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Assessment of Economic Losses due to Inadequate Post-Harvest Infrastructure Facilities for Marine Fisheries in Gujarat

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ABSTRACT

The study examines the economic losses on account of inadequate post-harvest infrastructure facilities for the marine fisheries sector in Gujarat, India. The primary data were collected during month of October 2015 covering three periods spread in the year 2014 & 2015 (October 2014 to September 2015) from three fishing harbours i.e. Veraval, *Porbandar* and *Mangrol* of Gujarat. It was observed that the post harvest infrastructure in marine sector in Gujarat seems to have received less attention. It is also true that as the industry has been pre-occupied with the exports, no major initiatives have been made for the development of the domestic market, mainly due to less demand. By and large, fish is sold in the most unhygienic conditions and this area needs considerable intervention in the coming period. Fishing harbours are being developed at both major and minor ports. However, the condition of washing and cleaning facilities available at selected harbours was unsatisfactory at *Porbandar* and *Mangrol* while same was very poor at Veraval harbor. Also the facilities like clean landing platform and cold storage/chill plants within the harbour premises and availability of insulated storage boxes on board the fishing vessel need to be ensured. The harbors like *Porbandar* and Veraval are overcrowded due to less space in harbor region and large number of boats parked there than its capacity. Because of same, fish catch exceeds the capacity of harbor. On an average, the economic loss due to inadequate post-harvest infrastructure facilities was estimated to be ₹ 18 per kg of fish caught. The major reasons for losses at this stage were physical damage during fishing and spoilage due to improper icing, whereas very minimal share was loss due to fish being eaten away by birds. The motorized trawlers followed by gill *netters* are major causes for fish losses. Therefore, there is a need of expansion of harbor regions as well as constructions of more number of jetties/landing platforms, along with proper maintenance of those infrastructures for minimizing economic losses.

Keywords: Marine fishery, production and conservation, post-harvest losses

The fisheries sector plays an important role in the Indian economy. It contributes to the national income, exports, food and nutritional security and in employment generation. The fisheries and aquaculture in India are vibrant economic activities, and have been one of the fastest growing food production systems during the last three decades. Their significance and contribution towards agricultural (4.75 per cent GDP in 2012-13 at current prices) and national economies (0.83 percent to national GDP in 2012-13 at current prices), livelihood and nutritional security, employment generation (14.49 million people) and foreign exchange earnings (over ₹ 33441 crores in 2014-15) have been enormous though understated so far. In India, fish is the major source of protein for over one-third of the population especially for the rural poor in coastal areas. About 35 per cent of Indian population is fish eaters and the per capita consumption is 9.8 kg whereas the recommended intake is 13 kg (Srinath *et al.*, 2008; GOI, 2011). The marine fish production has also been stagnating over

recent years (CMFRI, 2004). As per FAO, the post harvest loss in world fisheries is 10 per cent. Post-harvest Food Loss (PHL) in general is defined as the measurable qualitative and quantitative loss along the supply chain, starting at the time of harvest till its consumption or other end uses (De Lucia and Assennato, 1994; Hodges, Buzby and Bennett, 2011). Though the fishery sector has transformed in terms of its nature and significance, there are challenges yet to be addressed but reducing or if possible, eliminating economic losses of fisheries due to inadequate post-infrastructure (PHI) facilities is one of the most important of them. Being a highly perishable commodity, fish requires proper landing facilities, processing, storage, transport and distribution facilities running through the entire supply chain from capture to consumer. Thus, post-harvest fish losses are one of the immediate policy concerns as it happens in most of the fish distribution chains in India. The Gujarat state has a long coastline extending to 1600 km accounts for 19.70 per cent of the total coastline of the country and about 46 per cent of the western coastline of India. Out of the total production of 7.93 lakh MT in 2013-14, about 88 percent was marine fish while remaining 12 per cent was inland fish production in the state. There are 5 fish harbours existing in the state and there total fish production capacity of 388000 metric tons and another 5 harbours have been proposed to be established in the state.

In this context, the present study assesses the economic losses due to inadequate post-harvest infrastructure facilities for fisheries sector in Gujarat state, which is an important contributor to marine fishery resources in India.

