

A SURVEY OF THE QUALITY OF SALT CURED FISH PRODUCED IN THE KANYAKUMARI DISTRICT, MADRAS STATE

R. SRINIVASAN AND K. C. JOSEPH
Fisheries Technological Station, Madras State.

A survey of the quality of salt cured fish in Kanyakumari District, Madras State was done during the years 1963 and 1964 to obtain necessary basic information to formulate quality standards for these products which are gaining importance in the export trade. 155 trade samples of sun-dried, dry-salted, wet-cured and pit-cured fishery products were examined for their chemical quality and organoleptic characteristics. 26.5% of the sun-dried products, 25% of the wet-cured fish, 55.21% of the dried salted products and none of the pit-cured samples were found to be good in quality. The sun dried products were generally found to have heavy admixture of sand and were inadequately dried. The chief defects in the salt cured fish products were found to be the use of spoiled fish, imperfect cleaning and washing, use of impure salt, inadequate salting, curing and drying, and unhygienic conditions in all stages. Quality standards must be formulated for each variety of salt cured fish product and adequate measures taken to rectify the defects and enforce the quality standards.

INTRODUCTION

Kanyakumari District is one of the seven coastal districts of Madras State and has a coast-line of 65 km. extending from Leepuram, 2 km. to the east of Cape Comorin to Noorodithuru in the West Coast on the border of Kerala State. It provides the short but rich fish landing West Coast for Madras State. It had the highest fishing population of 22,969 and the highest average fish

catches of 125 tonnes / km. of Coast in Madras State in 1957 (Barlind, 1958). About 13,040 tonnes of fish are annually landed in this district and the different types of fish landed and their seasons are described in detail by Chacko and George (1958). About 80% of the catches are salt cured and a good portion of the cured products is exported to Ceylon and other South East Asian countries through Tuticorin port. Since the salt cured fish is gaining in importance in the export trade

of the country and the Government are initiating measures for the quality control of all the marine products including dried and salt cured fish, it was felt that a survey of the quality of the cured fish products in the trade would be helpful and provide the necessary basic information required. Since a good portion of the dried salt cured fish in the export trade originated from Kanyakumari District, the survey was conducted by the authors in Kanyakumari District during the years 1963 and 1964 and the results of this survey are presented in this paper.

FISH CURING PRACTICES

The methods of fish curing followed in the West Coast of the country have been described in general by Nicholson (1930), Venkataraman and Vasavan (1958) and Krishna Pillai *et. al* (1956).

The different methods of fish curing practised in Cape Comorin in particular for the different varieties and sizes of fish have also been described in detail by Joseph and Srinivasan (under publication). So detailed descriptions of the different types of curing followed for different species of fishes have been omitted in this paper. However the fish curing practices have been recounted briefly for ready reference, highlighting the variations in the methods practised. These methods may be broadly classified as follows :

- 1) Sun drying,
- 2) Dry salting, and
- 3) Wet salting.

1. Sun drying: This method is employed for fishes such as white baits (*Anchoviella Sp.*), Silverbelly (*Leiognathus Sp.*), Round Scad (*Decapterus Sp.*) and small sized specimens of other varieties also. Drying is done by spreading the fish catches on the beach sand or other open grounds where the fishes get dried by

the solar heat. During drying the fishes are turned occasionally, every two to three hours, to ensure quick and uniform drying. After the first day's drying, the partially dried fishes are gathered and heaped inside a godown or kept heaped in the drying ground itself with a covering of palmyrah leaf mats. For the second day's drying the fishes are spread in a thicker layer than on the first day. In Cape Comorin area this is usually done on coir mats. Generally the duration of drying is for two days. But when drying cannot be completed owing to cloudy skies or drizzling, the final drying is completed on the third or fourth day.

