INTRODUCTION
1.1. **Historical account**

There are two distinct phases in the fish processing industry in India. One is the saturated growth in the age old traditional curing upto 1953 and the second phase is the application of modern preservation methods and the export of frozen and canned fishery products to other countries (Govindan, 1969).

During the first phase, the sea food industry in India was mainly confined to the production and export of cured fish. Dried fish and salted fish have been conventional items in India from even the prehistoric times (Devidas Menon, 1976). For more than hundred years, India exported cured fishery products to the neighbouring
countries. This item occupied an important place in the world market till the early fifties. Ceylon, Burma, Singapore, Mauritius, Hong Kong etc. had been the traditional markets for cured fish from India. Later, India lost some of the markets owing to the political and administrative changes in these countries. Restrictions were imposed by importing countries like Ceylon, Burma stopped off-take of dry fish from India on the basis of a bilateral trade agreement with Pakistan involving exchange of rice for fishery products on account of foreign exchange difficulties. An internal market for the local products for providing impetus to the development of local fisheries was made in Singapore and Hong Kong.

On the basis of a trade agreement between India and Ceylon, 95% of the total export of dried fish from India was taken by Ceylon. The products were shipped from Tuticorin. The import of dried fish by individual importers in Ceylon was banned after the formation of a Co-operative Wholesale Establishment in 1961. The Indian shippers supplied the materials in accordance with the terms and conditions set forth in the price list issued by C.W.E. from time to time. The price list was common for several countries such as India, Pakistan and Aden supplying dried fish to Ceylon. The primary financier
in this trade was the Indian Overseas Bank Ltd., which gave 50% advance against the shipping documents without any inspection of the goods. This provision led to the export of goods of inferior quality and C.W.E. imposed arbitrary cut in the value of goods. The inordinate delay in receiving remittance caused hardships to the exporters. To solve these problems and to help the exporters of cured fish from India, the State Trading Corporation came into the picture. STC gave 65% of the f.o.b. value as advance against the shipping documents after conducting inspection of the products through the approved agency. The final accounts were settled after STC received remittance from CWE.

C.W.E. published a list of 10 exporters who alone were permitted to export dried fish to Ceylon. This was done to maintain quality and to avoid clerical labour involved in dealing with too many small parties. As the result of this, a large number of traditional exporters were thrown out of the business. As requested by them, Government of India issued in 1967 a notification canalizing the export of dried fish (excluding prawns, fish maws, shark fins, beach-de-mer and Bombay duck) from India to Ceylon. The exports were then subjected to vigorous inspection and quality control by the Export Inspection Agency.
In the past, the surplus fish that could not be marketed in fresh condition were cured. The State Governments provided curing yards and salt at subsidised rates to encourage fish curing. Later, in many states subsidy of salt was abolished and the Government curing yards were closed down as the emphasis became more and more for alternate methods of fish preservation (George, 1969).

