

FISHERIES OF THE WEST COAST OF INDIA

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FISH CURING AND FISHERY BY-PRODUCTS

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As in the case of many of the maritime countries of the world Fish Curing is one of the oldest industries in India. As much as 21% of the total production is marketed in the form of dried fish and 19%, comprising mainly sardine, mackerel, catfish, seer-fish, pomfret, shark, sole, etc., in the form of salted fish.

Fish Curing generally comprises all methods of preservation except refrigeration and canning, and includes (i) drying, smoking, salting and pickling of fish, (ii) various combinations of the above and (iii) methods in which vinegar is used or fermentation is adopted. In India, however, drying and salting are the most common methods used in the curing of fish. The present position of the fish curing and by-product industries in the country could be seen from the export-import figures for 1953-54 furnished in the table. Dried fish is exported to Ceylon, Singapore, Burma and other countries. Wet salted fish is mostly exported to Ceylon. Fish maws and shark fins are mainly exported to Hongkong, Singapore and U.K. Fish manure, mainly 'guano', is being largely exported to West Germany. Fish oils and other marine animal oils are imported from foreign countries for use in the leather industry. The same is the case with canned, fresh-chilled and frozen fish.

The Fish Curing industry has been flourishing through ages and has not been affected to any great extent by modern techniques of fish preservation and processing. The fact that more and more emphasis is laid on the supply of fresh fish to consumers by resorting to freezing and cold storage, however, cannot be overlooked. In spite of this modern trend the Fish Curing industry is not likely to suffer. The reasons for such a conclusion are as follows: Fish Curing does not require much of equipment and capital

*Import-export figures of fishery products during 1953-54**

Fishery Product	Exports		Imports	
	Quantity in metric tons	Value in Indian rupees (thousands)	Quantity in Metric tons	Value in Indian rupees (thousands)
Fish: dried, salted and smoked	28,257	43,035	3,237	1,612
Fish, dried (not salted)	18,111	28,375	1,991	670
Fish, dry salted	8,801	12,966	498	336
Fish, wet salted	1,036	507	556	339
Beche de mer	3	20	..	..
Fish maws and shark fins	309	1,187	32	48
Fish meals—fish manure	2,593	998	..	..
Fish oils .. ..	..	..	185	325
Canned fish .. ..	..	..	179	468
Chilled and frozen fish .. ..	..	..	13,213	14,098
Miscellaneous—				
Cowries	8	17	327	145
Tortoise shells	25	90	2	64
Other shells	112	243	8	13

* *Year Book of Fishery Statistics, F.A.O., Vol. 6, 1955-56.*

unlike in the case of freezing and canning and individuals with minimum capital could undertake drying, salting or smoking of fish using home-made equipments. Areas which are not adaptable to freezing or canning plants could be made use of for curing work. There is no organised by-product industry in India. The main reason for this may be the absence of fish canning factories which usually provide the raw materials for many of the by-products.

The chief methods of curing practised in the country, particularly in the west coast, are (i) drying, (ii) salting, both dry and wet salting, (iii) pit curing and (iv) 'Colombo method' of curing. Smoking is also being adopted in some parts of Orissa and Madras States. But somehow this process has not found favour with the fish-eating population of the country.

All the methods mentioned above are, in principle, intended to keep fish from spoilage caused mainly by bacteria, moulds, yeasts, etc., and that caused by chemical or physical agencies.

Direct Drying.—Natural air-drying or drying by mechanical dryers are the only processes which can strictly be called drying processes in fish curing industry. In India drying processes are mainly restricted to open sun-drying. The usual method is to rinse the fish in seawater soon after landing and spread them on coir or cadjan mattings in the open air. In certain areas no rinsing is done and at times fishes are spread even on the open sandy beach. Fishes like Bombay-duck, marine eels, etc., are dried by hanging them on bamboo or wooden rods or ropes stretched horizontally between vertical poles. This method is found to be very effective since all the sides of the fish get dehydrated uniformly. Further, in this method there is no possibility of extraneous matter like dirt or sand getting into the dry product. The process is similar to the one adopted in Norway for making stockfish.

A casual survey of the cured products prepared in the various fish curing centres in the country would show that no strict standards are followed by the curers. The same type of fish, collected from the same place during different periods, vary widely in moisture content and chemical qualities. A good percentage of insolubles, mostly sand, would also be present in the samples. The extent of variation in some of the main chemical characteristics of sun-dried fish is given in the table on a later page.

In many parts of Kerala especially in the southern region and in some places in Bombay State appreciable quantities of shrimps are also sun-dried and used, during certain seasons of the year.

