

# INVESTIGATIONS ON LONG DISTANCE TRANSPORTATION OF FISH

## I. TRANSPORTATION OF FROZEN FISH FROM COCHIN TO CALCUTTA

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Oil Sardine (*Sardinella longiceps*), mackerel (*Rastrelliger kanagurta*), cat fish (*Arius* sp.), threadfin bream (*Nemipterus japonicus*) and ribbon fish (*Trichurus* sp.) were frozen in glazed/unglazed blocks, packed in expanded polystyrene (EPS) insulated plywood boxes with and without additional ice and despatched in uninsulated parcel vans of trains from Cochin to Calcutta. The consignments reached the destination in excellent condition and were readily disposed off.

### INTRODUCTION

With the marine fish landings scattered over the more than 5000 km. of coast line, the fresh and brackish water fish resources situated at the numerous reservoirs, rivers, rivulets, lakes, ponds, paddy fields, salt pans and backwaters throughout the country and the potential consuming centres lying in some instances even thousands of kilometres away from the production centres, proper transportation of fresh fish poses a prominent problem in our country. Large quantities

of fresh water fishes from the various reservoirs in Tamil Nadu are transported by rail to Howrah throughout the year. Marine fishes from Gujarat and Ratnagiri coasts are transported by rail, trucks and carrier launches to Bombay. Considerable quantities of marine fishes from Gujarat coast find their way to Ahmedabad and Delhi by rail. However, such transportation on commercial scale leaves much to be desired by way of adopting better handling methods and hygienic practices, employing more efficient containers and ensuring better preservation of

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TABLE I  
PARTICULARS OF DESPATCH OF FISH

Consi- gnment No.	Name of fish	Wt. of fish in one block kg.	Net wt. of fish trans- ported kg.	Size of container: cm.	No. of con- tainers	Amount of glaze used kg.	Remarks
I	Oil sardine	2	56	30 x 30 x 37	4	35*	Containers: Second hand tea chests.
II	Oil sardine	2	42	30 x 30 x 37	3	18	-do-
	Threadfin bream	2	14	30 x 30 x 37	1	6	-do-
III	Cat fish	40	160	119 x 64 x 29	2	80*	Container specially made. 2 blocks packed in each
IV	Mackerel	1	56	30 x 30 x 37	4	Nil	Containers: Second hand tea chests.
V	Oil sardine	20	120	64 x 64 x 40	2	30	Containers specially made. 3 blocks packed in each.
VI	Threadfin bream	2	94	30 x 30 x 37	5	25	Containers: Second hand tea chests.
VII	Oil sardine	20	60	64 x 64 x 40	1	10	Container specially made. 3 blocks packed.
VIII	Oil sardine	20	60	64 x 64 x 40	1	10	-do-
IX	Mackerel	22	90	64 x 64 x 30	2	12	Containers specially made. 2 blocks packed in each.
X	Ribbon fish	32	64	64 x 64 x 30	1	22	} Frozen in trays with water in tunnel } freezer. 2 blocks packed in each container.
	Cat fish	30	60	64 x 64 x 30	1	22	

\*Includes weight of crushed ice.

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the highly perishable commodity by using adequate quantities of ice.

A container developed by the Central Institute of Fisheries Technology for fish transportation consists of a plywood box (second hand tea chest) insulated inside with expanded polystyrene (EPS) slabs sealed in polythene sheet on all the six sides (Anon, 1965; Venkataraman *et al.*, 1976). A trial consignment of 35 kg. individually frozen kalava (*Epinephelus* sp.) packed in EPS insulated plywood box with the interspace filled with crushed ice and despatched from Cochin in un-insulated rail wagon reached Calcutta in satisfactory condition (Anon, 1967). Frozen blocks of oil sardine packed in 2.5 cm. thick EPS insulated plywood boxes, transported in refrigerated rail wagon from Calicut to Madras, unpacked and iced at the top, repacked and despatched by ordinary rail wagon from Madras to Calcutta reached the destination in partially thawed condition (Anon, 1968). An All India Co-ordinated Research Project on Transportation of Fresh Fish and Utilization of Trash Fish was initiated by the Indian Council of Agricultural Research towards the fall of 1971, under which the present investigation was carried out during the period December, 1971 to March, 1972.