The decline in fish curing was mainly due to the tremendous increase in the consumption of fresh fish. This is attributed to the fast development of our fishing centres which are connected directly with major consumer markets with motorable roads. Also there has been substantial increase in facilities for icing fresh fish. Mechanised fishing and scientific methods of handling and preservation of fish were practically unknown to our country before the second world war (Govindan, 1975). Decline of fish curing was partly due to lack of demand of cured fish products in foreign markets and also, to some extent, due to the establishment of the freezing and canning industry. The Table 1 shows the trend of disposition of fish catch and the position of fish curing industry in India.
Table 1. Percentage disposition of fish catch in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Market- as fresh</th>
<th>Curing</th>
<th>Freezing</th>
<th>Canning</th>
<th>Reduction</th>
<th>Miscellaneous</th>
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<tbody>
<tr>
<td>1953</td>
<td>42.73</td>
<td>50.74</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1954</td>
<td>42.70</td>
<td>50.70</td>
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<td></td>
<td>6.30</td>
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<tr>
<td>1955</td>
<td>42.70</td>
<td>50.70</td>
<td></td>
<td></td>
<td>6.50</td>
<td></td>
</tr>
<tr>
<td>1956</td>
<td>42.70</td>
<td>50.70</td>
<td></td>
<td></td>
<td>6.60</td>
<td></td>
</tr>
<tr>
<td>1957</td>
<td>42.70</td>
<td>50.70</td>
<td></td>
<td></td>
<td>6.60</td>
<td></td>
</tr>
<tr>
<td>1958</td>
<td>42.76</td>
<td>50.71</td>
<td></td>
<td></td>
<td>6.58</td>
<td></td>
</tr>
<tr>
<td>1959</td>
<td>42.66</td>
<td>50.70</td>
<td></td>
<td></td>
<td>6.60</td>
<td></td>
</tr>
<tr>
<td>1960</td>
<td>47.90</td>
<td>43.80</td>
<td></td>
<td></td>
<td>8.40</td>
<td></td>
</tr>
<tr>
<td>1961</td>
<td>47.96</td>
<td>43.69</td>
<td></td>
<td></td>
<td>8.40</td>
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</tr>
<tr>
<td>1962</td>
<td>47.90</td>
<td>46.77</td>
<td></td>
<td></td>
<td>8.41</td>
<td></td>
</tr>
<tr>
<td>1963</td>
<td>67.40</td>
<td>27.10</td>
<td>0.40</td>
<td>0.10</td>
<td>5.00</td>
<td></td>
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<tr>
<td>1964</td>
<td>70.00</td>
<td>21.70</td>
<td>1.20</td>
<td>0.20</td>
<td>5.90</td>
<td>0.90</td>
</tr>
<tr>
<td>1965</td>
<td>68.30</td>
<td>25.60</td>
<td>1.30</td>
<td>0.40</td>
<td>4.10</td>
<td>0.20</td>
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<tr>
<td>1966</td>
<td>70.40</td>
<td>21.90</td>
<td>1.90</td>
<td>0.60</td>
<td>3.90</td>
<td>0.80</td>
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<tr>
<td>1967</td>
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<td>19.70</td>
<td>3.40</td>
<td>0.80</td>
<td>5.50</td>
<td>1.80</td>
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<tr>
<td>1968</td>
<td>69.10</td>
<td>19.30</td>
<td>4.10</td>
<td>0.70</td>
<td>5.20</td>
<td>1.60</td>
</tr>
<tr>
<td>1969</td>
<td>67.90</td>
<td>21.50</td>
<td>3.50</td>
<td>0.60</td>
<td>4.40</td>
<td>2.10</td>
</tr>
<tr>
<td>1970</td>
<td>67.00</td>
<td>20.30</td>
<td>4.60</td>
<td>0.70</td>
<td>5.50</td>
<td>2.80</td>
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<tr>
<td>1971</td>
<td>66.00</td>
<td>19.30</td>
<td>5.30</td>
<td>0.70</td>
<td>5.60</td>
<td>2.90</td>
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<tr>
<td>1972</td>
<td>68.20</td>
<td>17.50</td>
<td>5.00</td>
<td>0.70</td>
<td>4.90</td>
<td>3.20</td>
</tr>
<tr>
<td>1973</td>
<td>65.30</td>
<td>19.40</td>
<td>5.40</td>
<td>0.80</td>
<td>5.33</td>
<td>3.78</td>
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<tr>
<td>1974</td>
<td>63.70</td>
<td>23.20</td>
<td>4.50</td>
<td>0.40</td>
<td>4.94</td>
<td>3.18</td>
</tr>
<tr>
<td>1975</td>
<td>69.64</td>
<td>18.96</td>
<td>2.80</td>
<td>0.21</td>
<td>6.01</td>
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</tr>
<tr>
<td>1976</td>
<td>69.30</td>
<td>17.88</td>
<td>5.02</td>
<td>0.30</td>
<td>5.00</td>
<td>2.50</td>
</tr>
</tbody>
</table>

Source: FAO year books for different periods
Till 1959, about 50% of the total catch was processed by curing alone. This figure was lowered to about 25% in 1965 and from 1966 onwards, it was retained in the range 18-22% (FAO year book from 1953-76).

To some extent, the decline could be attributed to the low quality of cured fish products produced in the country. Very little attempt has been made to improve the quality of dried and salted fish. Processing of cured fish was in the hands of the illiterate people belonging to a poor sector of the community. Industrial principles and concept had never been applied to this traditional industry. As a result of all these, the fish curing industry in India remained as quite primitive.

In spite of the development of the sophisticated methods like freezing and canning, fish curing is still the largest single method of preservation of fish in India. Salting and drying remain to be the largest single method of fish preservation in the world because of its cheapness and easiness (Govindan, 1971). Fish curing is a labour intensive industry and it does not require much skill and technical expertise. Due to the low cost and easy availability, cured fish has become an ideal protein food to the people of the low income group.
Naturally the fish curing industry could not be taken to modern lines.

The low priced fish is normally taken for curing. Bombay duck, sardines, mackerels, catfish, anchovies, scianids, ribbon fish, silver belly, red mullet and other miscellaneous varieties are used for curing. There is a vast scope for modernising this industry which may even capture foreign markets for such products besides combating the protein deficiency in our country to a large extent. Transformation of traditional curing of fish into modern lines would benefit the fishermen, trade and the consumer.

1.2. Marine fish catch in India

India has a coast line of 6100 km. 1800 marine fishing villages are situated along this coast line with a fishermen population of about 3 million. One third of this population is actively engaged in small scale fisheries. About 2.19 lakhs of indigenous non mechanised craft and 16,000 mechanised fishing boats of various sizes are operated in this country. An annual marine catch of 14 lakhs tonnes is produced in India by using about 25 lakhs of different types of fishing gear (Govindan, 1982).
1.3. Marine products export from India

Till 1953 the handling and processing of fish were carried out by traditional methods in India. During this period, the market for Indian marine products were largely confined to under-developed or developing countries like Srilanka, Burma, Singapore etc. (Chidambaram, 1975). Dry prawn pulp, salted and cured fish, pickled or Colombo cured fish, dried shark fins, fish maws and fish body oil constituted the list of exported fishery products from India. Export figures from 1953-54 to 1982 are given in Table 2. Foreign exchange on account of marine products export increased from Rs.44.033 million in 1953-54 to Rs.3422.429 million in 1982. This increase in export was probably due to the introduction of freezing and canning, world wide scarcity of food and the inflation after the second world war.

