Chapter 1

GENERAL INTRODUCTION
1. Introduction

1.1. India

India has a total coastline of about 8129 km along the East and West Coasts. The continental shelf area is 0.512 million Sq k.m. with an exclusive economic zone of 20.2 lakh sq. km (Anon 1993a). India ranks seventh in the marine fish production and 2\textsuperscript{nd} in the inland fish production in the world. The total active fisherman population is 5.5 million and about 6.8 million people are employed in fishing and related activities. The fishing activities are carried out in the West and East Coasts. According to Diwan (2000) harvestable marine resource in EEZ was estimated as 3.93 tonnes and consists of 2.02 million tonnes of demersal, 1.67 million of pelagic fishes and 0.24 million of oceanic resources. Monsoon season from June to August lands pelagic and crustacean fishes. The general catch composition is predominated by pelagic fishes (45\%) followed by demersal fishes (41\%) crustaceans (12\%) and cephalopods (2\%) (Anon, 1997).

1.1.2. Fish utilisation

The utilisation of fish depends on the type of fish landed. The fish landing during 1997, 1998 and 1999 2001 and 2002 in India was mackerel 8.2, 6.64, 8.62, 3.87 and 3.62 \% ribbonfish; 6.41, 4.26, 5.12, 7.56 and 7.41 \% and shark 1.64, 1.78, 1.71, 1.49 and 1.40 \% in the respective years of the total catch (Anon., 1999, 2000b, 2003a). Most of the fishes landed (66 \%) are consumed in fresh condition, 16 \% is used for drying or curing, only 7 \% is used for freezing and 1 \% is used for canning. The per capita consumption of fish is 3.3 kg in 1997 (Anon., 1997). The current per capita consumption is 10 kg / annum and 56 \% of the Indian population is fish consumers (Diwan, 2000). The total quantity of dried items exported during 2000 – 01 was 7532.21 tonnes and value was 7022.15 Rs in lakh, of which 4.91\% was dried shark and 52.64\% was dried fish. The total quantity of dried items exported during 2001 – 02 was 8306.69 tonnes and value was 6795.54 Rs in lakh, of which 1.69\% was dried shark and 39.89\% was dried.
1.2.2. Present status

The state has 9 maritime districts. They are Thiruvananthapuram, Kollam, Alappuzha, Ernakulam, Trichur, Kozhikode, Kasargode, Malappuram and Kannur. Important landing centres are Neendakara in Kollam district, Munambam in Ernakulam district and Calicut in Kozhikode district. There are 222 fishing villages in these districts (Anon., 2000a). The people of these districts are engaged in fish curing / drying activities. The landing of mackerel in Quilon district was 4.83, 6.10 and 9.54 % and ribbonfish was 5.06, 6.56 and 4.47 % and shark was 2.10, 1.86 and 1.03 % respectively during 1997, '98 and '99. The landing of mackerel in Ernakulam district was 10.24, 3.83 and 6.13 % and ribbonfish was 6.80, 1.97 and 4.66 % and shark was 0.45, 0.45 and 0.59 % respectively during above period. The landing of mackerel in Kozhikode District was 13.01, 7.45 and 10.55 and ribbonfish 5.25, 4.19 and 0.95 % and shark 0.71, 0.42 and 0.92 % respectively during the above years out of the district – wise total landings (Anon., 2000a).

The state has many landing centres and fishing villages along the coast. About 61 % of the total landings are consumed in the fresh condition and the remaining part is utilised by various fish based industries. The arrival of the Indo-Norwegian Project during 1962, in the state helped heavy movement in the offshore fishing and allied fields and also in fish processing. The important fishes landed are shrimp, cuttlefish, squid, and other fishes. The important species of fish as sardine, prawns, mackerel, sharks, silver bellies, horse mackerel, sole and ribbon fish. But boat owners as well as the crew do not care about bycatch fishes or low value fishes. In most centres, low value fishes are thrown out in the sea. This weakens the preparation and production of dry fish. During the peak season, facility to preserve the fishes is not usually available. In order to avoid the difficulties, fishes are used as manure for coconut, palm or for other plantations. Further large-scale drying units are not available in Kerala Coast. According to Anon
salting and drying do not require much investment and is unorganised and the margin is also less.