DATA AND METHODOLOGY

The study is based on both primary and secondary data. The secondary data were collected from published sources as well as from the Department of Fisheries, Government of Gujarat. The primary data were collected in October 2015 covering three fishing periods in the year 2014-15 (October 2014 to September 2015) from three fishing harbours i.e. Veraval, Porbandar and Mangrol of Gujarat. These fishing harbours have been chosen for collecting the infrastructural gap to arrest post-harvest fish losses in Gujarat. From each site, a number of stakeholders involved in the supply chain viz. boat owner (30), fishermen (30), including the administrators were interviewed to collect information on the various aspects including fish quality and exlent of losses. In the present study, the economic losses in marine fisheries because of inadequate post-harvest infrastructure have been estimated as the value of losses (in both quality and quantity) of marine fish due to physical damage, spoilage or some other reasons.

RESULTS AND DISCUSSION

Among different fishing crafts and fishing gears available with selected respondents are high concentration of motorized crafts/boats was observed. On an average of both categories, per household had 2.08 motorised crafts and 0.23 traditional crafts. The boat owners had more number of both the crafts per household than fishermen, i.e. 3.17 motorized crafts/hh as compared to 1.0 motorized craft/ha with fishermen. Across the harbors, Mangrol respondents had highest number of crafts (3.15) followed by Veraval (2.20) and the lowest was in *Porbandar* (1.60).

The type of fishing gears used varied by type of fishing operation and target species. Trawlers and Gill nets were commonly used in family fishing as they were relatively of low cost. On an average, every household (both groups together) had 7.32 trawlers and 2.98 gill *netters*. Besides every household possessed other gears such as purse seine and cast nut (4.32), deep sea trawlers (0.75) and very few households had long lines tuna, squid jigging and shore seining. Across harbors, the highest number of trawlers per household was observed in Veraval, while Mangrol respondents had the highest number of gill netters and other gears/hh.

Details of Fishing Activities

The details on seasonwise hourbourwise fishing activities by selected boat owners and fishermen are presented in Table 1 which shows that on an average, the fishing days per season were estimated to be 64.9 days, (ranges between 65-69 days in three selected seasons during 2014-15). The highest fishing days were recorded in October-December period (67.2 days), followed by January-March period (66.8 days) and lowest were in April to September period (60.8 days), which may be due to 90 days

Table 1: Harbour-wise and Season wise Details of Fishing Activities (All)

Sl. No.	Particulars	Unit	Details of Fishing activities- ALL			
			Porbandar	Veraval	Mangrol	Av.
1	Oct. - Dec. 2014					
A	Fishing days per season	Av no.	66.6	66.4	68.6	67.2
B	Fishing trips in season	Av no.	5.5	4.4	10.3	6.7
C	Fishing trips by type of fishing craft	Av no.				
	a) Traditional		0.0	0.1	0.1	0.1
	b) Motorized		5.5	4.2	10.2	6.6
	c) Mechanized		0.0	0.0	0.0	0.0
	d) Others		0.0	0.0	0.0	0.0
D	Fishing Vessel	%				
	a) Day fishing		0.0	0.0	10.0	3.33
	b) Multi Day Fishing		100	100	90.0	96.67
E	Days of fishing per trip	Av no.	12.6	15.1	12.3	13.3
F	Fisherman on-board	Av no.	6.8	8.1	6.9	7.2
2.	Jan to Mar. 2015					
A	Fishing days per season	Av no.	63.4	69.2	67.9	66.8
B	Fishing trips in season	Av no.	5.0	4.6	11.0	6.9
C	Fishing trips by type of fishing craft	Av no.				
	a) Traditional		0.0	0.1	0.1	0.1
	b) Mechanized		5.0	4.5	10.9	6.8
	c) Motorized		0.0	0.0	0.0	0.0
	d) Others		0.0	0.0	0.0	0.0
D	Fishing Vessel	Av no.				
	a) Day fishing		0.0	0.0	10.0	3.33
	b) Multi Day Fishing		100	100	90.0	96.67
E	Days of fishing per trip	Av no.	12.8	15.4	11.7	13.3
F	Fisherman on-board	Av no.	6.6	8.0	6.9	7.2
3.	April to Sept. 2015	Av no.				
A	Fishing days per season	Av no.	57.6	60.5	64.3	60.8
B	Fishing trips in season	Av no.	4.5	4.0	9.5	6.0
C	Fishing trips by type of fishing craft	Av no.				
	a) Traditional		0.0	0.1	0.1	0.0
	b) Mechanized		4.5	3.9	9.5	5.9
	c) Motorized		0.0	0.0	0.0	0.0
	d) Others		0.0	0.0	0.0	0.0
D	Fishing Vessel	%				
	a) Day fishing		0.0	0.0	10.0	3.33
	b) Multi Day Fishing		100	100	90.0	96.67
E	Days of fishing per trip	Av no.	13.3	15.4	12.4	13.7
F	Fisherman on-board	Av no.	6.6	7.9	6.9	7.1
4.	Overall					
A	Fishing days per season	Av no.	62.5	65.3	66.9	64.9
B	Fishing trips in season	Av no.	5.0	4.3	10.2	6.5
C	Fishing trips by type of fishing craft	Av no.				
	a) Traditional		0.0	0.1	0.1	0.1
	b) Motorized		5.0	4.2	10.2	6.4
	c) Mechanized		0.0	0.0	0.0	0.0
	d) Others		0.0	0.0	0.0	0.0
D	Fishing Vessel	%.				
	a) Day fishing		0.0	0.0	10.0	3.33
	b) Multi Day Fishing		100	100	90.0	96.67
E	Days of fishing per trip	Av no.	12.9	15.3	12.1	13.4
F	Fisherman on-board	Av no.	6.7	8.0	6.9	7.2

