

water-tight chamber, similar to the previous case. The thin brass metallic diaphragm placed before the speaker, helped easy transmission of the sound waves into water. Fig 4 shows the diagram of the under-water speaker. The photograph (Fig 5) shows the under-water speaker, the electronic unit and the electric wire. The sound produced by the speaker was audible to a normal human ear upto a distance of about 100 m. However, at low frequencies, the range of transmission was found to have reduced to about 80 m.

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Central Institute of Fisheries Technology
Ernakulam, Cochin-11.

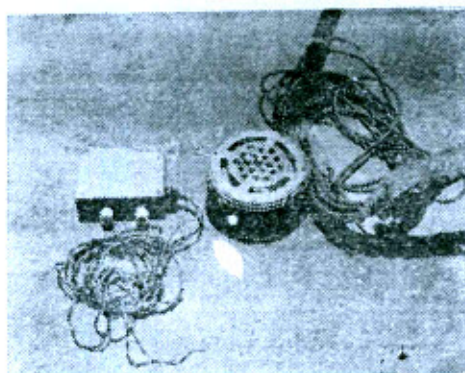


Fig 5. The under-water speaker and the electronic unit along with the electric cables.

sincere encouragement during the course of the development of the instruments.

T. K. SIVADAS

QUALITY AND SHELF LIFE OF DRIED SHARKS PRODUCED IN INDIA

The landings of elasmobranch fishes in India during the past nine years averaged 35,227 metric tons of which major contributions were from Madras, Kerala, Andhra, Gujarat, Maharashtra and Mysore in descending order of quantity. Major portion of the catch is converted to cured products and either exported to Ceylon and other far eastern countries or consumed internally. Though compulsory pre-shipment inspection was introduced recently, not much is known about the quality of the commercial products. This note deals with the quality and shelf life of dried sharks produced in India.

Samples of cured sharks were collected from various centres of production or export situated at Quilon, Changanacherry, Cochin, Calicut (Kerala), Tuticorin (Madras), Bombay (Maharashtra) and

Veraval (Gujarat) and were analysed for moisture, acid insolubles, ash, sodium chloride, Total Volatile Nitrogen (TVN) and Trimethylamine Nitrogen (TMA-N). Portions of the samples were stored in glass jars for assessing their shelf life. Samples were judged to be unacceptable when they developed high ammoniacal/putrid odours.

Statistical analysis of the results on moisture, ash, NaCl, insolubles, TMA and TVN are shown in Table I. Table II shows the storage life of the commercial samples in relation to the moisture content while the shelf lives of the samples prepared under controlled conditions with three different salt contents and varying moisture levels are shown in Table III.

Table I shows that the standard variation in moisture is very high when

TABLE I STATISTICAL ANALYSIS OF THE DATA ON CURED SHARK

Place and date of collection	Number of samples	Moisture %		Ash %		NaCl %		Insolubles %		TVN mg %		TMA mg %	
		1	2	1	2	1	2	1	2	1	2	1	2
Changanacherry	15	51.69	0.64	35.52	1.50	23.54	1.82	2.51	0.60	186.71	25.59	41.41	7.60
Calicut	10	52.03	3.81	38.77	2.60	34.80	2.27	0.86	0.56	173.41	54.69	15.17	5.46
Calicut	11	52.79	2.75	41.04	2.85	35.78	3.36	1.23	0.83	260.66	77.85	19.41	12.60
Bombay	14	28.74	9.35	30.13	3.15	27.3	3.36	0.11	0.06	—	—	25.43	6.47
Changanacherry	18	39.24	10.50	39.05	3.22	35.16	3.38	0.32	0.13	—	—	—	—
Veraval	4	29.14	2.08	31.71	1.33	28.70	1.21	0.12	0.02	—	—	31.75	3.71
Quilon	8	48.08	6.71	36.07	2.46	33.02	2.29	0.22	0.08	—	—	—	—
Cochin	8	40.54	6.68	32.03	6.77	27.09	5.43	0.71	0.22	110.29	28.95	—	—
Cochin	13	49.84	4.12	37.10	3.02	29.41	3.44	0.31	0.25	71.61	42.55	13.47	6.84
All the samples combined	110	44.63	10.61	36.41	4.61	30.68	5.48	0.78	0.89	167.60	77.90	25.43	13.76

(1) Mean, (2) Standard deviation

TABLE II SHELF LIFE OF COMMERCIALY CURED SHARKS UNDER ATMOSPHERIC CONDITIONS

Moisture %	Shelf life (weeks)	% of samples
35 and below	12 weeks or more	21.82
36-40	8-12	5.46
41-45	4-8	6.27
46-50	2-4	20.90
51 and above	less than 2 weeks	45.55

TABLE III EFFECT OF SALT AND MOISTURE ON THE SHELF LIFE OF CURED SHARK

I → 6 hours		12 hours		18 hours	
II → 22.8		30.13		32.76	
Moisture %	Shelf life (days)	Moisture %	Shelf life (days)	Moisture %	Shelf life (days)
60.23	10	56.87	20	55.25	20
57.45	20	55.37	20	53.20	20
54.76	..	52.04	30	48.25	60
52.77	30	46.04	60	44.00	100
51.77	35	44.81	100	43.98	100
48.03	..	40.81	120	43.74	105
46.13	..	37.08	120	34.88	200
39.34	41	25.51	200	26.55	200
30.25	41	23.38	200	18.57	200

I: Curing time

II: Salt % in muscle (DWB)

all the commercial samples are treated together indicating the non-uniformity of the materials. This may be due to the differences in the extent of drying for the different batches of material. Because of this, sets of samples collected from the same place and on almost the same date were treated separately. In each set ash

and sodium chloride show comparatively less variability. Variability in moisture was less for most of the samples when compared to the overall variation. The average moisture contents of samples from Bombay and Veraval were less than those from other places. Similarly TMA and TVN values show high variability in different sets. Shelf life of the commercial samples varied between 2 to more than 12 weeks for moisture contents of above 51% and below 35% respectively. Only 33.53% of the samples had shelf life above four weeks. Table III shows that curing shark flesh for 12 hours or more (Fish 3: Salt 1) yields samples with 30-32% salt. When moisture in these samples are below 45% they keep well for more than 3 months. It has been shown that nearly 50% of the urea is leached out during the curing process (Kandoran *et al*, 1965). This lowered urea level with the high salt content may delay the development of ammoniacal odours. It is suggested that uniform methods of salting and curing be followed to minimise quality variation. Salting shark flesh in 1:3 ratio and allowing to cure in self brine for more than 12 hours followed by drying give a product with satisfactory shelf life.

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