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Oil sardine, scientifically termed Sardinella longiceps, forms one of the most important of the marine fisheries in India. Known as "Mathi" or "Chala" in Malayalam, "Boothai" in Kannada and "Tarali" or "Haid" in Marathi, the fish is landed mainly on the west coast, from Quilon in the south and Ratnagiri in the north. The fishery has constituted on an average about 31 per cent of the total annual marine fish landings, based on the quantities landed during the past five years. The figures given below on the landing in different States and totals during the period show the magnitude of catch.

Of the total oil sardine catch in the country about 80 per cent is constituted by the catch in the State of Kerala alone and of the total catch in the State the quantity of the fish forms about 60 per cent. Though the fish constitutes nearly 3/5th of the total fish catch in the State, from the point of view of economy the fishery does not have that much importance as could be expected in consideration of the magnitude of the fish catch. This is mainly because fish processing industry based on oil sardines is not yet developed.

The present way of utilization

A major portion of the oil sardine catch in India is at present utilized for the preparation of sardine oil and sardine guano. In certain areas during the peak season of fishery and when the oil content of the fish is higher, almost the entire catch is processed for extraction of the oil since fish of such high oil content is not relished for consumption in fresh form. Apart from consumption in fresh form small portion of the total fish catch is at present processed into canned product. In case of fish like Mackerel, Seerfish, Pomfret etc. curing is the most widely practised method of preservation in the country. But, because of the comparatively high oil content of sardines, the quantity of the fish

Landings of oil sardines in India

Year.	Kerala	Mysore	Maharashtra	Goa	Gujarat	Madras	Pondicherry	Andhra	W. Bengal & Orissa	Andaman	Total
1964	190401	83797	—	N.A.	1	134	—	—	—	—	274333
1965	219170	39035	65	3561	—	32	—	—	—	—	261863
1966	202800	44253	63	—	—	37	—	61	—	—	247214
1967	235410	20481	353	—	38	32	—	—	—	10	256324
1968	247048	53727	221	—	N.A.	412	—	—	—	N.A.	301408

N. A.: Figures Not Available.

preserved by curing is also insignificant. The high oil content results in very early spoilage of the cured product due to rancidity.

Economic way of utilization

Since curing is not a satisfactory method for preservation of the fish, the other possible ways of preservation and processing of the fish in the country are canning and freezing. Though the fish is canned to a small extent, the product is mainly intended for the internal market. According to the available reports, because of the comparatively high cost of tin cans and vegetable oil in the country, the cost of production of canned sardines is much higher, when compared to that in many of the foreign countries which have a canning industry based on this type of fish. Because of the comparatively high cost of production, our canned product cannot compete with similar products in the international markets, it is reported. Thus until such time the conditions for competition in the international markets are made favourable, an export oriented sardine canning industry cannot have much scope.

Scope for the frozen product

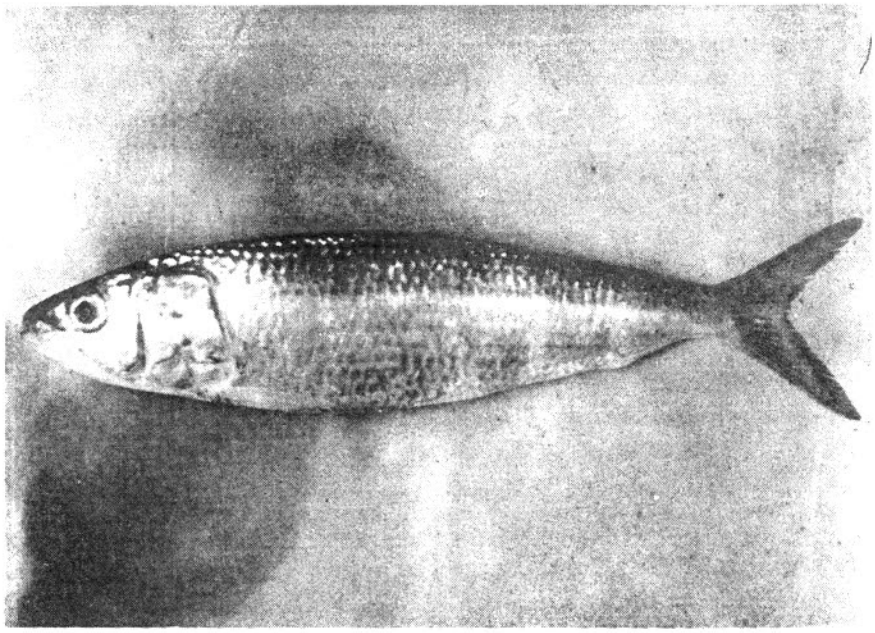
Though oil sardines are caught in abundant quantities in Kerala, commercial scale freezing of the fish has not been started as is the case with the other States too. Lack of knowledge in the technological aspects of preservation of the fish and markets for the frozen product might have been the reasons for the absence of any organised venture in this respect. Now, thanks to the research investigations carried out in the Central Institute of Fisheries Technology, Ernakulam, information on all the technological aspects of freezing preservation of the fish is available. It has also been found that as in the case of several varieties, for transportation of the fish to distant internal markets without the application of refrigeration during transport, the effective economic way is to transport the frozen fish in the type of insulated containers developed by the Institute in non-refrigerated rail wagons. Frozen oil sardines can be transported in good condition in a journey lasting upto 4 days. The fish reaching the destination after the period would be in the thawed state and could be sold as fresh fish. This technique of preservation and transport has the added advantage that during peak seasons the excess of fish catch can be quick-frozen and kept in frozen storage for sufficiently long period and transported to the distant internal markets as and when required. Thus, irrespective of the fishing season, it is possible to have a balanced distribution of the available quantity of fish.