Source: *Field Survey Data.*

(15th of May to 15th of August) fishing ban during this season.

Every season, around 6-7 trips were made (around 13-14 days per trip) with around 7 persons on board. In case of Porbandar and Veraval, all trips were multi-days fishing (ranges between 6-18 days), while 90 percent of trips of Mangrol respondents were multi-days and remaining 10 percent were a day fishing trips. Across both the groups, more than 95 percent of respondents had used motorized boat for fishing. The use of traditional crafts has been observed in Veraval and Mangrol harbor, while its share in total trips made was hardly 1-2 percent in the both groups. The average number of fishermen on board was 7.5 in case of boat owner, while same were 6.9 people in case of fishermen.

Details on Fish Catch and Sold

The harbor-wise and season-wise details on fish catch and sold is presented in Tables 2. On an average, around 14 tonnes fish per trip was caught in selected harbors. The maximum fish was landed at Veraval harbor by selected boat owners and fishermen, i.e. 14.65 tonnes/trip and the lowest was in Porbandar (12.23 tonnes/trip). Fish catch depends entirely on the size of the boats, types of fishing gear, types of nets and also the number of times the fishermen go to the sea in a day. Out of total fish landed at harbours, about 85 percent fish was of Grade I and remaining was categorized as low grade (around 15 percent), i.e. Grade II. Across the harbours, the percentage of Grade I fish ranges between 82 to 87 percent. It was observed that not only the fish landed per trip was higher in case of boat owner than fishermen but also the percentage of Grade I quality fish was higher. The reason for relatively high ratio of low value fish with fishermen than boat man was may be due to inadequate facilities available on board. In both cases, fish landed at Porbandar harbor was of relatively low grade quality than other two harbours namely Veraval and Mangrol. The fish used as dry/fish meal was found around 3.6 percent of total fish landed.

The sale pattern of fish landed indicates that, about 94 percent of total fish was sold, of which around 37 percent each was sold to exporter, around 29 percent to wholesaler and contractor and remaining was sold to retailer. In case of fishermen and boat owner, the percentage of fish sold to total was also around 93 percent and both groups preferred to sell one third of their output to the exporters.