1.3. Fish salting, drying and storage

Fish salting is a primitive and easy method to preserve fish at low expenditure and minimum manpower only is required to produce good quality preserved fish. It can be stored at room temperature for a short period without extra cost. The common salt is added and mixed and kept for short or long period and the water content is reduced in fish by the process called 'osmosis' and salty taste is added to the fish. By reducing water content in the fish, the bacterial action on the fish is reduced to some extent (Nair & Govindan 1978). According to Anon. (1969) there were 67 fish curing yards all along the coast and salt was issued to the fish curing yards at subsidised rates. The main type of fishes used for salting and drying are mackerel, ribbonfish, shark, silver belly, anchovies, lizard fish, kilimeen, malabar sole, sardine and lesser sardine. The quantity of drying of these fishes depends on the landings, demand and quality of fresh fish availability. Frozen and canned seafood form 86 % of seafood exports and dried marine products form only 14 %. A scheme for voluntary pre-shipment inspection of dried fish is also in operation Anon., (1969). But presently there is no clear data about the number of curing yards in the State.

Kandoran (1991) suggested 5% brine solution for wet salting of anchovies. 1:4 salt to fish was recommended by Indian standard institution (1967a, 1967b, 1969, 1974 and Keay 1986) for salting of thread fin bream, Jew fish, shark, mackerel. Thomas & Balachandran (1989) reported 1:3 to 1:10 salt to fish depending on size of fish. They further reported that people of Kerala use 1:4 salt to fish and in Tamilnadu, people use 1:5 salt to fish and the salting time is 12 to 24 hours. Salting is reported to change structural and mechanical feature of muscle tissue (Anon 1982., Stansby, 1963 & Voskresensky, 1965). Salt intake of fish was reported by Ramachandran & Solanki (1991), Serro et al., (1992) and Sankar & Solanki (1992). Chakrabarti et al. 1991: Reddy et al. 1991 and Gupta & Chakrabarti (1994) reported that brine salting reduced a_w from 0.96 to 0.82. Sikorski et al. (1995), Kleimannov et al. (1958) and Devadasan (2000) reported the loss of substantial amount of soluble protein in self-brine. The changes in urea in shark were reported by Kandoran et al., (1965) and Ramachandran & Solanki (1991). Krishnakumar et al. (1986) and Sankar & Nair (1988) reported the formation of FFA and PV. Sanjeev & Surendran (1993) and Hanumanthappa & Chandrasekhar (1987) studied the growth of bacteria using total plate count method in fish.

Devadasan et al., (1975) reported the effect of using tartaric acid and garlic as preservative in pickle curing of fish. Balachandran & Muraleedharan (1975) reported colombo curing of mackerel where they used Gorukha puli (Malabar tamarind) as preservative. The storage life of dried fish using natural preservative and anti-oxidant effect of betel leaf extract on dry cured fish was reported by Kalaimani et al. (1984). Hersom & Hullard (1981) suggested that the action of spices and herbs are greater than the chemicals preservatives; cloves, cinnamon and mustard exert greater preservative action than other spices. Further cardamom, cummin, coriander, pimento and ginger have little effect. Bay leaves, cloves oils are effective against bacteria (Hersom & Hullard, 1981).
fish. The total quantity of dried items exported during 2002–03 was 8177.70 tonnes and value was 8422.51 Rs. in lakh, of which 0.05% was dried shark and 62.34% was dried fish (Anon, 2004).

There is a change in the utilisation pattern of marine catches. There was a drop in the consumption of sun dried and salt cured products and fresh fish consumption increased. Further it showed that as regards the quality of cured fish, curing has often served merely as an outlet for utilisation of unwholesome fish. The cured fish products continued to play an important role in the diet for the weaker sections all over the country as it is comparatively cheaper and are easily transportable. This calls for curing methods, which improve the quality of the end product. The present major productions associated with traditional method, bring considerable wastage during storage due to infestation by insects and fungi and spoilage due to bacteria.