The export figures show that our fish processing industry depends mainly on a single item namely prawns which constitutes only 10 to 12% of our total marine landings. All our fisheries activities are centered round this commodity. In the course of this race for specialisation, our traditional fishery products, namely, dried fish, dry prawn pulp, shark fins and fish maws
Table 2. Growth in export of marine products from India

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity (Tonnes)</th>
<th>Value (Rs. '000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1953-54</td>
<td>30,851</td>
<td>44,033</td>
</tr>
<tr>
<td>1954-55</td>
<td>28,641</td>
<td>46,675</td>
</tr>
<tr>
<td>1955-56</td>
<td>23,972</td>
<td>39,219</td>
</tr>
<tr>
<td>1956 (April to December)</td>
<td>18,140</td>
<td>37,201</td>
</tr>
<tr>
<td>1957</td>
<td>22,778</td>
<td>45,861</td>
</tr>
<tr>
<td>1958</td>
<td>30,683</td>
<td>58,647</td>
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<td>1959</td>
<td>33,716</td>
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<td>16,337</td>
<td>40,216</td>
</tr>
<tr>
<td>1961</td>
<td>17,297</td>
<td>41,318</td>
</tr>
<tr>
<td>1962</td>
<td>11,619</td>
<td>37,475</td>
</tr>
<tr>
<td>1963</td>
<td>17,908</td>
<td>58,646</td>
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<td>69,237</td>
</tr>
<tr>
<td>1966</td>
<td>19,153</td>
<td>1,35,246</td>
</tr>
<tr>
<td>1967</td>
<td>21,764</td>
<td>1,99,286</td>
</tr>
<tr>
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<td>24,810</td>
<td>2,20,846</td>
</tr>
<tr>
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<td>30,584</td>
<td>3,30,731</td>
</tr>
<tr>
<td>1970</td>
<td>37,175</td>
<td>3,55,359</td>
</tr>
<tr>
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<td>34,032</td>
<td>3,91,725</td>
</tr>
<tr>
<td>1972</td>
<td>38,271</td>
<td>5,81,317</td>
</tr>
<tr>
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<td>48,785</td>
<td>7,95,763</td>
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<tr>
<td>1974</td>
<td>46,629</td>
<td>7,63,127</td>
</tr>
<tr>
<td>1975</td>
<td>53,412</td>
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<td>1976</td>
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<td>1978</td>
<td>77,946</td>
<td>21,21,574</td>
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<tr>
<td>1979</td>
<td>92,184</td>
<td>26,20,292</td>
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<tr>
<td>1980</td>
<td>74,542</td>
<td>21,88,756</td>
</tr>
<tr>
<td>1981</td>
<td>75,374</td>
<td>28,67,128</td>
</tr>
<tr>
<td>1982</td>
<td>75,136</td>
<td>34,22,429</td>
</tr>
</tbody>
</table>

Source: Statistics of marine products, MPEDA.
which once constituted the backbone of our fishery industry were neglected.

1.4. General methods of fish curing

Fish curing comprises of the traditional methods of preserving fish by drying, salting and smoking.

1.4.1. Sun drying:

Small and lean species of fish are usually sun dried without salting. Fishes like white bait, silver belly, small ribbon fish, Bombay duck etc. are sun dried. The fish is just washed and dried in the sun by spreading the material either on a mat, hard ground or even on a sandy beach. Bombay duck is usually dried on scaffolds. The material is usually dried for 3 days. The advantage of drying fish is that no nutrient is lost during processing. However, commercial sun dried fish will have a high content of sand.

The natural method of drying by solar evaporation is usually adopted for drying fish all over India. As solar energy is available in plenty in tropical countries like India, solar drying has got great economic advantage. Artificial drying of fish is tried only in some isolated cases in India. Due to the high cost involved in the
artificial drying, this method is not widely used in commerce at present.

1.4.2. Dry curing:

In this method, the fish is split open, gutted, washed and salted in a specific proportion depending on the size and species of fish. Salting is done in cement tanks or in any other suitable containers. When the salt penetrates into the fish muscle by osmotic pressure, water is pressed out from the muscle thus forming the self-brine. During the salting process, the fish muscle changes from a translucent to an opaque stage and becomes more fibrous in texture. The salted fish is kept without disturbance for one day or more to get the fish properly ripened or matured. The salted fish is then taken out and rinsed in self brine, sea water or fresh water and dried in sun for 2 or 3 days. If there is rain, the salted fish is allowed to remain in the salting tank for some more days till sun drying is possible. Drying is done on mat, concreted ground, on ropes or directly on the sandy beach. Dried fish is packed in different indigenous containers like bamboo basket, palmirah mat, coconut leaf mat, gunny bag etc. and despatched to markets.
1.4.3. Mona cure:

Mackerels, lactarius etc. are cured by this method in Maharashtra region. The fish is not split open. Instead, the viscera is pulled out through the buccal cavity of the fish. After washing, the salt is stuffed into the belly cavity through the mouth in a specific proportion and stacked in the salting tank. After salting, the fish is dried as in the case of dry curing.