2) *Dry salting* The method of dry salting practised on this coast for a large variety of fishes is the same in all the fish villages; *Trichiurus*, *Caranx*, *Lactarius*, *Dussumieria*, *Sharks*, *Serranus*, *Cvbium*, *Arius*, *Lethrinus*, *Sphyaena*, *Leiognathus Sp.*, *Balistes*, *Chorinemus*, *Lutjanus*, *Chirocentrus*, *Histiophorus*, *Mackerel*, *Tuna* etc., are the varieties most commonly dry salted in the district. Large sized fishes are descaled and cut and split open along the dorsal side with a sharp and pointed knife inserted just behind the head and moved back to a point very near to the caudal fin, so that the fish is split open, the knife bracing the backbone which will be retained on the right half of the split fish. The entrails and gills are removed. Longitudinal cuts are made beginning from near the tail so that the split fish is cut into strips 3 cms. to 5 cms. wide, but without severing their connection at the tail end. These are then washed and salted. The salt: fish proportion varies from 1:4 to 1:6 by weight, depending upon the size of the fish and are then put into curing tubs. Cement cisterns, wooden tubs and earthenware pots are in use for this purpose, wherein the salted fish remains overnight. The self-brine formed during the interval is allowed to accumu-

late in the curing tubs. The next day the fishes are washed in the self-brine and dried in the sun for two to three days. The period under cure will vary from 12 to 24 hours depending upon the time of landing the catches. Morning catches remain under cure for the maximum period, until the next morning when they are removed for drying. The drying is done on coir mats, palm leaf mats, or on the ground itself.

For medium sized fish only the dorsal slit is made and entrails removed, but they are neither split open nor are their heads cut off. For the smaller sized specimens no cutting is done; they are merely salted and the rest of the curing is done as described above.

3. *Wet salting*:— Curing by this method is practised for almost all varieties of marine food fishes irrespective of size. *Serranus*, *Lethrinus*, *Lutjanus*, *Caranx*, *Chorinemus*, *Arius*, *Trichiurus* and *Sharks* are the common fish cured by this method in Kanyakumari District. Scales, where present, are not removed unlike in the case of dry salting. A deep incision is made along the dorsal side with a sharp knife inserted behind the back of the head being moved to a point a few cm. behind the rear end of the dorsal fin and the entrails are removed. The fishes are then washed and salt packed inside the slit. The ratio of salt : fish at this stage will be about 1 : 4 by weight. The salted fish is now either placed in tubs or pits or simply heaped on the floor to remain for two to three days with more salt being sprinkled over each layer of fish while packing. In the case of fish cured in tubs or heaps on the floor, the selfbrine formed during this period is allowed to drain off.

As regards curing in pits, after stacking the salted fish in pits, usually up to 4 feet deep and lined inside with palm

leaf mats, the top is covered by mat. This is now covered with a layer of soil of about one foot thickness. The covered pits are either weighted with large boulders or stones or tread upon by the fishermen. The self-brine formed in the salted fish placed in pits in this fashion is absorbed by the surrounding soil which is invariably loose and sandy on the coastal areas where this type of curing is in vogue. On the second day the fishes are subjected to a re-salting (Salt . Fish = 1 : 8) and restacking in the tub, pit, or heap as the case may be. After three days thus under cure the fishes are removed and packed in palmyrah leaf mats with a further sprinkling of salt before being despatched to the market. *Lactarius Serranus*, and *Dussumieria* are the varieties found pit cured during the present survey.

Quality of the cured fish products :

Methods of Assay: Representative samples of cured fish were collected from the various fish curing yards, dried fish markets and shandies and from the godowns of the dried fish merchants both in the Kanyakumari District and at Tuticorin during the years 1963 and 1964. These were analysed chemically and organoleptically as per standard methods of analysis already described by Joseph (1963). The chemical factors determined were the percentages of moisture, sodium chloride, total ash, acid insolubles, total volatile basic nitrogen and trimethylamine nitrogen, all on the original moisture basis. The quality of the products was also organoleptically adjudged on the basis of their appearance, texture, flavour, odour, fungal attack and insect infestation, if any, and classified accordingly as good, fair, poor and unfit for human consumption.

Discussion of results and conclusions:

The results for the 155 samples of cured fish procured from various sources

in the trade are presented in Table I, II, III and IV respectively for sun-dried wet cured, dry-salted and pit-cured products.

Among the sun-dried products, dried white baits (*Anchoviella sp.*) are the most commercially important and are produced on an extensive scale in the district from June to January every year. About 60% of the total exports of dried fish from Tuticorin are composed of dried white baits and amount to as much as 10,000 tonnes annually. Most of the quantity of dried white baits come from Kanyakumari District. In view of the commercial importance of this product a study of the quality of dried white baits in the trade was made by Srinivasan *et. al* (1967) and standards have also been prescribed for this product by the Indian Standards Institution in I. S. 2883 - 1964.

