PROCEEDINGS OF THE SYMPOSIUM

ON

LIVING RESOURCES *of* THE SEAS AROUND INDIA

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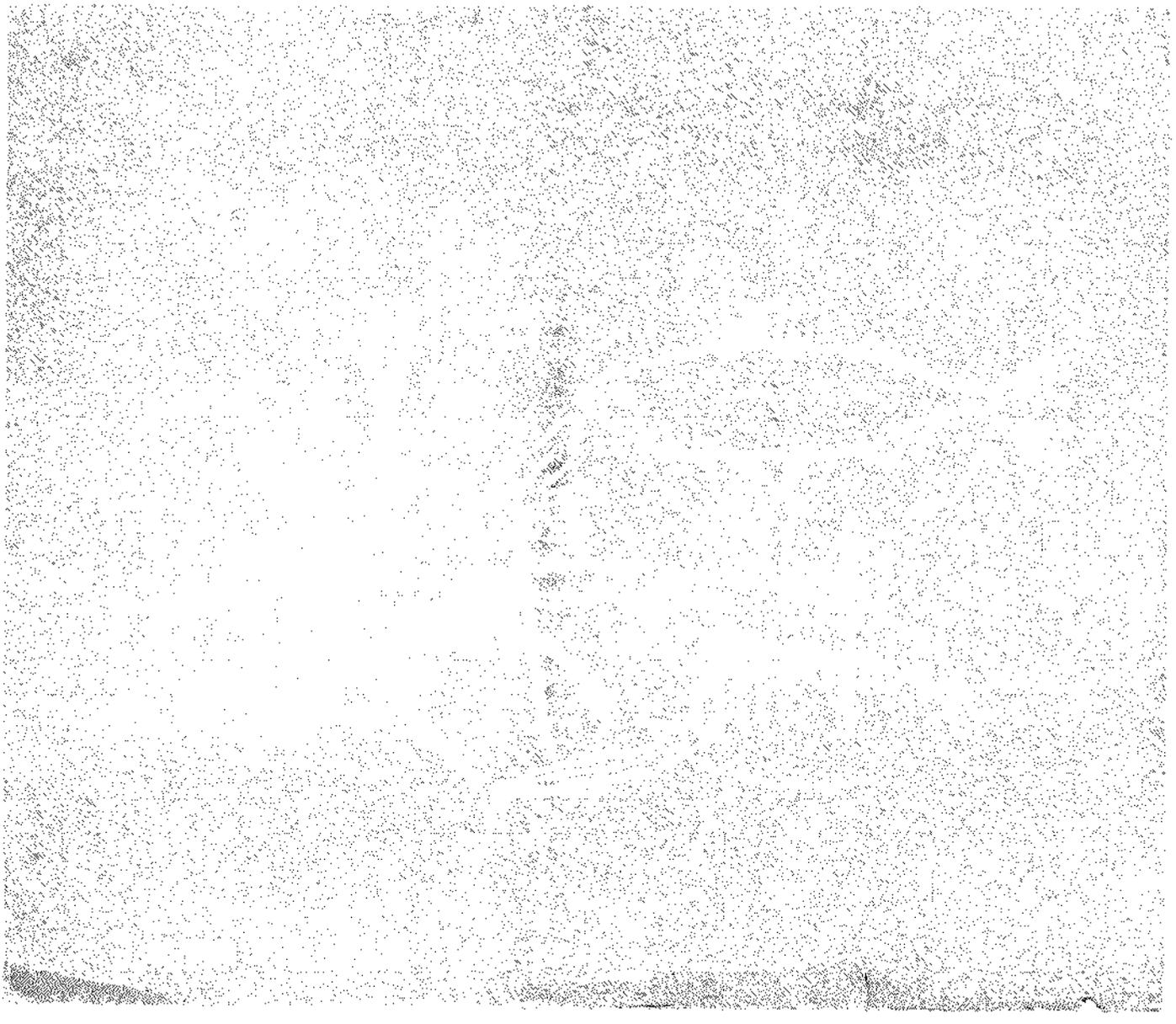

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QUALITY CONTROL FOR THE BETTER UTILISATION OF INDIA'S FISHERY RESOURCES

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ABSTRACT

The role played by Quality Control research in improving the quality of fisheries products manufactured in India is reviewed. The impact of improvements in sanitary conditions in the fishing boats, primary processing centres and factories, care of water and ice supplies and measures to control the production processes at various stages, on the physical and chemical quality and bacteriological content of the products is discussed in detail.