1.4.4. Wet curing:

This method is also known as the Ratnagiri method and it is almost similar to the "Kench cure" of Western countries. Split and gutted fish is salted and stacked in cement tanks and some weight is applied on the top. The self-brine formed is allowed to drain out continuously. After 3 days, the salted fish is packed as such and sent to the market. Fish is not dried in this method. In some areas, the salted fish is directly packed in bamboo baskets with salt and the self-brine flows out freely. After the curing is completed, the same baskets with fish are sent to markets.

1.4.5. Pit curing:

Pit curing is generally done in Tamil Nadu. The
split and gutted fish is salted and stacked in a 60 cm deep pit in the sand with a lining of palmirah leaf mat. The top of the fish is also covered with a similar mat and then with sand. Salting and maturation take place under anaerobic conditions for about 36 to 48 hours. The fish is then taken out of the pit, packed and sent to markets without drying.

1.4.6. Colombo curing:

Fish cured in this way is solely intended for the Colombo market. Mackerel is usually taken for this type of curing. The gutted and split fish is mixed with salt in the required proportion along with small pieces of the Malabar tamarind (Garcinea cambogea) in the ratio 1:10 and tightly packed in wooden drums. Self-brine is retained in the container along with the fish. The drum should be filled with extra brine to replace air from the top layer. The top lid is fixed and made water tight. As the fish is in the medium of concentrated brine fortified with tamarind, the fish attains a characteristic flavour and also gets an added protection. The fish is out of contact with air. The salted fish is not dried.
1.4.7. Smoke curing:

Smoke curing is not usually practised in India. The fish is split, gutted and scored, washed and immersed in brine for a specified period. The brined fish is taken out, drained and surface dried. The fish is then taken to a smoke-kiln. Fish is hung inside the smoke chamber and smoke is generated by burning saw dust, wood shavings, coconut husks etc. Smoking period depends on the species and size of fish. Smoked fish may or may not be dried for some more time to reduce the moisture content and then packed.

At present, fish curing in India consists mainly of salt curing and sun drying. Smoking is rarely practised. Pickling is restricted to South Kanara and Malabar region and the method called "Colombo curing" is almost non-existent now. Pit curing is also almost discontinued (Durairaj, 1981).

1.5. Spoilage in cured fish

Rust is a common type of spoilage seen in salted fish. Fish affected by rust will have colour of rusted iron, unpleasant taste and rancid fat odour. Rust is caused by the oxidation of fat by atmospheric oxygen. Salt present in the fish accelerates the process of
oxidation. The best method of controlling oxidation is by preventing contact with air. Fish should be kept covered with brine during salting and dried fish should be properly packed.

'Pink' or 'red' is a serious type of spoilage seen in salt cured fish. Large quantities of cured fish get spoiled and become unfit for human consumption due to the 'red' attack. This defect is caused by the microorganisms present in the salt used for salting fish. Preventive measures consist of keeping the fish out of contact with air and storing at lower temperature. Chemical preservatives can also be used for arresting the 'red' attack in cured fish.

Salted and dried fish are usually attacked by moulds. Mould attack is not seen at moisture levels below 15%. Chemical treatment can arrest mould growth.

Maggots also attack salted fish. Cheese fly (*Drosophila casei*) deposits its eggs on the salted fish or on the sides of the container. The maggots hatch in two to four days and infest the whole salted fish. The maggot metamorphoses into a red pupa from which a fully grown cheese fly emerges a week later. Keeping the premises clean, use of concrete floors and covering the
salted fish to avoid flies laying eggs are the normal preventive measures.

1.6. **Approach to fisheries extension in India**

Even though extension is a well organised net work all over the country in agriculture and animal husbandry, fisheries field lacks such an infrastructure for its development. Barring a few Central and State Fisheries Departments, many fisheries institutions do not have a separate extension wing. Fisheries extension work is carried out by the Central and State Fisheries Departments and Agricultural Universities. The Fisheries Departments under the Ministry of Agriculture and Irrigation, Government of India is the planning and policy making body for fisheries development in India. The extension Directorate of the above Ministry has the responsibility of organising extension programmes in the agriculture sector. The Fisheries Faculties of Agricultural Universities have, in the recent years, taken up fisheries education at the graduate and postgraduate levels. The four ICAR Institutes, namely, Central Institute of Fisheries Technology, Central Marine Fisheries Research Institute, Central Inland Fisheries Research Institute and Central Institute of Fisheries Education are the
premier organisations responsible for fisheries research and extension activities in India.