Extent and Causes of Losses in Fish Value

Harvest losses are losses that occur at the time of harvesting and onboard the fishing craft. It is important to know the causes of losses of fish value, which have been presented in Table 3. The economic losses in terms of low market value of fish due to poor post-harvest infrastructure have been estimated to ₹ 18.10 per kg. The rate of fish loss was higher during the period Oct-Dec and was the lowest during April-Sept period. The higher rate of loss was recorded by fisherman (around ₹ 19/kg) as compared to boat owner (₹ 16/kg). The major reasons for losses at this stage were physical damage during fishing and spoilage due to improper icing, whereas very minimal share was loss due to fish being eaten away by birds. The motorized trawlers followed by gill *netters* are major causes for fish losses.

The method of sale adopted and preferred by boat owner and fishermen was sale at pre-agreed price, followed by auction method of sale, sale to contractor and combination of above methods. The timeliness of receipt of money also matters in fishery business, especially for fishermen which are totally dependent on same.

It was observed that on an average 50 percent of respondent mentioned that they had received money in advance while corresponding figures for fishermen and boat owner were 61.1 and 40 per cent respectively. Thus, 60 per cent fishermen received money in advance, while remaining amount was received in mix way, i.e. some advance and some after 15 days or so. In case of boat owner, 20 percent respondent received money after a 15 day time.

The details on time and cost incurred in fishing activity per trip are presented in Tables 4. The total operational expenditure incurred has been estimated to be ₹ 1.71 lakh/per visit comprised of expenditure on food and water, fuel cost, ice cost, hired labour and other miscellaneous items. There was huge difference in cost incurred by respondents of three selected harbors. The highest cost was incurred by the respondents from Veraval harbor (₹ 2.24 lakh) while the lowest cost was recorded by respondents from Porbandar harbor (₹ 1.44 lakh per

Table 2: Harbour-wise & Season-wise Details of Fish Caught & Sold (ALL)

Sl. No.	Harbour	Details of Fish Caught & Sold (ALL)							
		Porbandar		Veraval		Mangrol		Total	
1.	Oct - Dec 2014	tons	%	tons	%	tons	%	tons	%
A)	Fish landed per trip	4.20	100.0	5.33	100	4.31	100.0	4.61	100.0
	a) Grade I (high value)	3.03	72.0	4.05	76.1	3.42	79.4	3.50	75.9
	b) Grade II (low value)	1.18	28.0	1.28	23.9	0.89	20.6	1.11	24.1
B)	Fish Sold	3.94	93.9	4.98	93.6	4.09	94.9	4.34	94.1
	a) Exporter	1.14	28.9	2.69	53.9	0.82	19.9	1.55	35.6
	b) Wholesaler	0.99	25.0	1.39	27.8	1.46	35.5	1.28	29.4
	c) Retailer	0.10	2.6	0.06	1.3	0.30	7.3	0.15	3.5
	d) Contractor	1.72	43.5	0.85	17.1	1.53	37.3	1.36	31.4
C)	Fish waste/fish dumped	0.11	2.7	0.16	2.9	0.06	1.3	0.11	2.3
D)	Fish use to dry/fish meal	0.15	3.5	0.19	3.5	0.16	3.7	0.16	3.6
2.	Jan to Mar 2015								
A)	Fish landed per trip	4.19	100.0	4.62	100	4.28	100.0	4.36	100.0
	a) Grade I (high value)	3.10	74.0	3.50	75.8	3.42	79.9	3.34	76.6
	b) Grade II (low value)	1.09	26.0	1.12	24.2	0.86	20.1	1.02	23.4
B)	Fish Sold	3.92	93.6	4.22	91.3	4.04	94.3	4.06	93.0
	a) Exporter	1.57	39.9	2.00	47.4	0.86	21.3	1.47	36.3
	b) Wholesaler	1.00	25.5	1.26	29.8	1.33	32.9	1.20	29.4
	c) Retailer	0.19	4.8	0.19	4.4	0.27	6.6	0.21	5.3
	d) Contractor	1.17	29.7	0.78	18.4	1.59	39.2	1.18	29.0
C)	Fish waste/fish dumped	0.13	3.0	0.17	3.6	0.11	2.6	0.14	3.1
D)	Fish use to dry/fish meal	0.15	3.5	0.23	5.0	0.13	3.0	0.17	3.9
3.	April to Sep2015								
A)	Fish landed per trip	4.19	100.0	4.45	100	4.03	100.0	4.22	100.0
	a) Grade I (high value)	3.28	78.3	3.50	78.7	3.26	80.7	3.34	79.2
	b) Grade II (low value)	0.91	21.7	0.95	21.3	0.78	19.3	0.88	20.8
B)	Fish Sold	3.94	94.1	4.12	92.6	3.73	92.4	3.93	93.1
	a) Exporter	1.34	34.0	1.97	47.8	1.25	33.5	1.52	38.7
	b) Wholesaler	1.33	33.6	1.06	25.7	1.08	28.8	1.15	29.4
	c) Retailer	0.09	2.2	0.21	5.1	0.10	2.5	0.13	3.3
	d) Contractor	1.19	30.2	0.88	21.4	1.31	35.1	1.13	28.7
C)	Fish waste/fish dumped	0.09	2.2	0.16	3.6	0.19	4.7	0.15	3.5
D)	Fish use to dry/fish meal	0.15	3.6	0.17	3.8	0.12	2.9	0.15	3.5
4.	Overall								
A)	Fish landed per trip	12.6	100.0	14.39	100	12.63	100.0	13.20	100.0
	a) Grade I (high value)	9.40	74.8	11.05	76.8	10.10	80.0	10.18	77.2
	b) Grade II (low value)	3.18	25.2	3.34	23.2	2.53	20.0	3.01	22.8
B)	Fish Sold	11.8	93.9	13.32	92.5	11.86	93.9	12.33	93.4
	a) Exporter	4.05	34.3	6.66	50.0	2.92	24.6	4.54	36.8
	b) Wholesaler	3.31	28.0	3.70	27.8	3.86	32.5	3.62	29.4
	c) Retailer	0.38	3.2	0.46	3.4	0.66	5.6	0.50	4.0
	d) Contractor	4.07	34.5	2.51	18.8	4.42	37.3	3.67	29.7
C)	Fish waste/fish dumped	0.33	2.6	0.48	3.4	0.36	2.9	0.39	3.0
D)	Fish use to dry/fish meal	0.44	3.5	0.59	4.1	0.41	3.2	0.48	3.6

