General Introduction
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Seafood is being used, as a main protein source from time immemorial and it mainly comprised of finfishes, crustaceans and molluscs. On a global basis, fish represents about 14% of animal protein. There are differences in the rate of consumption of fish in different parts of the world. It is estimated that 60% of people in developing countries obtain 40 -100% of the animal protein in their diets from fish (Clucas and Ward, 1996).

The world’s annual catch of fish and marine invertebrate is currently at about 90-100 million tons. Certain species of fish and shellfish have remained unutilized or underutilized and only 20% of the total catch is used for human consumption. India is blessed with a coastline of 8129 Km and continental shelf of 0.5 million Km\(^2\), has 2.02 million Km\(^2\) Exclusive Economic Zone with an estimate of sustainable resource potential of 3.9 million tones of fish per annum (Hameed, 1998). Of these total catch, few marine resources are not utilized by the people due to lack of awareness about the rich nutritive value of the seafood products.

The increasing world population and awareness on the nutritional advantages of consumption of fishery products are leading to ever increasing demand for fish. In developing countries many of which rely on fish largely for this animal protein requirements (Jeena et al., 2003). Fish and fish products are now transported between nations, far and wide and hence its freshness or quality is becoming much more important as this reflects on the price.
About two-third of the total landed fish in India are consumed in the fresh condition and the remaining is utilized for preservation by other methods. Food technologists all over the world are focusing much attention on the development of products that are convenient to the consumer (Joseph, 2003).

Approximately 14% of the animal protein consumed by human comes from marine fisheries. However there are tremendous variations between countries. Seafood and seafood-based products have become very popular world wide in recent years, as it is a delicious and nutritious food item rich in protein, vitamins, minerals and polyunsaturated fatty acids. However, seafood is a highly perishable product and food poisoning due to consumption of contaminated and spoiled fishes caught from polluted water continues to occur and hence safety of seafood is a matter of concern (Venugopal, 2003).

The underutilized species are those that are presently caught but not used or not fully used for human consumption. The catch of gastropods is only a small proportion, about 1% of this group (FAO, 1995). The yield of meat from bivalve molluscs is variable, ranging from 8 to 30% depending on species and season of capture.

Molluscs form a valuable resource along east and west coasts of India and Andamans and Nicobar Islands, providing source of food, lime, pearl, decorative shells for shell handicraft trade, raw material for calcium carbide industry and constituent for medicinal preparations. In recent years, due to greater demand of molluscan meat, both in internal market and for export, there is a considerable pressure in fishing efforts leading to increased molluscan landings forming 4-5% of the total fish landings (Appukuttan, 1996).
Molluscs are soft bodied, heterogeneous group of animals with great antiquity and diversity. The shells of molluscs are extremely diversified in shape and colour. Oysters, mussels, clams, pearl oysters and chanks are the important molluscs exploited in India from time immemorial. There are 28 species of bivalves and about 65 species of gastropods, which are of importance in shell trade and for edible purpose. Also 14 species of cephalopods are exploited commercially at present. Bivalves are by far the most important group compared to gastropods for commercial exploitation and utilization as foods. Among the bivalves, windowpane oyster, green and brown mussels, clams and scallops are utilized as food locally and to some extent for processing and export trade. The availability of the above resources in sufficient quantity for commercial processing and marketing has to be studied carefully so that the resources would not be depleted due to large scale exploitation.

Shellfish play a vital role in India's economy and their popularity is increasing due to their delicacy and food value. Bivalves such as oysters, clams and mussels have been serving the nutritional needs of a segment of the coastal population. Most of them are good sources of protein, glycogen and minerals and are easily digestible and comparing favorably with other animal foods (George and Mathew, 1996). They have approximately 8-10% of protein (by weight), 4-5% of carbohydrates, 2-3% of minerals and 1-2% of fat. Among the molluscan shellfish, oysters are considered very delicious and also nutritious with appreciable amounts of glycogen, proteins and vitamins A and B and minerals. A considerable quantity of oysters, clams, mussels and gastropods are processed into frozen, canned and dried products in various countries. Oyster and mussel meat are processed into frozen products, canned products, smoked products, chutney powder and pickle products (Jayachandran et al., 1988; Balachandran et al., 1988).
Most people in India does not realize the value of the edible gastropods as food, but in other countries the gastropod meat is very much relished. Snails and olives have been special items of dinner at the time of Pliny the younger (Cook, 1895). The periwinkles (*Littorina*) that are abundant between tidemarks are collected in large quantities in United Kingdom, U.S.A and Ireland and eaten after boiling (Russel and Yonge, 1963). The abalones, which are said to have delicate flavor, are being used in large quantities in Mexico, U.S.A and Japan and in lesser quantities in Canada, South Africa, Taiwan, Korea and Australia (FAO, 1970). The edible whelks (*Buccinum* Spp, *Busycon* Spp), trochids and strombids are also being used in Japan, Chile, U.K, Korea and Malaysia.