Community Development Project and National Extension Services were started in India immediately after independence. Unfortunately these Project and Services did not include fisheries. Very often the Extension Officer for Agriculture or Animal Husbandry was considered to be responsible for giving extension advice to fishermen and fish farmers. In 1951, the Balwant Rai Mehta Commission focussed the attention on the need for separate Extension Officers in fisheries to train the village level workers in this field.

The working group of the Fifth Plan on Research, Training and Extension pointed out that extension is the weakest link in the development of fisheries (Mammen, 1980). The group recommended the following.

1. the establishment of extension training centres, one for inland fisheries and one for marine fisheries.

2. provision of equipment and extension literature support to the state level extension units.

3. starting of Fish Farmers Development Agencies.

4. starting of fishery data and information service and starting a Fishery Information Forecasting Bureau for marine fisheries.
1.7. **Extension Units for fish culture**

The Central Inland Fisheries Research Institute started the first organised extension service in fisheries in the early fifties for organising fish fry trade. The success of this unit led to the establishment of nine more extension units on a regional basis during the second Five Year Plan. The activities of these units included survey of cultivable water areas, correction and improvement of ponds, collection of fish seeds from riverine sources, demonstration of induced breeding, nursery practices, weed control etc. These extension units functioned for about 10 years and later most of them were transferred to the States. Two units were converted into Extension Training Centres. These two centres at Hyderabad and Agra are now functioning under the Indian Council of Agricultural Research (Mammen, 1980).

1.8. **Extension work in fresh water fisheries**

The formation of Fish Farmers Development Agency was an important step for extension work in fresh water fisheries. FFDA provides a package assistance under the direct control of the District Collector. The functions of FFDA include long lease of water areas, training,
extension services, credit and incentives by way of subsidy.

1.9. **Extension work in brackish water fisheries**

This fishery is almost similar to inland fisheries. Many maritime states having water areas like paddy fields, bheels etc. have already practised shrimp culture. However, all these states have run into serious difficulties in the construction of brackish water farms. To solve this problem, Government has proposed to survey, design and prepare project reports for large brackish water fish farms adopting an area development approach. Such large farms will work as 'Collective farms' with the extension support in the matter of fry collection, rearing, harvesting etc. The Central Inland Fisheries Research Institute, Central Marine Fisheries Research Institute, Central Institute of Fisheries Education, Marine Products Export Development Authority and State Fisheries Departments provide technical assistance to interested parties for brackish water fisheries (Mammen, 1980).

1.10. **Extension work in marine fisheries**

Technical expertise and extension support are now available in the country for the culture of mussels, oysters, pearl oysters, sea weeds etc. It is reported that the lagoons or coral islands, the Gulf of Manner,
Palk way, Gulf of Cambay, Gulf of Kutch, certain areas in the Andaman and Nicobar Islands etc. are suitable places for mariculture. Extension support is necessary for fishery information and fishery forecasting. Immediate extension work is also required for conservation, particularly in respect of shrimp resources and protecting juveniles in the back waters. (Mammen, 1980).

1.11. Extension work on fishing craft and gear

The Fifth Five Year Plan gave emphasis on the introduction of mechanised fishing boats mainly for trawling and gill netting. Other fishing methods such as purse seining, pole and line fishing and long lining were also introduced. However, very little work has been done for the improvement of traditional fishing craft like catamaram, canoes and plank built boats.

Substantial improvement has been made on fishing gear materials. The vegetable yarn has been replaced by synthetic yarn, particularly for marine fishing. However, the design aspects of fishing gear have to be further improved which requires more research and extension.

1.12. Extension work on handling and processing of fish

Since the introduction of freezing and canning of fish in India, considerable amount of extension work has
been carried out to maintain the hygienic condition of fish processing plants and the quality of processed fish products. However, similar achievements could not be made in other aspects of fish processing. Processing techniques have been developed in handling, preservation and production of new fishery products from low priced fish and fish wastes. Many of these techniques are not yet adopted by the trade.

1.13. Organisation of fisheries extension by various fisheries establishments

Extension activities in fisheries are carried out by various Central and State agencies. A brief account of the work done by these organisations is given below.

1.13.1. Central Inland Fisheries Research Institute:

CIFRI has been disseminating technologies on modern aquaculture practices by training courses, demonstrations, Operational Research Projects and Lab to Land Programmes. The Institute is regularly organising Fish Farmers Days, exhibitions, film shows etc. for transferring the improved practices of fish farming. Communication is also conveyed to fish farmers through radio, TV, newspapers and extension publications. Representatives of the Institute participate in farmer’s meetings, discussions,
demonstrations etc. organised by the village organisations and other departments. The Institute organises ad-hoc training programmes for the extension, scientific and technical personnel from State Fisheries Departments, fish farmers and bank officials. Training courses are also conducted for fish farmers at Krishi Vigyan Kendras.

An advisory service is maintained for people who visit the Institute for technical advice. Technical queries are replied regularly on various aspects of fish culture. CIFRI has taken up Lab to Land Programmes for transferring the improved aquaculture technology to the fields.