Table 3: Nature and Causes of Losses in Fish Value

Sl. No.	Particulars	Causes of losses of fish value											
		Boat owner (n=30)				Fishermen (n=30)				ALL (n=60)			
		Oct.-Dec. 2014	Jan.-Mar 2015	April Sept. 2015	Av.	Oct.-Dec. 2014	Jan.-Mar 2015	April Sept. 2015	Av.	Oct.-Dec. 2014	Jan.-Mar 2015	April Sept. 2015	Av.
I	Economic loss in terms of low market rate- ₹/kg due to poor post harvest infrastructure	16.7	16.2	16.1	16.3	20.2	18.6	17.9	18.9	18.4	17.3	17	18.1
II	Causes of Fish Losses (% respondent)												
a	Physical damage during fishing-1,	40	36.7	30	35.6	30	33.3	50	37.8	35	35	40	36.7
b	Spoilage due to improper icing-2,	6.7	10	23.3	13.3	46.7	36.7	20	34.4	26.7	23.3	21.7	23.9
b	Fish eaten by birds-3,	0	0	6.7	2.2	0	0	0	0	0	0	3.3	1.1
d	Both-1 & 2	53.3	53.3	40	48.9	23.3	30	30	27.8	38.3	41.7	35	38.3
III	Kind of craft												
a	Trawlers-1,	73.3	66.7	53.3	64.4	73.3	70	76.7	73.3	73.3	68.3	65	68.9
b	Gill neters-2,	6.7	6.7	16.7	10	23.3	20	16.7	20	15	13.3	16.7	15
c	Deep sea trawlers-3,	0	0	3.3	1.1	0	0	0	0	0	0	1.7	0.6
d	Long liner for Tuna-4,	0	0	0	0	0	0	0	0	0	0	0	0
e	Squid jigging-5,	0	0	0	0	0	0	0	0	0	0	0	0
f	Shore seining-6	0	0	0	0	0	0	0	0	0	0	0	0
g	Both 1 & 2	16.7	20	26.7	21.1	3.3	6.7	0	3.3	10	13.3	13.3	12.2
h	Both 2 & 3	3.3	6.7	0	3.3	0	3.3	6.7	3.3	1.7	5	3.3	3.3
IV	Method of sale												
a	Auction-1,	30	36.7	26.7	31.1	23.3	26.7	26.7	25.6	26.7	31.7	26.7	28.3
b	Pre-agreed -2,	33.3	23.3	53.3	36.7	30	26.7	26.7	27.8	31.7	25	40	32.2
c	Contract 3	30	23.3	6.7	20	23.3	20	23.3	22.2	26.7	21.7	15	21.1
d	Auction + Pre-agreed	0	3.3	10	4.4	13.3	16.7	13.3	14.4	6.7	10	11.7	9.4
e	Pre-agreed + Contract	6.7	13.3	3.3	7.8	10	10	10	10	8.3	11.7	6.7	8.9
V	Receipt of money												
a	In advance-1 ,	33.3	43.3	43.3	40	60	60	63.3	61.1	46.7	51.7	53.3	50.6
b	On same day-2,	0	0	6.7	2.2	0	0	3.3	1.1	0	0	5	1.7
c	In week time-3	0	0	0	0	0	0	0	0	0	0	0	0
d	In 15 days-4	26.7	16.7	16.7	20	16.7	16.7	10	14.4	21.7	16.7	13.3	17.2
e	Both- 1 & 4	20	23.3	10	17.8	13.3	10	13.3	12.2	16.7	16.7	11.7	15
f	Both 1 & 2	20	16.7	23.3	20	10	13.3	10	11.1	15	15	16.7	15.6