#### MATERIALS AND METHODS

The fish used for the study were oil sardine (*Sardinella longiceps*), cat fish (*Arius* sp.), mackerel (*Rastrelliger kana-gurta*), threadfin bream (*Nemipterus japonicus*) and ribbon fish (*Trichurus* sp.). All the fishes except mackerel were obtained in excellent iced condition from the mechanised fishing vessels of the Indo Norwegian Project (now Integrated Fish-

eries Project), Cochin. Mackerel was procured from a fishing village near Cochin immediately after landing. All the fishes were frozen in blocks of different sizes as described in Table I with glaze water except in one consignment of mackerel which was wrapped 1 kg. each in polythene sheet and frozen as such. The containers used were second hand tea chests of size 30 cm. × 30 cm. × 37 cm. (height) and plywood boxes specially made to suit the size of the boxes (Table I), with insulation of 2.5 cm. thick EPS slabs sealed in 200 gauge polythene sheets provided on all the six sides internally. The frozen blocks were packed in these containers and in some cases the inter-spaces were filled with crushed ice (Table I). After placing the top insulation boards, the lids were nailed and the boxes given a binding with thick coir rope. They were despatched from Cochin by rail in ordinary parcel vans to Calcutta with transshipment at Madras. Altogether 10 consignments were sent which reached the destination normally after a journey of 70 hrs. covering a distance of 2360 km. where inspection and analysis were carried out by Project's Unit functioning at Jadavpur University and the excess fish marketed by the Central Fisheries Corporation.

#### RESULTS AND DISCUSSION

The variety of fish used, weight of fish in one block, size of container, amount of glaze used *etc.*, are described in Table I.

Results of chemical and bacteriological examination of fish samples before despatch are shown in Table II. Staphylococci were absent in all the samples except

TABLE II

## CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF THE FISH BEFORE DESPATCH

Consign- ment No.	Name of fish	Moisture %	TMA mg./100g.	TVN mg./100g.	Total plate count/g.	Total coli- forms/g.	Fat: % (D. W. B.)
I	Oil sardine	70.03	1.908	14.00	$6.10 \times 10^3$	Nil	30.37
II	Oil sardine	70.03	1.908	14.00	$6.10 \times 10^3$	„	30.37
	Threadfin bream	77.78	Nil	13.53	$1.63 \times 10^4$	„	Not estimated
III	Cat fish	77.85	Nil	11.90	$4.77 \times 10^3$	„	12.31
IV	Mackerel	77.57	0.626	16.90	$1.56 \times 10^4$	„	Not estimated
V	Oil sardine	74.57	1.200	12.00	$1.71 \times 10^4$	41	17.34
VI	Threadfin bream	76.28	0.275	9.34	$1.64 \times 10^4$	Nil	Not estimated
VII	Oil sardine	72.52	2.724	16.34	$1.93 \times 10^5$	324	„
VIII	Oil sardine	72.52	2.724	16.24	$1.93 \times 10^5$	324	„
IX	Mackerel	76.61	0.777	15.54	$7.40 \times 10^3$	9	„
X	Ribbon fish	Not done	Not done	Not done	$2.87 \times 10^4$	44	„
	Cat fish	-do-	-do-	-do-	$1.45 \times 10^4$	Nil	„

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TABLE III  
ANALYSES OF THE FISH AT THE DESTINATION\*

Consign- ment No.	Name of fish	Total plate count/g.	Organoleptic quality	Remarks
I	Oil sardine	$6.10 \times 10^3$	Fair	Frozen blocks found hard and in tact.
II	Oil sardine	$3.85 \times 10^5$	Fair to poor	Belly bursting in 1%. Blocks hard.
	Threadfin bream	$3.92 \times 10^4$	Fair	Blocks hard and in tact.
IV	Mackerel	$2.94 \times 10^3$	Fair	Partially thawed. No damage to box.
V	Oil sardine	$2.08 \times 10^4$	Fair	Blocks hard and in tact.
VI	Threadfin bream	$1.21 \times 10^3$	Fair	Reused container found broken. Blocks hard.
VII	Oil sardine	Not done	Poor	Received after 6 days. Completely thawed. Belly bursting in 60%.
VIII	Oil sardine	$1.02 \times 10^5$	Poor to off	Box found broken. Blocks completely tha- wed. Belly bursting in 70% of fish.
IX	Mackerel	$6.17 \times 10^4$	Fair	Temp. of fish: $+10^\circ\text{C}$ . Slight damage to box. Blocks hard.