In samples cured by sun-drying alone, only 26.5% of the samples were good based on organoleptic assessment and chemical indices of spoilage. 50% of the samples were fair and the rest poor and unfit for human consumption. The moisture content ranged between 12.35% to 50.98% the average being 20.73%. This was evidently too high for an unsalted product to ensure good keeping qualities. The percentage of NaCl varied between 0.70 and 3.66. Acid insolubles varied from 2.28% to 29.58%, the average being 12.54%. This is attributed to the heavy admixture of sand inherent in the method of drying on the sand. Acid insolubles can be considerably reduced by drying the products on raised concrete platforms or atleast on palm mats. Total volatile basic nitrogen was found to be high, ranging from 64.0 mg % to 840 mg % the average being 277.7 mg %. This indicates a high degree of spoilage caused by the absence of salting coupled with inadequate dehydration. Krishna Pillai, *et al*, (1958), observed that cured fish

products obtained by sundrying alone, were of higher nutritive value, compared to those prepared by other methods of curing, since the loss of body fluids during curing was the minimum in this type of curing. But as found from the present investigation inadequate drying can spoil this advantage, because in the absence of salt the progress of spoilage will be faster in sun-dried samples than in salted samples of even higher moisture content. In view of this, the curers are advised to adhere to the quality standards already prescribed for dried white baits (*Anchoviella Sp.*) in I. S.: 2883 - 1964.

In the wet salted fish samples studied from the region also only 25% of the samples were of good quality, the rest coming under the grades, fair (20%) poor (30%) and unfit for human consumption 25%. In those samples the moisture ranged from 41% to 61% with an average of 50.35%, which is too high even for a salted product. This is considerably higher than the results reported by Krishna Pillai, *et. al.* (1956) for wet cured fishes collected from different centres along the West Coast of India. The sodium chloride content ranged from 8.95% to 26.32%, the average being 15.01%. The T. V. B. N. content of these samples was also very high ranging between 82.75 to 570.0 mg % The average T. V. B. N. value was 267.5 mg %. The fact that 55% of the wet-cured samples examined were of unsatisfactory quality from every point of view fortifies the view that this type of curing is to be discouraged. But the products of this type have a special appeal with certain consuming centres as pointed out by the authors in an earlier communication (Joseph and Srinivasan, (1964) in the press). Salting, unless followed by drying of the salted fish, or packing in brine as in the 'Colombo curing' (Srinivasan and Venkataraman (1958), cannot ensure satisfactory keeping qualities for more than a week at the most.

As regards pit curing the samples were found to be very unsatisfactory and no sample was good. These had high moisture content, slightly less than in wet cured fish. Moisture ranged from 41.77% to 57.54% with the average at 48.77%. Those products were characterised by poor appearance, soft and flabby texture, very poor flavour, often unpalatable, very unpleasant odour and infestation by maggots and flies. The NaCl content ranged from 8.70% to 13.05% which was rather low. T. V. B. N. values were very high, ranging from 180.0 mg % to 339.0 mg% the average being 255.5 mg%.

The dry salted cured fish was found to be the most satisfactory among the products of the different methods of curing. Among this type of samples examined 55.12% were good and only 4.47% were unfit for human consumption, the remainder coming under the grades, fair (23.88%) and poor (18.42%). Though the percentage of moisture was much less than in wet and pit cured fish, the average percentage of moisture was still as high as 41.39%. This can be brought down to around 27.5%, the ideal moisture level for salt-cured fish as recommended by Sen *et al.* (1961) by increasing the duration of drying by a few hours. According to Venkataraman and Vasavan (1958) quality dried salted fish should have a moisture of 35 to 40% only with NaCl on dry basis at 20-25%. The dry salt cured products surveyed contained NaCl ranging from 6.32% to 23.34% with an average of 13.84% only indicating inadequate salting in a number of cases. Venkataraman and Vasavan (1959) reported that salt-cured fish in the initial stages of spoilage had T. V. N. values of around 200 mg %. In the present investigation also it was found that generally the cured fish samples classified as 'Good' according to the organoleptic rating had T. V. B. N. values of not more than 200 mg %.