1.13.2. Central Marine Fisheries Research Institute:

Transfer of technology through training, demonstration and other extension programmes has been given priority in the programmes of CMFRI. The Institute has taken up Operational Research Projects on 'blending sea farming with traditional capture fisheries' to train the fishermen in the methodsof mariculture of fishes, prawns and molluscs so that these could be undertaken along with traditional capture fisheries. The integrated approach to blend culture fisheries with capture fisheries for rural development is a new concept in the marine
fisheries sector in India. The appropriate technologies in the culture of various species of fish are demonstrated to the interested fish farmers and entrepreneurs. The Institute is giving technical assistance to State Government Departments on fish culture. The Institute participated in the Co-operative Intensive Prawn Farming Project jointly sponsored by Kerala Government, MPEDA and CMFRI. This project was intended to demonstrate the economic viability of intensive prawn culture to the industry and fish farmers.

Under the Lab to Land Programme of the Institute, CMFRI gives training in scientific farming methods and respective technologies in a phased manner. The Institute also conducts training courses in marine prawn culture, pearl culture, oyster culture, under water diving by SCUBA, fishery resource assessment, population dynamics etc. A Krishi Vigyan Kendra is also run by CMFRI to impart need based and skill-oriented vocational training to fish farmers who intend to go for self employment. Consultancy service and publication of extension literature are other methods followed by CMFRI for technology transfer.

1.13.3. Central Institute of Fisheries Technology:

This Institute has been in constant contact with
the fishing and fish processing industry and maintaining proper feedback on technological problems of the industry. The Institute conducts frequent training courses on various aspects of fishing, fish processing and allied subjects for the benefit of the personnel from the industry, Government Departments and new entrepreneurs. In addition to this, ad-hoc training courses are conducted on improved methods of fishing and fish processing in response to specific requests from the parties. CIFT has got a consultancy service to provide technical information and guidance for entrepreneurs directly and through various other Departments. The Institute organises exhibitions, film shows, fishermen mela and open house discussions to project various technologies developed at the Institute. Demonstrations are organised in different states to show various methods, formulae and recipes developed. The Institute is having provision for replying technical queries pertaining to fishing and fish processing received from different parties. Design drawings of various equipments and machinery developed at the Institute are supplied on specific requests from the parties. CIFT is having facilities to test and give certificate on the equipments, materials and products related to fishery industry. Remedial measures for technical problems or
defects of such items, if any, are also suggested by the Institute. Scientists of CIFTR are regularly visiting fish processing factories to give technical guidance on the maintenance of hygiene of fish processing plants and the quality of processed fishery products.

Publication is another major item helping the technology transfer by this Institute. Extension publications on various technologies developed by the Institute are brought out and distributed to the interested parties.

Lab to Land Programme is still another notable item of technology transfer. Various technologies are transferred under this programme by adopting fishermen families of coastal areas.

The Institute conducts follow up action and studies the impact of various extension programmes conducted so as to identify and solve the problems in technology transfer. The feedback information from the field is used to formulate problem oriented research programmes of the Institute.

1.13.4. Central Institute of Fisheries Education:

This Institute has been organising short term
training programmes in various aspects of fresh water and brackish water fish farming for the nominees of State Fisheries Departments and Corporations, private entrepreneurs, the educated unemployed, fish farmers, fishermen, rural youth and candidates sent by fish farmers, industry and social organisations.

1.13.5. Marine Products Export Development Authority:

MPEDA is contributing significantly to the development of fisheries in India through several developmental programmes. Training programmes on improved methods of fish culture, fishing and fish processing are organised by MPEDA in collaboration with other Fisheries Departments or agencies. Subsidies are provided by MPEDA to different individuals and agencies who take up improved methods of fish culture, fishing and fish processing. Extension literature is published extensively by this Department. Consultancy service on fisheries is also provided by MPEDA.

1.13.6. Directorate of Extension:

The Directorate of Extension under the Ministry of Agriculture and Rural Development, Government of India is sponsoring training programmes through the Extension Education Institutes and other Departments on various
aspects of agriculture including fisheries.

1.13.7. Central Food Technological Research Institute:

CFTRI, under the Council of Scientific and Industrial Research, conducts training programmes on preservation and processing of fish and fish products through its Meat and Fish Section.

1.13.8. Other organisations:

Central Institute of Fisheries Nautical and Engineering Training (CIFNET) is engaged in educational activities. Regular academic courses on various disciplines of fisheries are conducted by this Institute for the State Fisheries Officials and educated fisheryouth.

Integrated Fisheries Project (IFP) is also conducting different courses on fisheries for Departmental and private candidates.

Fisheries Survey of India (FSI), though not conducting any academic courses or training programmes, propagates the new information on fish resources through various mass media.

1.14. Present status of fisheries extension

As the general approach to fisheries extension
in India has already been explained in the previous pages, the status of fisheries extension in the three states covered under the present investigation is described here.

1.14.1. Kerala:

The Extension wing of the Fisheries Department was started only in 1976 (Vasavan, 1980). It was organised as a small unit with limited resources. The extension personnel were exclusively drawn from the cadres of the State Department and they were very few in number.

