shades, table lamps, pen holders, paperweights, shell balls, wall hanging mirror clocks, garlands, bracelets, models of monuments, birds and animals. Larger species like *Pleuroploca trapezium*, *L. lambis*, *C. ramosus*, *C. cornuta*, *Turbinella pyrum*, *Melo melo, Phalium glaucum*, *Monetaria moneta*, *Monetaria caputserpentis*, *Lyncina vitellus*, *L. carneola*, *Lambis chiragara*, *T. angulata, Busycon contrarium* (sinistral) were also sold for decorating showcases. About 10 genera (*Strombus spp., Cassis spp., Cyprea spp., Lambis spp., Conus spp., X. pyrum, Oliva spp, Babylonia*) of ornamental gastropods were used for the production of shell crafts in the ancient times (Venkataesan, 2010). The ornamental products observed by Natarajan et al (1988) were table lamps, agarbathi stands, lamp shades, beads, ear drops, hair pins, necklaces, fantasy flowers, sculptures of Gods and Goddesses, bangles, shell screens of doors as well as window curtains and flower vases.

Cassis cornuta was the favourite of shell collectors among helmet shells from primitive time; a single large shell fetched a price of about Rs. 150/- (Nair et al., 1976) and now the price of this shell changed to Rs. 450-500/-. Among the ornamental shell products, key chains were the most popular item, large cowrie shells and cones were used for the production of key chains in the past (Jegadis, 2000), recently major species that are used for making key chains are *Natica vitellus*, *N. tigrina*, *Cantharus tranquebaricus, Babylonia spirata*, *B. areolata*, *M. caputserpentis*, *Marginella sp*., *Oliva vidua*. The carved shell key chains were made from species like *Filifusus filamentosus*, *Strombus canarium*, *Tibia curta* and *Bufonaria crumena*. The key chains fetch a price of Rs. 20/- per piece.

The species used for the manufacture of table lamps were *L. lambis*, *Melo indica*, *Murex ramosus*, *Nautilus sp*., *X. pyrum*, helmet shells (*Cypraeacassis rufa*), *Bursa spp*., *Charonia sp*., *Tonna*, *Thais*, *Murex*, *Trochus niloticus, T. marmoratus*, *T. niloticus*, *Nautilus*, *C. ramosus*, *L. lambis* and *M. melo* (Nair et al., 1976; Well, 1989; Rao, 2003). The design and diversity of lamps varied and the most expensive lamps were made out from *Trochus* and *Turbo*, fetching a price of Rs. 75/- (Nair et al., 1976). The important species used for the making of table lamps in the present study are *C. tranquebaricus*, *Cypraea tigris*, *C. ramosus*, *Conus inscriptus*, *Bursa garnularis*, *Nassarius stolatus*, *Turricula javana*, *Indothais lacera*, *M. caputserpentis*, *B. spirata*, and *Lambis trucnata*. The prices of lamps varied from Rs. 100 to 230/- depending on the species used.

Important ornaments made from shells observed in the study are bracelets, garlands, rings, bangles and studs. Some authors reported that the species used for this purpose were periwinkles, olive shells, horn shells (*Cerithidea*, *Pyrene, Planaxis* and *Cerithium)*, *Oliva*, *Umbonium*, *Planaxis*, littorinids, cones, cowries and bivalves like *Placenta placenta* (Nair et al., 1976; Rao, 2003). Mohanraj et al (2011) also reported the use of unfinished or broken shells for carving out shell ornaments. The present study observed shell garlands made from *Turbo intercostalis*, *Planaxis sulcatus*, *Pseudominolea nedyma*, *Pyrene sp*. and *Ancilla ampla,* priced at Rs. 20-40/- per piece. Considering shell bracelets, shells like *T. intercostalis* and *M. annulus* are used. The price of the product varied from Rs. 20 to 30/- per piece. Studs are very popular in the market and the species used for the purpose are *Oliva todosina*, *Agaronia nebulosa, A. ampla,* small shells of *B. spirata* and *N. tigrina*. The price of the studs varied from Rs. 20-30/-. As stated by the previous reports, earrings and studs made from *Trochus*, *Turbo* and *Xancus* and fastened with gold or silver were sold at a price of Rs. 15/- (Nair et al., 1976). However, all three species were not observed during the present study.

Nair et al (1976) give a clear picture of the different kinds of ornaments made from the shells; among them, bangles were the costliest item in South India, a set of four was priced between Rs. 6/- and 15/-. *Strombus canarium* was also used for making rings in Tamil Nadu, Malabar and Kanara regions (Rao, 1974). *T. pyrum* was the only species used for making the shell bangles and rings during the present study, which has more demand in the market and bangles fetched a price of Rs. 150 per piece and rings were priced at Rs. 20/-. Appukuttan and Ramadoss (2000) also reported that chanks were entirely used for bangle making. 'Baby milk feeders' made from chanks reported by Rao (1974) were not observed during the present study.

The occurrence of hair clips decorated with gastropod shells in the market is another important shell craft noted in the present study and the species used for the purposes are *Scalptia scalariformis*, *N. tigrna*, *N. stolatus*, *A. ampla*, *U. vestiarium*, *N. nodifer*, *M. moneta* and small shells of *B. areolata* as well as *B. spirata*. The price of these products varies from Rs. 25 to 30/-. According to Rao (1974) and Babu et al. (2011) ashtrays were also prepared from the gastropod species like *M. virgineus*, *X. pyrum* and *T. niloticus* and were mounted on wooden bases. However, in the present study ashtrays were not observed in the market.

Rao (1974) listed three large gastropods (L. *lambis*, *T. dolium*, *X. pyrum*) used whole for ornamental purposes and reported the use of *M. indica* and *T. marmoratus* as table decorative as well as mantelpieces. Babu et al (2011) recorded the use of large gastropods like *L. lambis*, *L. chiragra*, *T. pyrum* and *T. dolium* for ornamental purposes. *C. tigris* was used for interior decoration on tables as well as shelves. The important species which are widely used as whole showcase or decorative items in the present study were *P. trapezium*, *L. lambis*, *C. ramosus*, *C. cornuta*, *T. pyrum*, *M. melo*, *P. glaucum*, *M. moneta*, *M. caputserpentis*, *L. vitellus*, *L. carneola*, *L. chiragara*, *T. angulata*, *B. contrarium* (sinistral) and turban operculum. The price of all these shells also varied depending on their sizes and species. The present survey observed sinistral *B. contrarium* fetching a price of Rs. 100-3000 per piece as the species with the highest demand in the market. The study also observed that a total of 24 species of ornamental gastropods are used both as whole showcase items as well as decorative items. The present study also observed the occurrence of four scheduled species of gastropods namely *P. trapezium*, *L. chiragara*, *Dolomena Plicata sibbaldi* and *C. cornuta* conserved under the Indian Wild Life Protection Act, 1972.

5. Conclusion

The Gulf of Mannar in Tamil Nadu was famous for ornamental shell industries with a large number of people actively engaged in the collection of shells including women folks were also participating in this part-time avocation. The shell cleaning procedures are times taking and it provides employment opportunities for a large number of peoples. People involved in the shell craft industry were generally unwilling to participate in the survey, probably due to the involvement of scheduled listed (Wild Life Protection Act, 1972) species in the trade. However, a large number of people are actively engaged in shell collection and supply them to the shell craft industries located along the Tamil Nadu coast. These shell products are in great demand in the domestic and international markets.

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