Though the dried salt cured products were better than the sun-dried, or wet-cured or pit-cured products, the survey reveals that there is great scope and need for improving these products also. The dried salted products were found to be generally of sub-standard quality because of one or more of the following defects:

- i) Use of already spoiled or spoiling fish as raw material,
- ii) Imperfect cleaning and washing of the fish;
- iii) Use of impure salt,
- iv) Inadequate curing,
- v) Inadequate drying, and
- vi) Handling, curing under unhygienic conditions and thus contaminated with sand, flies and maggots in these stages.

Though efforts have been and are being made by the State Fisheries Department to improve the fish curing industry in the district by prescribing the quality and quantity of salt to be used, supplying good quality salt at subsidised rates, improving the fish curing yards by constructing cement curing and washing tubs, making adequate fresh water available in the fish curing yards, etc., the conditions observed in many curing yards demand the strict enforcement of hygienic conditions, correct salt:fish proportions and curing and drying times. Quality standards should also be worked out for each variety of dried salted fish and adequate measures taken to enforce these standards for the products.

SUMMARY

A survey of the quality of the salt cured fish in Kanyakumari district was done during the years 1963 and 1964 to

TABLE I SHOWING THE RESULTS OF ANALYSIS OF TRADE SAMPLES OF
SUN-DRIED WHITE BAITs (*ANCHOVILLA SP*)

Sl. No.	Name of Factor	Range of variation			Percentage of samples in different range			
		Minimum	Maximum	Average	6	7	8	9
1	Moisture %	12.35	50.98	20.73	<u>Below 15%</u> 10.94	<u>15% to 20%</u> 51.56	<u>20% to 25%</u> 20.31	<u>Above 25%</u> 17.19
2	NaCl %	0.70	3.66	1.71	<u>Below 1%</u> 10.94	<u>1% to 2%</u> 64.06	<u>2% to 3%</u> 21.87	<u>Above 3%</u> 3.13
3	Acid Insolubles %	0.72	29.58	12.54	<u>Below 5%</u> 10.00	<u>5% to 10%</u> 23.33	<u>10% to 15%</u> 38.33	<u>Above 15%</u> 28.34
4	T. V. B. N Mg/cent	64	840	277.7	<u>Below 100</u> 6.99	<u>100—200</u> 32.52	<u>200—300</u> 27.07	<u>Above 300</u> 32.52
5	Organoleptic grading	<u>Good</u> 26.5	<u>Fair</u> 50.0	<u>Poor</u> 21.9	<u>Unfit for human consumption</u> 1.6

TABLE II — SHOWING THE RESULTS OF

Sl. No.	Name of Fish	Source	Moisture %	NaCl %
1	2	3	4	5
1.	Serranus	Cape comorin and Muttom Fish curing yards	48.17 to 58.60	15.16 to 18.61
2.	Lethrinus	Cape comorin Fish curing yard	57.72 to 61.01	16.50 to 24.04
3.	Caranx	-do-	58.75	17.92
4.	Shark	Colachel, Thoothoor and Muttom Fish curing yards and Kollencode	42.20 to 57.33	8.93 to 18.20
5.	Trichiurus	Colachel and Enayamputhenthurai Fish curing yards	43.18 to 51.60	12.17 to 14.65
6.	Chorinemus	Muttom and Kadiapatnam	47.11 to 48.00	10.11 to 15.91
7.	Arius	Cape comorin Fish curing yard	41.63	15.01
8.	Lutjanus	-do-	50.53	26.32

