Investigations on Long Distance Transportation of Fish III. Field Trials With a Dismantlable Insulated Galvanised Iron Container

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The paper communicates the results of field trials conducted with a dismantlable insulated galvanised iron container designed and fabricated by the first two authors in their laboratory. Different varieties of fishes and different types of packing, namely, fresh iced, chilled iced and frozen were employed in the transportation experiments which were conducted from Kakinada to Howrah, Kakinada to New Delhi and Paradeep to Howrah. In all the experiments the container performed exceedingly well and has still remained in very trim condition.

The importance of proper transportation and distribution of fresh fish in India has been brought out and details of experiments carried out in successfully transporting fish in frozen form over long distances of the order of 2360 Km form Cochin to Calcutta in ordinary rail wagons have been reported (Govindan *et al.*, 1977). Design and fabrication of an insulated, dismantlable and returnable galvanised iron container suitable for this purpose have been described and its advantages over conventional as well as more recently developed containers have been pointed out in the second part of this series (Govindan and Gupta, under publication). The present communication presents the results of extensive field trials conducted with this newly developed container and conclusively proves its efficiency.

Materials and Methods

The field trials undertaken were (1) from Kakinada to Howrah (2) from Kakinada to New Delhi and (3) from Paradeep to Howrah. Fresh iced, chilled iced and frozen fish were employed in the transportation experiments conducted from Kakinada and the fishes used were procured from a local brackish water fish farm and from the landings of mechanised boats at the Kakinada fishing harbour in very fresh condition. Transportation was done in un-insulated parcel vans of express trains, consignments to Howrah being transhipped at Samalkot Junction and those to New Delhi at Vijayawada Junction into the respective connecting trains. Fishes employed for the experiments from Paradeep to Howrah were of marine origin and were transported from Paradeep to Cuttack by road (100 Km) and from there to Howrah by ordinary rail wagons (500 Km). Total bacterial counts were determined using sea water agar, total coliforms in desoxycholate lactose agar and staphylococci in Chapman's agar media as described by Lekshmy and Pillai (1964).

Results and Discussion

Types of fishes employed, methods of packing and bacteriological quality of the

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fish at the time of packing, in experiments from Kakinada to Howrah are described in Table 1. Organoleptically all the samples were in 'excellent to good' condition at the time of despatch. Results of analyses of the fishes transported in the above experiments at the receiving end are shown in Table 2.

Table 3 describes the types of fishes, methods of packing and bacteriological characteristics of the fishes that were transported from Kakinada to New Delhi in the above container. All samples were organoleptically in 'good' condition at the time of despatch. Details of analyses of these consignments on arrival at New Delhi are shown in Table 4.

Table 1. *Types of fishes, methods of packing and bacteriological quality of fishes at the time of packing in experiments on transportation from Kakinada to Howrah*