A rich harvest of sardine

Recent reports also indicate that there is scope for export of oil sardines to countries like France. In view of the storage life of the frozen fish and improvements that can be effected in its quality by special treatment, export of frozen oil sardines does not pose any problem, when the market for the product is fully known.

Technical problems of freezing and remedies

The major difficulty encountered in preserving oil sardines in ice or in the frozen state is the phenomenon of "belly bursting". The belly walls of the fish break up and the visceral portion comes out thus spoiling the appearance of the fish and reducing consumer acceptability. Small size sardines which contain lesser amount of fat



" Sardinella longiceps "

show more belly bursting. Thus fat content of the fish also has influence on the extent of this undesirable phenomenon. Any external pressure exerted on the fish, as for example in the case of block freezing in contact plate freezer, serves to hasten the phenomenon and increase its extent. (Freezing of the fish in individual form could therefore have been an effective way of retarding the phenomenon but for the practical difficulty and uneconomic nature of such freezing).

Apart from 'belly bursting' the high oil content of the fish also stands in the way of preservation of the fish by freezing because of the development of rancidity during storage subsequent to freezing. (The oil content of sardines is comparatively high even up to the extent of 18 per cent on the basis of the weight of the fresh fish).

Investigations undertaken in the CIFT on the causes of " belly bursting " and measures for its prevention, have shown that treatment of the fish in brine solution of specific concentration for a specified period greatly reduces the extent of belly bursting. Apart from reducing belly bursting, the treatment also gives a better appearance and firmer texture to the material. When heated in the brine the salt absorbed by the fish is not to any significant extent as to impart undesirable taste to the material. On cooking the heated fish, only a slight salty taste remains. The absorption of salt is even much less in the case of sardines of bigger size and higher fat content.

As regards the high oil content of the fish, it is seen that even samples with the highest oil content can be quick frozen and stored at the temp. of—20°C for more than two months in very good condition.

On the basis of the findings of the CIFT on the freezing characteristics of oil sardines, the method for freezing the fish can be summarised as below :

Method of freezing oil sardines

1. The material used for freezing should be fresh. If there is any time lag before freezing keep the material properly iced. Avoid rough handling since the belly wall tends to break due to abrasion.
2. Wash the material thoroughly in good water. Washing can be done by hosing water on the material spread on perforated aluminium or stainless steel topped table. Remove damaged or burst pieces if any.
3. Keep the material in 15 per cent sodium chloride solution for 30 minutes. This reduces the extent of belly bursting during freezing and subsequent storage.
4. Weigh out the material in 2.27 kg. (5 lb) lots or on any other standard weight and fill in trays. Add approximately 900 ml. of ice cold water to each 2.27 kg. material in the tray.
5. Admit the filled trays into the freezer for quick freezing. Quickfreeze the material within the minimum possible time at -40°C. Care should be taken to avoid excessive pressure on the material in order to avoid possible belly bursting.
6. Reglaze the frozen block by dipping in ice cold water (chlorinated at 5 ppm level) for a few seconds (or by adding ice cold water on the frozen block kept in the carton). Wrap the slab in polythene paper (if not already done) and then pack in waxed carton. Pack suitable lots in master cartons.
7. Store the frozen material at -23°C or below. Oil sardines

quick-frozen and stored at the above temp. keep normally for more than 3 months in good condition.

The storage life of frozen oil sardines at –23°C in relation to the pre-processing ice storage period has also been worked out at the Institute. It has been found that with increase in pre-processing ice storage from 0 to 5 days, there is decrease in frozen storage life from 20 weeks to 2 weeks (at –23°C).

The storage life of frozen oil sardines at –23°C in relation to varying pre-process ice-storage periods is shown below :

Days of ice storage	Weeks of frozen storage at –23°C
0	20
1	20
3	12
5	2

The storage life of the frozen material has also been found to be inversely related to the oil content of the fish as can be seen from the following table :

Oil content of the fish (moisture free basis) Percentage.	Storage life at -20°C after freezing - months.
10.30	5
18.20	4
20.00	3.5
40.39	3
42.43	2

From the foregoing it is clear that preservation of oil sardines by freezing does not pose any technological problem if the recommended procedure which has been worked out after extensive investigations on the freezing characteristics of the fish, is followed. A venture by any processor in the commercial scale freezing of the fish either for export or for internal trade, would be a guide line for the others towards an organised attempt for economic utilization of the fish. It goes without emphasis that more and more products should be processed for export to earn the much needed foreign exchange.