The Department has started various programmes on mechanisation of small boats, pilot projects on pearl culture, mussel culture and fish culture. Fingerlings are produced and distributed to the fish culturists. Fisheries Technical Schools and Fishermen Training Centres are run by the Fisheries Department. A comprehensive programme for imparting specialised re-orientation course for the benefit of the technical personnel has been drawn up. It has been proposed to issue catamarans, dug-out canoes and plank built canoes to the traditional fishermen on subsidised basis availing institutional finance. Provision of necessary infra-structure facilities like roads, water supply, community halls, ice plants and workshops in selected villages has also been proposed.
Better housing facilities are provided to the fishermen. A fishermen Welfare fund for the payment of old age benefits and expenses connected with death and marriage ceremony has been included in the budget provision of the state. Several houses are constructed and handed over to fishermen under the housing and colonisation scheme. There is arrangement with All India Radio to broadcast special weather bulletin and cyclonic forecasts extensively for sea going fishermen.

1.14.1.1. Kerala Agricultural University:

The University, through its Fisheries College, is conducting training programmes on scientific methods of fish farming for officials from different departments. Technical advice and guidance are also given to the fish farmers on fish farming. Technology on aquaculture is transferred to fish farmers through Lab to Land Programme. Extension pamphlets are prepared on fresh water fish farming, brackish water fish farming etc. and distributed to the interested parties. Demonstration of fish processing methods is arranged in collaboration with other Fisheries Departments.

1.14.2. Tamilnadu:

The Fisheries Department of the erstwhile Madras
Presidency, started in 1907, was not only a pioneer in fisheries research and development but also a forerunner in fisheries extension work (Chellappan, 1980). The fish curing yards with the salt subsidy scheme, the fisheries schools and the fishermen co-operatives in the coastal fishing villages are only a few examples of the past fisheries extension activities of the department.

The fish seeds of quality fish are stocked, cultured and harvested by the Department and demonstrated to the public on the profitability of fish culture in the inland water spreads. The major reservoirs are stocked with quality fish seeds. In order to encourage private fish farming and composite fish culture practices and to step up per hectare production in inland ponds and tanks, Fish Farmers Development Agencies have been established. To find out new fishing grounds in inshore areas and to popularise new and diversified fishing methods among fishermen, Inshore Fishing Stations have been established. To facilitate the fishermen to transport their catches from the landing centres to the nearby marketing centres, the Department has provided them with vans on nominal hire charges through the fishermen co-operative societies, marketing unions and federations. Fisheries training
centres are in operation to impart training to the fishermen boys in maintenance of mechanised vessels, fabrication and operation of nets etc. Primary Fishermen Co-operative Societies have been organised in fishing villages and District Co-operative Federations have been formed for improving the fishing industry and welfare of the fishermen through co-operative enterprises. All types of loans are given to the fishermen through the co-operative societies for purchasing fishing equipments and to clear the debts and free them from the clutches of the middlemen. To replace cotton nets, to popularise nylon nets and to increase the fish catches, the advantages of using nylon nets are explained and nylon yarn is distributed to fishermen through the Fishermen Co-operative Societies on subsidy basis. The Department is constructing houses and allotting to fishermen. Suitable guide lights are being installed in needy fishing villages along the coast as an important socio-economic measure. Mechanised fishing craft are introduced by the Department to make the traditional fishermen adopt modern fishing methods. The integrated rural development and adult education are implemented in the state. Fisheries schools are run by the Fisheries Department in the coastal fishing villages.
The extension units of the Department are conducting demonstrations of technologies of fish seed production, composite fish culture, prawn and juvenile collection, prawn culture, fish curing, drying of fish, icing of fish, transport of iced fish etc. Films are screened in fishing villages and educational institutions. Various leaflets, handouts, brochures, pamphlets etc., on fisheries development are distributed among fishermen. Radio and Doordharshan talks and group discussion on various schemes and achievements are given by the fisheries officials. Fishery development projects and fishermen welfare programmes are telecast in TV. Frequently, articles of fisheries interests are also published in Tamil and English dailies.

1.14.2.1. Tamilnadu Agricultural University:

The fisheries college functioning under the Tamilnadu Agricultural University is undertaking various extension activities for the development of fisheries in the state. The Directorate of extension education is co-ordinating the extension work of all the agricultural fields including fisheries. The communication centre disseminates the new knowledge to fish farmers, fishermen and processors through AIR, television, newspapers,
journals, film shows etc. Technical assistance is given to the fishery industry by experienced extension workers. The farmers training centre imparts training to interested parties on fresh water fish culture. The Krishi Vigyan Kendra is actively involved in extension education activities for rural uplift. The staff of Fisheries College assist the Farmers Training Centre to conduct monthly meeting at the Block level to enlighten villagers on modern methods of fisheries. Fish seeds are distributed to interested parties through seed sales depots. Technical queries received from different parties on fisheries are replied. Farmers' Day is celebrated to disseminate the information on all aspects of fisheries development. Exhibitions are conducted to display the findings of the Fisheries College. Lab to Land Programme is also organised by adopting fish farm families and supplying fish seeds to them for modern fish farming.