In India, oysters, clams, mussels and a few gastropods are local delicacies along the coastal region from where they are collected. Marine gastropods form the largest group of species in the phylum mollusca in shallow seas. Of these, only a small number of species are suitable for being utilized as food by man. The gastropods are mainly fished in many parts of the world for bait, for their beautiful shells, which are having ornamental value, and for the manufacture of lime. The edible gastropods limpets, trochids, whelks, the sacred chank (*Xancus pyrum*), olives (*Oliva* spp), and the green snail (*Turbo* spp) are represented in different regions of the Indian coasts in the intertidal zone and shallow waters. They are fished by fishermen and poor coastal people for food usually when fishes are not available (Sundaram, 1974). The meat from button shell, *Umbonium* and the Babylon snail, *Babylonia spirata* are the two species that are reported to be sold in fish stalls in Malvan and Bombay. Swamy *et al.* (1988) have reported that the meat of chank (*Xancus pyrum*) is consumed domestically and has been exported to other countries.
The traditional chank divers of Tuticorin started consuming chank meat since the famine of 1877. There is a good demand for the chank flesh as an item of food by this people. The chank flesh is found to be rich in protein and mineral and the values compare favorably with the flesh of any fish (Chari, 1966). The foot of the animal is pulled out of the shell by means of a sharp, curved knife. The flesh so scoop out is boiled, sliced and sun dried for frying. These chank flesh chips are rich in protein and minerals (Venkataraman and Chari, 1953). In fact molluscs such as clams, oysters, scallops and mussels were found to have a large percentage of non cholesterol sterols present that appear to have a positive effect.

In the Gulf of Mannar region, Southeast coast of India, many of the edible gastropods are collected and utilized by the coastal people. Among the gastropods, Umbonium vestarium, Turbo intercostalis, Lambis lambis and oliva gibbosa were eaten by the people by making curries and soup (Rai, 1932; Hornell, 1951). Turbo marmoratus is found in the shallow to deep waters of Andaman and Nicobar islands and regularly fished there along with Trochus niloticus. The foot of these animals are boiled, salted and dried for local consumption and export (Setna, 1933; Rao, 1939).

The cephalopods such as squids, cuttle fishes and octopi are exclusively marine molluscs. These are commercially important and are fished in large quantities in several countries. At present utilization of cephalopods as food is very limited in India. Only the coastal dwelling people have taken advantage of these nutritious items and the people of interior places are not much familiar with the shellfish (Sarvesan, 1974). Most of the squids, cuttle fishes and octopi are valued as food and bait in many parts of the world. Especially people of Japan, Korea, Mediterranean countries, Philippines, Malaysia, Indonesia and Taiwan extensively utilize cephalopods as food. In India, only squids are relished to a large extent.
among the cephalopods. The meat of cephalopods is clean, attractive and has good flavour. It is also highly nutritive.

Nowadays, throughout the world, much emphasis is being given to post-harvest handling, processing and quality control of molluscan products as these items are often involved in various types of food poisoning when compared with the crustacean and finfish products. Handling and quality control aspects of these products assume great importance due to the public health problems involved in the consumption of these products.

In India, a number of seafood processing units are presently engaged in the production of various types of molluscan products for export. Japan is the major importer of Indian molluscan products and to a lesser extent the USA and some European countries (Gopakumar, 1996). Most of the molluscan meats are exported as frozen products.

The need for diversification in fish processing technology for better and more efficient utilization of the catches has been increasingly realized all over the world. For better utilization of low value fish, considerable progress has been made through the development of minced meat technology. Value addition and diversification to satisfy the ever changing and diverse demands from the importing countries as well as urban consumers at home are some of the major challenges faced by the Indian fish processing industry. The development of value added products have utmost importance in the processing sector because of the increased potential for realization of high unit value of those products.
The technology for ready-to-eat / cook food product preparation is now rapidly advancing in India. Many ready-to-eat / ready-to-serve products such as pickle, soup powder, wafers, cutlet, fish balls, fish rolls, chutney powder, sauce, stewed fish and fish sausage are prepared from sea foods. For the utilization of the molluscan meat, development of value added products is very essential and it would increase the consumer acceptability towards the products developed from underutilized molluscs.

Diversification of new products from the molluscan meat is very much essential because direct consumption of the molluscan meat may not appeal to the public; the incorporation of dried molluscan meat for the preparation of value added products was thought to be more acceptable. In India, many ready to cook or ready to serve products such as pickle, flakes, smoked product, chutney powder, chips and soup powder have been prepared from gastropods like Chicoreus ramosus, Babylonio spirata, Pleuroloca trapezium and Xancus pyrum (Patterson et al., 1994, 1995; Ramesh and Ayyakkannu, 1995; Patterson and Ayyakkannu, 1997a, b; Patterson, 2000; Dhanapaul et al., 1994; Shanthini and Patterson, 2001; Shanthini, 2003).

The gastropods, Chicoreus ramosus (Muricidae) and Hemifusus pugilinus (Melongenidae) are landed mainly through skin diving and by-catch from trawl and modified gill nets in Gulf of Mannar region. Nowadays the meat of the Chicoreus ramosus is largely exported as frozen meat to the Southeast Asian countries and they have good market value in the processing sector, but the H. pugilinus meat is not exported to other countries. Further, the meat of these two gastropods is not utilized for domestic consumption, except limited use by a section of fisherfolk as dried chips.
The objective of the present study is the development of value added products using the underutilized marine gastropods, *C. ramosus* and *H. pugilinus* and to create awareness among the public about the protein rich marine gastropods meat. The development of value added products such as pickle, soup powder, chutney powder, smoked products and wafers would help in adding appealing appearance to the gastropod meat among the consumers and thereby increase its utilization in domestic market. The popularization of the developed products among the various sections of people including school children would be much helpful to make aware about the rich value of these underutilized gastropod meat and also to utilize all harvested marine resources wisely without any loss.