Source: *Field Survey Data.*

trip). The high cost per trip at Veraval respondent would be due to longer time taken for fishing (174.1 hours). Around two third of total cost was incurred on fuel only, followed by about one fifth of total cost on hired human labour for fishing activity. Thus, these two costs put together accounted for about 84 percent of total cost.

Availability and Requirement of Infrastructural Facilities

The infrastructural facilities available on board play an important role in reducing the post harvest losses. It can be seen from the Table 5 that at overall level, fish hold capacity of fishing vessel was 10.7 tonnes/boat, which was almost same in case of both

Table 4: Details on Time and Cost incurred in Fishing Activity per trip

Sl. No.	Particular	Unit / trip	Time and Cost incurred in Fishing Activity per trip (ALL)			
			Porbandar	Veraval	Mangrol	Overall
1	Fishing nets/gears taken per fishing trip	Av. No.	13.4	16.8	15.1	15.1
2	Distance of the fishing ground from the shore	Nautical miles	88.2	180.9	109.0	126.0
3	Approximate time taken for fishing	hrs.	130.3	174.1	118.5	141.0
4	Approximate time taken for landing/unloading					
	a) Handling by (Machine) Mechanical Device	hrs.	26.0	40.1	28.6	31.6
	b) Handling Manually	hrs.	4.1	2.9	2.7	3.2
5	Quantum of fuel taken on board the vessel (diesel)	Liters	2267.5	3515.0	2282.5	2688.3
6	Fuel utilized per each trip	Liters	1947.5	3110.0	2026.5	2361.3
7	Operational expenses/trip					
	a) Exp. on Food & Water	₹	9200	15250	9675	11375
	b) Fuel Cost	₹	94064	150213	97880	114052
	c) Hired labour cost	₹	24900	38900	26200	30000
	d) Ice cost	₹	3900	5650	4625	4725
	i) total quantity	kg	9100	11550	7550	9400
	ii) Rate	₹/Kg	1.3	1.2	1.3	1.2
	e) Any other expenditure	₹	11303	13552	10121	11659
	f) Total Cost	₹	143367	223565	148501	171811