1.2.1. Kerala State

Kerala is the one of the smallest state in the whole of India. Anon (1984) noted that Kerala is a leading marine producer. It has a continental shelf of 40,000 sq km. and the coastal line of nearly 590 km (Anon., 1993a). The state is broadly classified into three natural sub-divisions, the highland, the midland and the lowland. The production of fish in India during 2001 was 1,23,175 tonnes and the state contributed 43,112 tonnes (35.0%) of mackerel (Anon. 2004). Fish curing is popular in this state. About four / fifths of the population are accustomed to take fish regularly. George et al. (1978) reported that the fish landing along Kerala Coast comprises pelagic and demersal fishes and consists mainly of oil sardines, mackerel, other sardines, sciaenids, cat fishes, elasmobranchs, silver bellies, anchoviella, kalava, ribbon fishes, tuna-like fishes thread fin, rock cods, etc.
The storage temperature for dry fish was recommended by Rubbi et al. (1983) as 13°C for superior quality than at room temperature. Camu et al. (1983) for 18°C and Tressler & Lemon (1951) recommended low temperature. Ramachandran & Solanki (1991) and Anon. (1956) studied the organoleptic changes of dried fishes.

The cured fish have very short storage life than dried fish as the water content in the fish is not removed at the surface and the chances of growth of salt loving bacteria are high. Further the salt content on the dried fish absorbs moisture resulting in pink colouration and dun formation, which reduce storage life. Chemical changes due to oxidation of lipids in the muscle tissue cause brown colour at belly region where the fat content of the fish is normally more. This causes rancid odour and discolouration to product and causes less consumer acceptance. So the processor is forced to sell the product even at a low price when the physical appearance of the product is not attractive. The prolonged storage of fish in salt water causes breakage and reduces the original shape and brings less revenue.

There are 58 fresh fish and 9 important dry fish markets in Kerala (Anon., 2000a). The important dried fish / cured fish markets are Alwaye, Changanacherry, Kottayam, Athirumpuzha, Vaniyankulam, Iddukki & Palghat (Anon., 1969, 1984) and Parakkode and Kasargode (Anon., 2000a). In coastal areas, consumption of dried fish is confined mostly to off-season, when fishing is totally stopped. In the interior parts of the state, owing to lack of transport facilities, cured fish is sold for the major part of the year. The population density in the state is the highest among the states in Indian union. The highest pressure in population gives raise to formidable problems both economical and social (Anon., 1984).

1.3.1. Transportation of dry fish

It is an important process to reach product to the destination in time for better price and sales. Various kind of transportation used are train, truck and cars by road
The salted fishes are usually packed in vallam made by using dried coconut leaves or using dried bamboo sticks. This is due to the fact that the packing materials are easily available at low price. The price in market is always flexible even due to simple variation in stock or new arrival. Dry fish from other states influence the dry fish market in state. The latest developments in communication system cause rush of the product in market. So the dry fish processors really have to be more vigilant to sell their product at a high price and to check with the market movements.

During monsoon season, the landing of fresh fish is usually low and demand for salted fish is more. During this period, price of cured fish increases. The price varies to a large extent and it varies with variety of fishes. The consumer has to pay high price. The cost of linear transportation adds enormously to the cost of the product. As a result, the consumers in the hilly and interior region have to pay high price to cured products even though made from low cost fish. This necessitates the need for proper transportation and marketing system.

1.3.2. Aims of present study

- To compare processing strategies of cured fish processors in dry fish processing units at important centres.
- Market analysis of processed, dried or cured fish products. Analysis of risk factors in the business to evolve strategies to overcome the risk.
- Processing of common commercial cured and dried fish using standard Methods and to study the storage characteristics.
- Introduction of HACCP principles for dry fish processing and storage