\*Consignment No. III (cat fish) and X (ribbon fish/cat fish) not sampled.

in consignment V (oil sardine) in which they occurred to the extent of 16/g. Organoleptically all samples were graded 'good' except consignment VIII (oil sardine) which was only 'fair' with slight rancid flavour and belly bursting in smaller fishes. Results of analysis of these samples on arrival at Calcutta are presented in Table III. Coliforms and Staphylococci were absent in all samples except consignment IX (mackerel) in which the former organisms occurred to the extent of 49/g. The results of chemical and bacteriological analyses presented in Table II fully corroborate the organoleptic observation of the quality of fish samples before despatch. Results given in Table III show that all consignments reached the destination in 'fair' condition with the frozen blocks still hard and in tact excepting in two cases. In the case of consignment VII (oil sardine) which reached Calcutta only after 6 days of despatch from Cochin due to some mishandling enroute, the frozen blocks had completely thawed out, with belly bursting occurring in 60% of the fish and organoleptic rating becoming 'poor'. In the case of consignment VIII (oil sardine) the container got broken enroute and the fish got completely thawed out by the time it reached the destination. Organoleptically this fish was graded 'poor to off'.

It has been reported that iced fish (1 : 1) in 2.5 cm. thick EPS insulated tea chests kept in the laboratory at ambient temperatures (26 to 32°C) remained in prime condition only for 55 to 60 hrs. (Perigreen and Govindan, 1969). The storage life will be much less under conditions of actual transportation due to handling and exposure to outside temperatures etc.

Hence, if fresh iced fish were to be transported from Cochin to Calcutta, it would necessitate re-icing, re-packing and re-booking enroute, which add considerably to the cost of transportation. Shelf life of frozen fish (-15 to -18°C) packed in the above container and kept in the laboratory (26 - 32°C) was 96 hrs. (Perigreen and Govindan, *loc. cit.*). Storage life will be considerably less under actual field conditions of transportation. But even then it is sufficient for transporting the fish safe from Cochin to Calcutta without re-icing enroute. That is the reason for employing only frozen fish in these experiments. Also previous experience has shown that expenditure incurred in transporting fish in frozen form worked out to be less than that in iced form especially over long distances (Rao, 1973), because the container can hold a larger nett weight of block frozen fish. The cost of transporting 1 kg. fish in frozen form from Cochin to Calcutta worked out to around Re 1.00, assuming that the plywood boxes and insulation could be used four times. Rao (*loc. cit.*) further observed that in spite of the considerably long distance over which fish are transported from Cochin to Calcutta, the expenditure incurred in transporting 1 kg. of fish is only marginally in excess of that over shorter distances, because the former is in the form of frozen blocks while the latter is in iced form. Central Fisheries Corporation could readily dispose off the fish at a comfortable margin of profit.

#### CONCLUSION

Fish in frozen form can be transported by rail in ordinary parcel vans from Cochin to Calcutta in 2.5 cm. thick EPS

insulated plywood boxes without reicing enroute. Even in the absence of glaze and additional ice, the frozen fish withstood the transportation under the conditions of the experiments reported.

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#### REFERENCES

- Anon. 1965. *Fish Technology News letter*; 6, 2 : 4. Central Institute of Fisheries Technology, Cochin.
- Anon. 1967. *Annual Report of the Central Institute of Fisheries Technology* : 9.
- Anon. 1968. *Annual Report of the Central Institute of Fisheries Technology* : 21.
- Perigreen, P. A. and T. K. Govindan. 1969. *Fish. Technol.*, 6, 2 : 74.
- Rao, K. Krishna. 1973. Paper presented at the Second Workshop on All India Co-ordinated Research Projects on Transportation of Fresh Fish and Utilization of Trash Fish, Mangalore, April, 1973.
- Venkataraman, R., P. R. G. Varma, P. V. Prabhu and A. P. Valsan. 1976. *Fish. Technol.*, 13, 1 : 41.