Salting.—Salting is another equally important process by which fish is cured in India. Regular fish salting work is going on in the numerous Government as well as private fish curing yards distributed all along the west coast of the country. The preservative action of salt is due to the restriction of microbiological activity following desiccation of the tissues. Salt enters the body of the fish, removes sufficient liquid to form a brine to cover them, at the same time makes the body fluids saturated with salt. This latter phenomenon helps in coagulating the proteins in the body fluids which in turn get deposited on the skin and cell-walls. Other functions served by salt are, the direct action of NaCl on the putrefactive micro-organisms, the removal of oxygen and the sensitization of micro-organisms to carbon dioxide.

The success of salting process has been found to depend, to a large extent, on the following factors:—



Dry Curing of Ribbon-fish in Malabar



Sun-drying of Bombay-Duck (*Harpodon*) at Versova, Bombay

(i) *Composition of Salt.*—It has been shown by actual trials that fish salted with pure salt are limp, soft and have straw or cream colour, and that the presence of calcium and magnesium causes whitening and stiffening of the flesh and imparts acrid flavour to the product.

(ii) *Temperature.*—It is practical knowledge that temperature influences the penetration of salt during salting processes. The higher the temperature the greater will be the rate of penetration of salt into the body of the fish.

(iii) *Condition of Fish Used for Salting.*—Small fishes like sardines are salted without gutting and removing the entrails. Under such conditions salt penetration will be very slow, and will often be insufficient during the normal period of salting. Big fishes are gutted, washed well in seawater and deep longitudinal scores are made before applying salt. This facilitates easy penetration of salt uniformly throughout the fish.

(iv) *Method of Salting.*—The technique of salting varies considerably, dry salting, wet salting, brine salting and various combinations of these. The products differ in the texture of their flesh and flavour and also in their chemical quality.

(v) *Fat Content of Fish.*—It is generally accepted that the more the fat content the less will be the rate of penetration of salt. Further, in fatty fishes rancidity soon develops when the salted fish is kept in contact with air.

In India, both dry salting and wet salting are practised. In certain areas in the south and south-east coasts a process called “pit curing” is also carried out. This process is similar in principle to wet curing with the exception that the fish treated with definite proportions of salt are buried in pits lined with cudjan mattings over the sides and top, covered over with sand which is trampled down to give pressure. After two to three days in the pit, the fish are removed and marketed without any further treatment.

In dry salting the proportion of salt to be added to fish has been fixed by the various State Governments. But these standards are not strictly followed by fish curers with the result that salted fish is far from uniform. The range of variation in some of the essential chemical constituents of dry salted fish, given in table below, is sufficient proof of the above statement. The situation thus requires some serious thinking by both Government agencies and fish curers for the improvement of the quality of our salted fish products.

Wet salting process is next in order of importance and is practised in places like Ratnagiri, Malpe, Calicut, etc., in the west coast. In the “Ratnagiri process” of wet curing the fish are stacked on cement floors with half of the calculated quantity of salt applied evenly. The next day fish are restacked with

Method of Curing	Moisture %	T.V.N. mg./100 g.	Salt Content %
Sun-drying	13·8-42·5	48·5-287·0	0·6-15·2
Dry salting	20·0-51·0	25·0-467·6	7·1-21·5
Wet salting	33·0-50·9	67·0-313·0	10·0-17·6
Pit curing	35·5-45·5	126·0-666·0	15·8-18·6

the top layer moved to the bottom and half of the remaining salt applied. On the third day it is again restacked and the remaining salt added. The self liquor is allowed to flow off. The product is marketed without drying.

In Alleppey the process is almost similar except that the entire quantity of salt is applied to well cleaned and gutted fish (mostly sardines and mackerels) and then arranged in close-woven bamboo baskets. The fish is marketed without drying.

An ingenuous method of salting called “*mona*” cure is done in the N. Kanara district of Mysore State. The entrails of fishes like mackerel, *Otolithus*, *Lactarius*, etc., are pulled out through the mouth and after thoroughly washing, the abdominal cavity is filled with salt. The rest of the procedure is the same as in dry cure.

As in the case of fish, different processes are adopted in the curing of prawns also in the west coast of India. The method is to sundry the prawns. Smoking is also practised on a cottage industry scale in the Circars.

‘Prawn pulp’ is prepared on a large scale in the west coast. Prawns are boiled in seawater and sundried on coir mattings or bamboo trays. The hard-dried, product is packed in jute bags and beaten with clubs to separate shells from meat. The product is generally exported to Malaya and Burma.