Consignment No.	Name of fish	Quantity in kg.	Type of packing	Total bacterial count/g	Total Coliforms/g
1	*Chanos chanos*	26	Fresh iced 1:1	2.80×10^4	13
2	-do-	35	-do-	1.00×10^4	25
3	-do-	40	chilled and iced 1:0.75 (fish to ice)	4.00×10^3	9
4	-do-	40	Frozen individually, iced 1:0.5 (fish to ice)	1.68×10^4	16
5	*Synagris* sp. *Upenoides* sp.	53	Glazed frozen blocks, no additional ice added	1.28×10^4	23
6	*Chanos chanos*	53	-do-	1.02×10^4	33
7	*Synagris* sp. *Upenoides* sp.	35	Fresh iced 1:1	2.60×10^4 1.70×10^4	122 61
8	*Chanos chanos* Mullet (*Mugil* sp.)	32	Frozen individually, iced 1:1	1.60×10^4 2.10×10^4	44 55
9	Eel (eviscerated)	30	-do- iced 1:0.75 (fish:ice)	1.10×10^5	90
10	Cat fish	40	Frozen glazed blocks, iced 1:0.5 (fish to ice)	1.48×10^4	28
11	Bombay duck	30	-do- iced 1:1	8.40×10^4	25
12	Ribbon fish Seer	20 11	Chilled and iced 1:1	4.60×10^4 4.50×10^4	24 12
13	Eel (eviscerated)	21.5	-do-	3.80×10^4	Nil
14	*Synagris* sp. *Upenoids* sp.	53	Frozen glazed blocks, iced 1:1, 2 containers	4.10×10^4	31
15	Sciaenids *Synagris* sp.	11.5 18.5	-do- one container	1.20×10^4 1.80×10^4	20 12
16	*Synagris* sp. Seer *Pristipoma* sp.	47 20	-do- iced 1:0.5 2 containers	9.90×10^3 6.70×10^3 1.80×10^4	14 Nil Nil
17	Cat fish Seer Elacheta } Eviscerated	27	Frozen individually, iced 1:1	7.80×10^3 1.30×10^3 7.00×10^3	Nil 19 20
18	*Synagris* sp. Seer	24 8	Frozen blocks iced 1:1 -do- individually	1.80×10^4 9.10×10^4	Nil Nil
19	Ribbon fish	31	Fresh iced 1:1	1.38×10^4	Nil
20	Seer *Pristipoma* sp. *Hilsa* sp.	33	chilled, iced 1:0.8	1.60×10^3 — —	14 — —
21	*Synagris* sp.	35	Fresh iced 1:0.75	9.40×10^3	22
22	Sciaenids	41	chilled iced 1:1	1.89×10^5	476

Two trials were conducted with the container for transporting fish from Paradeep to Howrah. Fish were packed with 1:2 (ice to fish) proportion of ice (temperature at the time of despatch:15 and 12°C respectively) and transported by road to Cuttack and from there by rail to Howrah at ambient temperature of 26 to 28°C. The consignments reached the destination next day (about 24 h) in 'fair' condition with 1 and 5 kg of ice respectively still left unmelted in the container. These trials indicated that the container is equally efficient in insulation properties as plywood boxes with expanded polystyrene insulation and fibreboard boxes with wood-wool insulation with the added advantage that it is of a permanent nature (Chattopadhyay — personal communication).

The consignments from Kakinada to Howrah generally took 40 hours at ambient temperatures of 25 to 35°C (January to July season) involving one transhipment at Samalkot Junction. In all cases except two, they reached the destination in a 'fair' condition of preservation with varying amounts of ice still remaining unmelted

Table 2. *Results of analyses of fish consignments at Howrah*

Consignment No.	Name of fish	Total bacterial count/g	Total coliforms/g	Organoleptic quality	Remarks
1	*Chanos chanos*	1.21×10^4	60	Fair	3 kg ice remaining, temp. 10°C
2	-do-	2.41×10^6	360	-do-	-do-
5	*Synagris* sp.				
	Upenoides sp.	1.01×10^5	Nil	-do-	Partially thawed blocks
6	*Chanos chanos*	1.04×10^4	Nil	Good to fair	-do-
7	*Synagris* sp.	8.51×10^7	Nil	Poor to off	Received after 3 days, no ice left, temp. 34°C
8	*Chanos chanos*	2.93×10^4	20	Fair	5 kg ice left temp. 0°C
	Mullet (*Mugli* sp.)	3.31×10^4	Nil	-do-	
9	Eel (eviscerated)	1.81×10^4	2	-do-	4 kg ice left temp. 2°C
10	Cat fish	6.10×10^6	Nil	Fair to poor	Received after 4 days, no ice left
11	Bombay duck	6.31×10^4	Nil	Fair	Partially thawed blocks
12	Ribbon fish	1.48×10^5	Nil	-do-	5 kg ice left,
	Seer	2.12×10^5	14	-do-	temp. O°C
13	Eel (eviscerated)	2.61×10^5	Nil	-do-	-d0-
16	*Synagris* sp.	3.01×10^4	Nil	-do-	1 kg ice left, temp. 0°C
	Seer	1.51×10^4	Nil	-do-	5 kg ice left
	Pristipoma sp.	5.60×10^4	Nil	-do-	(2 containers)
17	Cat fish	1.02×10^4	10	-do-	3 kg ice left in the container temp. 0°C
	Seer	5.61×10^4	10	-do-	
	Elacheta	8.80×10^3	10	-do-	
18	*Synagris* sp.	2.01×10^5	Nil	-do-	10 kg ice left temp. 0°C
	Seer	3.21×10^5	Nil	-do-	
19	Ribbon fish	2.98×10^6	Nil	-do-	5 kg ice left, temp. 5°C
20	Seer	3.10×10^5	Nil		5 kg ice left, temp. 5°C
	Pristipoma sp	1.71×10^5	10	-do-	
	Hilsa sp.	5.10×10^4	50		
21	*Synagris* sp	1.10×10^5	50	-do-	7 kg ice left, temp. 10°C
22	*Sciaenids*	1.50×10^5	32	-do-	1 kg ice left, temp. 5°C