IT is a well-known fact that the private sector took the leading part in introducing the more sophisticated methods of fish processing like canning and freezing in India and in establishing an export trade in these commodities. From the time this industry started with the first shipment in 1953 it has grown substantially and today occupies perhaps the second place among the world's major shrimp exporters with an annual export figure of over 2,300 tonnes of frozen prawn and 1,800 tonnes of canned prawn. The rapid development, although phenomenal, has not been without hurdles and the hurdles were more pertaining to quality such as maintenance of uniformity in weight, improvement in organoleptic and bacteriological characteristics and most important of all, the standardization of process conditions at various stages.

In the early stages of growth of the prawn processing industry the processor did not have the benefit of technical assistance except for the instructions received from the buyers. These often turned out to be widely divergent in nature and did not bear much relationship to the organic character of the material handled for processing. This could only have been so as the species of prawn familiar to the buyers are totally different from what is processed in India. Most of the commercial species, viz., *P. indicus*, *M. dobsoni* and *M. affinis*, to mention the three major species, are marked by their own range of colour for the shell and meat, flavour and spoilage pattern. The result was the total dependance of the exporters on the importers in these early days. Odd consignments got rejected in the importing countries for real and hypothetical reasons over which there was no appeal or argument and which only created a feeling of helplessness among the processors in India. The total rejections in some years went upto 7 to 10% of the quantity exported. The real break started with the establishment of the Central Institute of Fisheries Technology in 1958, one of the main objectives of which was to carry out investigations and to provide technical assistance to the industry on various aspects of quality control. Today the over-all rejections in the importing countries have come down to less than 0·10%. This was achieved in two ways—by detaining sub-standard material at the exporting end by an inspection procedure made compulsory with effect from 1965 and by providing constant technical guidance to the processors in quality control aided by research on short-term and long-term problems. An idea of the improvement effected during the short period of seven years is seen from Table I which shows the extent of occurrence of sub-standard products in the total production.

The problems faced by the industry were many and varied. The most important of all was the amenability of the different species constituting the raw material to different conditions of preservation, storage and supply. Studies showed that irrespective of the species, prawns, sardines and other major varieties of fish remained in fairly good condition for 4 hours at atmospheric conditions

TABLE I

Percentage of sub-standard samples in frozen prawn products

	Headless	Peeled and Deveined
1960	35–45	50–55
1961	15–35	20–50
1962	2–15	10–25
1963	0–15	10–20
1964	5–10	12–18
1965	0·05–1·2	1·2–3·0
1966	0·4–0·8	1·2–2·7
1967	0·7–1·0	1·6–4·1
1968 (9 months)	nil –0·9	1·4–1·8

without ice after which it is considered unacceptable for processing although edible. Under iced condition, however, the period of acceptability was found to be longer, of the order of 4–5 days (Velankar *et al.*, 1961 *a* and *b*; Pillai *et al.*, 1965). Actual freezing trials carried out on iced materials revealed a decrease in the shelf life (Shenoi, Chinnamma and Pillai—Unpublished) after specific periods of icing as indicated in Table II.

TABLE II

Shelf life of frozen fish products prepared from material iced for different periods

Type of fish	Period of icing prior to storage	Shelf life of frozen prawn as judged by organoleptic rating	
		Headless	Peeled and Deveined
Prawn	0	over 25 weeks	over 20 weeks
	1	do.	do.
	2	do.	do.
	3	18	15
	5	12	4
	7	8	2
Sardine	0	20	
	1	20	
	3	12	
	5	2	
Seer	0	over 16 weeks	
	1	do.	
	3	do.	
	6	do.	
	10	8	
	15	4	

FACTORY SANITATION AND MICROBIOLOGICAL QUALITY

Another serious problem faced by the processing industry in the early days is the heavy microbial build-up in the processed products particularly in frozen prawn products (Lakshmy and Pillai, 1964). Investigations (Pillai *et. al.*, 1965) showed that over 9% of headless fresh frozen prawn, 17% of the larger size groups of peeled and deveined frozen, 35% of the smaller size groups and 22 to 35% of the cooked frozen prawn contained bacterial loads of over 1 million per gram with high counts of organisms like *E. coli*, Enterococci and Staphylococci. An enquiry into the reasons

(Gopalakrishna Iyer and Choudhuri, 1965; Gopalakrishna Iyer and Pillai, 1965; Gopalakrishna Iyer *et. al.*, 1966) revealed that this high build-up was the direct result of contamination of the material during the course of processing from the boat deck, holding containers, ice, water, contact surfaces, etc. It was further seen that even with normal cleaning there is possibility of high bacterial build-up on utensils used in the factories at the high tropical temperature condition. These observations called for effective washing schedules at the various sections like fishing vessels, primary process centres and the factories, continuous treatment of water used for washing, glazing and cooling operations and for the preparation of ice, and measures for process control.