TABLE III SHOWING THE RESULTS OF

Sl. No.	Name of fish	Source	Moisture %
1	2	3	4
1.	Chorinemus	Fish Curing Yards or Godowns at Manakudy, Pallamand Enayamputhenthurai	40.09 to 47.79
2.	Caranx	-do-	
3.	Arius	Thoothoor and Cape Comorin	40.09 to 48.94
4.	Histiophorous	Manakudy, Colachel Thoothoor and Enayamputhenthurai	30.84 to 45.92
5.	Shark	Colachel Kadiapatnam, Thoothoor and Enayamputhenthurai	34.43 to 43.52
6.	Lutjanus	Colachel, Thoothoor Muttom, Cape comorin and Manakudy	23.98 to 48.95
7.	Cybium	Colachel and Kollencode	45.32 to 57.04
8.	Lethrinus	Colachel, Kadiapatnam Muttom and Cape comorin	32.52 to 53.64
9.	Serranus	Cape comorin, Muttom Manakudy and Thoothoor	37.72 to 47.68
10.	Trichiurus	Manakudy and Colachel	29.96 to 44.15
11.	Silver bellies	Kollencode, Colachel and Thoothoor	23.25 to 43.18
12.	Lactarius	Kollencode and Muttom	29.13 to 40.01
13.	Mackeral	Kollencode and Manakudy	36.99 to 39.63
14.	Sphyraena	Kollencode and Thoothoor	35.75 to 40.36
15.	Tuna	Thoothoor	36.45
16.	Chirocentrus	Thoothoor and Muttom	31.84 to 44.71
17.	Balistis	Kadiapatnam	37.05
18.	Dussumieria	Muttom and Kollencode	40.30 to 44.01
		Manakudy	47.85

ANALYSIS OF TRADE SAMPLES OF WET CURED FISH

Range of Variation			
Ash % 6	T. V. B. N. (Mg/cent) 7	T. M. A. N. (Mg/cent) 8	Organoleptic grading 9
17.97 to 21.14	350.00 to 412.50	63.00 to 101.00	Poor to unfit for consumption
18.98 to 26.82	367.50 to 385.00	85.00 to 97.50	Unfit for consumption
19.98	370.00	96.00	-do-
10.87 to 20.32	162.50 to 361.50	30.00 to 114.00	Poor to Fair
14.37 to 17.98	82.75 to 252.00	25.50 to 46.00	Poor to Good
17.03 to 18.71	103.00 to 112.50	21.50 to 33.00	Good
16.90	155.00	47.50	Good
32.01	390.50	84.00	Unfit for consumption

ANALYSIS OF TRADE SAMPLES OF DRY SALTED FISH

NaCl % 5	Ash % 6	T.V.B.N (Mg/Cent) 7	T.M.A.N. (Mg/Cent) 8	Organoleptic Grading 9
11.82 to 17.04	15.72 to 18.13	173.50 to 217.60	43.00 to 102.50	Poor to Good
7.72 to 20.01	12.12 to 25.03	124.00 to 249.00	40.00 to 156.00	-do-
6.02 to 21.10	12.12 to 25.25	98.00 to 380.00	14.50 to 122.50	Unfit for consumption to Good
14.22 to 15.48	16.53 to 18.77	64.50 to 225.00	28.00 to 60.00	Good
4.45 to 18.84	9.81 to 22.13	114.50 to 367.50	17.50 to 144.50	Unfit for consumption to Good
9.42 to 22.53	12.00 to 29.07	70.50 to 163.00	35.00 to 66.50	Fair to Good
10.25 to 19.77	14.40 to 21.00	112.00 to 133.50	21.50 to 87.50	-do-
8.34 to 18.44	10.26 to 21.88	84.50 to 287.00	16.50 to 118.50	-do-
7.52 to 23.34	14.00 to 29.63	130.00 to 360.00	25.50 to 115.50	Unfit for consumption to Good
11.53 to 14.80	14.37 to 17.91	32.75 to 253.00	25.50 to 50.50	Poor to Good
7.89 to 11.53	10.68 to 15.00	156.00 to 312.00	65.00 to 68.50	Good
7.95 to 9.95	11.40 to 17.30	202.00 to 226.50	62.00 to 70.00	Poor to Good
6.32 to 14.62	9.76 to 16.96	150.50 to 382.00	67.00 to 70.00	Poor to Fair
15.68	18.09	76.50	20.50	Good
13.18 to 17.62	15.87 to 20.31	123.00 to 130.00	18.00 to 48.00	Fair
6.51	10.10	183.00	32.50	Good
10.12 to 14.48	13.80 to 16.01	100.00 to 231.00	37.00 to 47.50	Fair to Good
14.95	18.05	171.00	42.50	Good