Note: Consignment Nos. 3, 4, 14 and 15 were not sampled due to late arrival at the destination

Table 3. *Types of fishes, methods of packing and bacteriological quality of fishes at the time of packing in experiments on transportation from Kakinada to New Delhi*

Consignment No.	Name of fish	Quantity kg	Type of packing	Total bacterial count/g	Total coliforms/g	Staphylococci/g
1	*Synagris* sp.*	23	Glazed frozen	1.57×10^3	11	22
	*Upenoides** sp.	25	blocks, no extra ice	2.50×10^4	Nil	Nil
2	*Chanos chanos**	50	-do-	6.50×10^3	Nil	Nil
3	-do-*	44	-do-	3.08×10^4	Nil	Nil
4	-do-*	40.5	-do-	2.80×10^4	17	Nil
5	Seer**	26	chilled, iced 1:1	7.04×10^3	30	Nil
6	Shark	39	Fresh iced 1:0.75	3.30×10^4	11	11

*Temperature at the time of packing–18°C
**Temperature at the time of packing–5°C

Table 4. *Results of bacteriological and organoleptic analyses of the fish on arrival at New Delhi*

Consignment No.	Name of fish	Total bacterial count/g	Remarks
1	*Synagris* sp. *Upenoides* sp.	Not done	Fair, almost thawed, temp O°C
2	*Chanos chanos*	1.12×10^4	Good, partially thawed, temp. O°C
3	-do-	1.30×10^4	-do-
4	-do-	1.10×10^4	-do-
5	Seer	2.42×10^4	-do-
6	Shark	Not done	Highly spoiled condition, strong ammoniacal odour. Received 27 h late, no ice left, temp. 35°C

Note: Coliforms, salmonella and coagulase positive staphylococci were absent in all samples except No. 3, in which the last organism occurred to the extent of 17/g

in the containers as seen from Table 2. In two instances (consignment Nos. 7 and 10) the fish reached the destination only after 3 and 4 days respectively after despatch due to delay in transhipment. In both these cases the fish were 'poor to off' organoleptically with no ice left in the boxes, their temperatures reaching the ambient with consequent high bacterial counts.

Fish despatched from Kakinada normally took 50 hours to reach New Delhi with one transhipment at Vijayawada Junction, ambient temperatures being 25 to 35°C (January to April season). All consignments except one were in fine condition bacteriologically and organoleptically as shown by the results presented in Table 4. In the case of consignment No. 6 (shark), it took 27 hours more than normal and the fish was in a state of advanced spoilage with strong ammoniacal odour. The type of packing (fresh iced), inadequate proportion of ice (1:0.75-fish to ice), longer time taken for the journey and comparatively high ambient temperatures (35°C) have all contributed to the deterioration of this consignment of fish.

Hence the new container has proved its worth in the field studies reported here. Altogether four containers were employed in the above experiments, each of them getting more or less equal chance of usage, being returned from the destination and reused. Even after all these experiments, the containers are still in excellent and reusable condition except for slight dentings here and there at the corners.

The authors record their thankfulness to Shri G. K. Kuriyan, Director, Central Institute of Fisheries Technology, Cochin-682 029, for kind permission to publish these results and to Shri M. R. Nair, Project Co-ordinator, for going through the manuscript.

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