The effect of introduction of these measures was spectacular as may be seen from Table III.

TABLE III

Effect of ideal cleaning schedule and process control on bacterial load in prawn

	Total count/g	Faecal Streptococci/g	*E. coli*/g
A. Processed under unhygienic conditions	(1) $8{\cdot}9\times10^6$	260	Nil
	(2) $7{\cdot}2\times10^6$	860	210
	(3) $3{\cdot}5\times10^7$	590	157
B. Processed under hygienic conditions	(1) $8{\cdot}2\times10^4$	Nil	Nil
	(2) $7{\cdot}1\times10^4$	do.	do.
	(3) $4{\cdot}3\times10^3$	do.	do.

This problem of high bacterial load was found to be more with cooked frozen prawn, for which strict bacteriological standards were introduced by importing countries like Australia, U.K. and U.S.A. Although the organoleptic quality of the products exported from the country satisfied the most rigorous tests, the bacterial counts were found to be much higher than the limits imposed suddenly. The challenge prompted a series of investigations which resulted in working out a standard process for the preparation of bacteriologically sound cooked frozen prawn (Gopalakrishna Iyer, Choudhuri and Pillai, 1968). The result is the resumption of unrestricted flow of cooked frozen prawn, export of which had been completely stopped for a short period, into the above markets. The total bacterial load seldom exceeds a few thousands per gram against the allowed limits of 2,50,000/g in Australia, 1,00,000/g in U.K. and 2,00,000/g in U.S.A.

The studies on bacteriological characteristics of ice stored and frozen fishery products have been further elaborated into investigations on possible sources of contamination of the products by faecal indicator and pathogenic strains of bacteria like *E. coli*, Streptococci, Staphylogocci and Salmonella. From the point of view of hygienic standards these specific groups of organisms assume greater importance than total counts. The investigations carried out in this field (Lakshmy and Pillai, 1964; Lakshmy, 1964) have not only traced the course of contamination by the organisms but also worked out effective preventive methods which help the processor to manufacture products completely free from such objectionable organisms.

Among process control measures the one that needed urgent attention was maintenance of uniform declared weights in the packs irrespective of whether it is frozen or canned products. Investigations showed that several factors can affect the final weight of the products. In the case of canned prawn it has been observed (Choudhuri and Balachandran, 1965) that both blanching period and the concentration of brine affect the drained weight, the ideal combination being 7% brine and 5 minutes blanching time. With lower ranges of either of these or combination a lower drained weight resulted which would mean rejection and with higher ranges the results were just the reverse causing over filling, loss of vacuum and wastage of precious material. With this information on hand canners are now in a position to make suitable adjustments in fill weights to suit

the process followed by them and to obtain correct drained weight. In the case of frozen products (unpublished data) factors like the pre-process ice storage, pre-pack drajning period, amount of water glaze, the size of pieces constituting the pack, type of pack, etc., are found to influence the final drained weight. To compensate for the thaw drip loss which may vary between 3 and 12% depending on the above factors the processors generally make an arbitrary excess allowance of about 100 to 450 g for every 2,270 g blocks. This has been found to invariably result in fluctuating drained weights. Calculation from available data shows that over 100 tons of frozen material now go unnoticed per annum in the form of excess weight. Efforts to work out control charts for correct drained weights in respect of the different types of prawns under different variable product and process conditions mentioned above are progressing.

In the case of canned products one of the most serious problems faced by the industry was the frequent occurrence of blackening both of the product and containers. Of the total detained at the point of inspection at the export end nearly 50% was found to be due to the above defects. Investigations (Nandakumar *et al.*, 1968—under publication) showed that blackening is primarily due to the presence of copper beyond levels of 1·2/mg (D.W.B.) in the material. It was also found that iron can produce similar discolouration if the pH of the can contents is beyond 7·0 while copper produces blackening at both acid and alkaline condition and that blackening due to iron can be completely prevented by maintaining a residual acid level of 0·1%. The industry reacted readily to these findings and has helped in bringing down the detention due to blackening to the level of 0·5%.

The foregoing deals with only one of India's fishery resources, *viz.*, prawn and the contribution made by quality control research in its better utilisation. Our efforts are extended to other spheres as well. Methods have been standardized for canning of important varieties of fishes like sardine, mackerel, pomfret and tuna which have now been adopted to advantage by the trade. A method has been developed to prevent 'belly bursting' in oil sardines (*Sardinella longiceps*) which may open up a new phase in internal distribution of this fish.

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