1.14.3. Karnataka:

The extension work is carried out as an integrated part of fisheries developmental activities (Rao, 1980). Fisheries wall postures, charts, display panels etc. are used in the extension work. Training in various aspects of fisheries is arranged for fisher boys. Fish Farmers
Development Agency is arranging training for the fish farmers and providing technical know-how and guidance. Fish famine relief schemes, rehabilitation and colonisation schemes, fishermen distress relief grant, subsidy and loan schemes for fishing etc. are some of the programmes of Fisheries Department. Primary co-operatives and co-operative fish marketing federation are functioning in the state. Department is running fisheries schools and fishermen training centres. The Department is producing fish seeds in the production farms and rearing them into fry and fingerling stages in the rearing farms and nurseries constructed at Taluk Headquarters and then transporting to various places for stocking in suitable water areas.

1.14.3.1. University of Agricultural Sciences:

The fisheries college under the University of Agricultural Sciences, Karnataka is undertaking various extension activities like agricultural production programme, Lab to Land programme etc. through its staff and students. In addition to transferring the improved technologies to the field, the staff members of the college prepare extension literature and give extension talk and radio talk. The field programmes include demonstrations of
scientific methods of fish culture and fish processing. The fish products developed at the college are distributed to nutritionally weaker sections of the society through the Department of Social Welfare. Visits are made to the fish farms and fish processing factories and technical advice is given on improved methods of farming and processing. Under the Lab to Land Programme, families are adopted and technologies on fish culture and fish processing are transferred.

1.15. **Scope of the present study**

Curing is the oldest and cheapest method of preservation of fish all over the world. Fish curing industry has not shown much improvement from its primitive nature because this industry is mainly handled by illiterate and less educated fishermen/fisherwomen. They do not know much about the importance of scientific methods of fish curing. The cured fish produced by them is unhygienic and poor in quality. Because of the negligence and ignorance of the fish curers, a considerable quantity of this protein rich food is spoiled and lost every year.

Cured fish is generally consumed by the poorer section of the society to whom standards, hygiene,
sanitation etc. have no meaning. The dealers who export or sell these products are usually not the producers, but only middle men. No quality control will be effective from the stage of the dealers

In spite of all the deficiencies of fish curing, this is the most important one among all the preservation methods in India. In view of the low per capita income of the people in India and other developing countries, cured fish suits most to the consumers (Saxena, 1973). Even though freezing and canning of fish have well advanced, these account only about 5% of the total fish catch in India while about 18-20% of the catch is processed into cured products. Moreover, fish processed by freezing and canning are too costly and far beyond the purchasing capacity of the common man. Cured fish is the cheapest item of processed fish available to him. This clearly shows the importance of fish curing in India. This situation demands urgent steps to be taken for rectifying the defects of the fish curing industry and for adopting improved practices to avoid the wastage and enhance the quality of cured fish. If the quality is improved, cured fish will have more demand in internal as well as external markets. High quality cured fish can be prepared by
following the improved methods. Therefore, the transfer of new technology to the fish curing industry is the solution of the problems existing in this industry. Taking into consideration the importance of cured fish in India, Central and State Governments have invested considerable amount of money to investigate the technological problems in the production of cured fish and to suggest methods for solving the problems. Research has been conducted extensively in the Central and State sectors and various remedial measures have been suggested to improve the fish curing industry in India. Inspite of the prejudice against cured fish because of their existing low quality, research work in recent years have indicated that their quality can be greatly improved and shelf-life prolonged if the methods are standardised. To achieve this aim, Central and State Departments have already made considerable efforts to transfer the improved methods to the fish curing industry by way of training courses, demonstrations, Lab to Land Programmes, film shows, exhibitions, personal discussion etc. As the result of this, fish curers have started adopting the improved practices in fish curing. Still there seems to be a considerable gap between the technology available and
the technology adopted in this field. A comprehensive study on the extent of adoption of improved practices in fish curing and the factors involved in low or non-adoption of certain aspects is lacking at present. This gap has to be filled up. The possible methods for the effective transfer of technology for the production and distribution of high quality cured fish products and improvement of socio-economic condition of fishermen engaged in fish curing have to be identified.

1.16. Objectives

The main objectives of the present study are the following:

1. To identify the technological gap in terms of the knowledge of fish curing technology among fish curers and fisheries extension workers.

2. To identify the technological gap in terms of adoption of fish curing technology among fish curers.

3. To study the reasons for partial adoption or non-adoption of improved fish curing practices by fish curers.

4. To evolve a strategy for effective transfer of technology related to fish curing.
1.17. **Limitations**

The study had the limitations of time, personnel and languages. However, care was exercised to make the study as systematic as possible. The strategy suggested for technology transfer in fish curing industry may not be suitable as such for all the states. But the main problems of fish curing industry being the same for all the states, the recommendations may be valid in general with some modifications taking into consideration the conditions existing in each state.