The method of “semi-drying” prawns, initiated by the Madras Fisheries Department has been adopted now on a commercial scale at Tanur and places nearby. The method consists of “blanching” cleaned prawns in 4 to 6% brine in tinned copper vessels for 2 to 3 minutes, removing the shells by hand, followed by brining at 25° Be and drying. The product has good natural appearance and the meat is soft; and as such it is bound to have consumer appeal.

The only method of pickling practised in India is the 'Colombo method' popular in Malabar and S. Kanara districts. The material produced in these places is intended mainly for export to Ceylon. A substance called *gorukapuli* (the fleshy covering of the seeds of *Garcinia cambogea*) is used as an adjunct to salt in this process. Usually mackerel, rainbow sardine and oil-sardine are used in this type of curing. The gutted fish is salted with the correct ratio of salt and then a small quantity of *gorukapuli* is thrust into the abdominal cavity of the fish. The fishes are arranged in large wooden barrels with intermittent layers of salt and *gorukapuli*. The possibility of using ordinary tamarind in place of *gorukapuli* has been engaging the attention of the Central Marine Fisheries Research Station, and the results achieved so far are encouraging. It is expected that sardines and mackerel pickled with salt and ordinary tamarind would be acceptable to fish-eating people in the country as they are quite familiar with tamarind in other ways.

One of the causes for the diversity in quality of cured fish, as could be seen from the table, might be the uncertainty in the quality of the salt used. A lot of experimental work has to be carried out to determine the optimum level of sodium chloride desirable and the maximum impurities allowable in fish curing salts. Work on these aspects has already been initiated at the Central Marine Fisheries Research Station.

Fish Meal and Oil.—The preparation of fish meal and body-oil from fishes has been in vogue in India from very early times. Certain fishes like the oil-sardine are used for the extraction of body-oil during periods of abundance. The methods are primitive. On the other hand the liver-oil industry, especially the shark-liver oil industry, has shown considerable progress and there are three modern factories, one at Calicut, one at Trivandrum and the third at Bombay.

All oil-bearing species of fish other than those explored for liver-oil can be utilized for the production of body-oil. Usually body-oil extraction and fish meal preparation are undertaken together. The industry is common in the west coast in places like Malabar and S. Kanara where large shoals of oil-sardine appear between August and February. The method adopted in these places is the one developed by the Madras Fisheries Department and consists in cooking the fish in open pans and pressing out the oil from the cooked material. The residue is dried in the sun and forms "guano" which is used as manure. The oil is separated from the water and filtered.

In modern techniques of fish meal manufacture both the dry and wet reduction processes are employed. In the dry reduction process the material

is crushed to small pieces and cooked in a chamber externally heated by steam, while it is kept stirred. The dried residue forms the meal. In the wet process steam is passed directly into the mass at high pressure and cooked fish pulp is passed into a press to remove water and oil. In this process, oil is collected as a by-product. The fish meal plant operating at Calicut employs the dry reduction process and treats lean fish for the production of meal. There is great scope for the introduction of modern techniques in our country for the manufacture of fish meal and fish oil on a cottage industry basis. Both these products find numerous industrial uses and could play an important role in the development of our national economy.

Good fish meal can be utilized as an animal or poultry feed. They contain almost all the essential amino acids in fair proportions as well as most of the vitamins of the B group. Fish meals also supply a liberal quantity of calcium, available phosphorus and trace minerals. Besides, fish meals are known to contain A.P.F. which helps optimum growth in animals fed on it. Efforts are now being made to utilize fish proteins to combat protein malnutrition in human beings. Various methods of preparation of edible fish flour are known in the advanced countries. In India, work is in progress at the Central Marine Fisheries Research Station in developing a fermentation process for the preparation of quality fish flour for edible purposes from elasmobranch fishes. Considering the peculiar position of India as a predominantly rice-eating nation this aspect of the fish meal industry is bound to have increasing importance in the coming years.

Shark fin makes excellent soup and the skin of sharks could be processed into high quality leather.

A variety of useful products could be made out of fish scales, skins and bones. Fish scales when carbonized give animal charcoal which finds use in clarifying, decolourising and otherwise purifying liquids and solutions. The scales of fishes contain an iridescent substance called "guanine" which is used in the manufacture of 'pearl essence', used in making artificial pearls.

Isinglass prepared from air-bladder of fishes is used in the clarification of wine and also as an adhesive in the preparation of court plaster, special cements, etc. Enzymes extracted from fish-guts are used in leather industry.

In conclusion it has to be mentioned that there is vast scope for the development of fish curing and fishery by-product industries in India. Much of the fish wealth of the country is not fully utilized, as fishermen lack facilities and technical knowledge. It is for the detailed investigation of these and related problems that a Central Fisheries Technological Research Station is being established by the Government of India.