TABLE IV SHOWING THE RESULTS OF ANALYSIS OF TRADE SAMPLES OF PIT-CURED FISH

Sl. No.	Name of Fish	Source	Moisture (%)	NaCl (%)	Ash (%)	T. V. B. N. (Mg/cent)	T. M. A. N. (Mg/cent)	Organolptic grading
1.	Lactarius	Fish Curing Yard Enayamputhenthurai and Kadiapatnam	41.77 to 57.54	11.31 to 12.20	13.42 to 17.63	130.00 to 309.00	83.00	Fair
2.	Dussumeria	Fish Curing Yard Enayamputhenthurai	53.58	13.05	14.86	339.86	110.50	Poor
3.	Serranus	Manakudy	42.18	8.70	16.95	194.00	40.00	Poor
		Maximum	57.54	13.05	17.62	339.86	115.50	Good...Nil
		Minimum	41.77	8.70	13.42	180.00	49.20	Fair....50%
		Average	48.77	11.82	15.52	255.50	78.63	Poor...50%

obtain necessary basic information to formulate quality standards for these products which are gaining importance in the export trade. The salt cured fish products in the district can be broadly classified as sun-dried, dry-salted and wet-salted products. The chemical quality and organoleptic characteristics of a total of 155 trade samples of all the three categories were assessed.

In sun-dried products which were mainly dried white baits (*Anchoviella Sp.*) only 26.5% of the trade samples were good, the chief defects in the products being heavy admixture of sand and inadequate drying. Strict adherence to the standards prescribed in I. S.: 2883 - 1964 for dried white-baits (*Anchoviella Sp.*) will considerably improve the quality of these products.

In the wet-salted products only 25% of the trade samples were good and as much as 55% of the samples were of bad quality in most respects, the chief defects being very high moisture content, very poor salting and use of already spoiled fish for the curing. None of the pit-cured products was good in quality, the defects being poor appearance, soft and flabby texture, unpleasant odour and infestation by maggots and flies. The wet and pit-cured products being generally of bad quality and of very low keeping qualities, their production and consumption should be discouraged.

The dried salted products were found to be the most satisfactory among the three categories with 55.21% of the trade samples being good. There was good scope and need for further improving the quality of those products, the Chief defects being, the use of spoiled or spoiling fish, imperfect cleaning and washing, use of impure salt, inadequate salting, curing and drying and unhygienic conditions of

handling at every stage of processing. Quality standards should be formulated for each variety of these products and adequate measures must be taken to rectify the defects and enforce these standards.

ACKNOWLEDGEMENT

The authors are thankful to the Director of Fisheries, Madras for his kind permission to publish this paper.

REFERENCES

- Barlind, F. H. 1958 F. A. O. Report No. 931.
- Chacko, P. I. and George, S. 1958 Madras Fisheries Marketing Report No. III, Madras Government Publication.
- I. S. I. New Delhi 1964 "Indian Standard Specification for Dried white baits (*Anchoviella Sp.*) I. S. 2883.
- Joseph, K. C. 1962 *Madras J. Fish* pp. 427-30.
- Joseph, K. C. and Srinivasan, R. "On the fish curing practices at Cape-Comorin" *Madras J. Fish* a (in press)
- Krishna Pillai, V. Valsan, A. P. and and Rajendranathan Nair, M. 1956. *Indian J. Fish.* 3, 43-58.
- Nicholson, P. A. 1930. "The Preservation and curing of fish". Government Press Madras.
- Sen, D. P., Anandasamy Iyengar, N. V. R. and Lahiri N. L. 1961. *Food Sci.* 10, 5, 123-156.
- Sreenivasan, A. and Venkataraman, R. 1958 *Proc. 11nd International Symposium Food Microbiology*, Cambridge, 1957. pp 117-129.
- Srinivasan, R., Sabapathy, N. and Joseph, K. C. 1967. *Madras J. Fish*, 3, 61-66,
- Venkataraman, R. and Vasavan, A. G. 1956. Madras Fisheries Station Reports and Year Book 1954-55, pp 391-410.
- Venkataraman, R. and Vasavan, A. G. 1969 Madras Fisheries Station Reports and Year Book, 1955-56, pp. 261-265.