Note: *1 Nautical mile= 1.852 km.;* ***Source:*** *Field survey data*

Table 5: Infrastructural Facilities Available on Board of Fishing Vessel

Sl. No.	Particular	Infrastructural facilities available (ALL)			
		Porbandar	Veraval	Mangrol	Overall
A	Fish-hold capacity (tons)	10.5	11.8	9.65	10.65
B	Ice boxes (No.)	11.3	11.8	10.4	11.17
C	Capacity in Kg	465	545	430	480
D	Insulated boxes (No.)	0.0	0.0	0.0	0.0
E	Capacity in Kg	0.0	0.0	0.0	0.0
F	Facilities for hauling the fish (%)				
	a) Dragging	45	40	55	46.67
	b) Lifting	55	60	45	53.33
F	Status of Fish hold (%)				
	a) Fresh	100	100	100	100.00
	b) Not Fresh	0	0	0	0.00
	c) Spoiled	0	0	0	0.00
G	Washing/cleaning facilities onboard (%)				
	a) yes	65	95	90	83.33
	b)No	35	5	10	16.67
H	Vessel has on-board processing facility – Yes (%)	100.0	100.0	100.0	100.0
	a) Icing facility	100.0	100.0	100.0	100.0
	Icing capacity (in tons)	9.5	10.65	9.8	9.98
	b) freezing facility	0	0	0	0.00
	c) canning facility	0	0	0	0.00
	d) smoking facility	0	0	0	0.00
	e) other facility	0	0	0	0.00
	c) Mode of disposal of waste fish: sorting on Board (% to total)	100	100	100	100
	d) Duration for sorting/grading of fishes on board (Hrs.)	1.00	1.53	1.14	1.22

Source: *Field Survey Data.*

boat owner and fisherman. The average number of ice boxes available were 11.17 having capacity of 480 kg. It is important to note that no fishing boat had insulated box on board. The lifting facilities were available on about 53 percent boats while dragging facility was with remaining ones. The status of fish hold in both categories and at all three harbors was fresh one. The washing and cleaning facility was available on about 83 percent craft, while 17 percent were not having this facility. However, in case of boat owner, all the fishing boats/craft had this facility.

Further, all selected respondents had on board processing facility. Among the various processing facilities, icing facility was available on all fishing crafts of both fishermen and boat owner, having average capacity of about 10 tones. However, no boat had other processing facilities like freezing facility, canning facility, smoking facility, smoking facility and any other facility on board. The sorting of board facility was available on all the crafts used by fishermen and boat owners. On an average 1.22 hours were spent in sorting/grading of fish on board.

The details on low value fish is presented in Table 6 which indicate that at all three harbors and by both categories, no fish (young fish) was categorized as low value fish, while due to spoilage, about 0.3 tons of fish per trip has been treated as low value. Out of total spoilage, 61.32 percent is classified as by catch which was used for fish meal.

The details on distance of facilities away from sea shore indicate that on an average, the facilities like chill plants, cold storage, ice plants and insulated vans are available about 3 kms away from sea shore. These facilities were available relatively closer to Veraval and Mangrol harbor than Porbandar harbor. Flake ice plant facility was much closer to Porbandar harbor than other two harbours. In order to transport the raw fish, availability of insulated van facility was very rarely available in selected three harbors in Gujarat. Mostly trolley was used for transport of raw fish followed by use of ice boxes for same. The grading and sorting of raw fish was done on board by both boat owner and fishermen of all three harbors.

The respondents were asked to share and rank their suggestions on important post harvest facilities to minimize losses of fishes. Table7 presents, at overall level, the highest number of respondents (46.7 per cent) ranked I to the facility of having clear landing platform with washing and drainage facilities followed by facility of cold storage/chill plants with in the FH premises (36.7 per cent) and insulated storage boxes on board the fishing vessel (16.7 per cent). The same preference was recorded by the respondents of Veraval and Mangrol. While in case of Porbandar, preference was not same. Porbandar respondents ranked I to the facility of cold storage/chill plants with in the FH premises while facility of cold chain network was ranked as less preferred facility in all three harbours. Same trend was observed in case of fisherman and boat owner.

It was observed that about 32 percent respondents had incurred loss of 2-5 percent of total sale value, while 25 and 15 percent respondents incurred loss between 5-10 and 10-25 percent of total sale value respectively. Across the harbor, the trend was same, while across category, it was not same. Due to inadequate facilities, about 57 percent fishermen had incurred loss between 5-15 percent (of total sale value), while 37 percent boat owners incurred loss in

Table 6: Details on Low Value of Fish (All)

Sl. No.	Particular	Details on Low Value of Fish/trip-ALL			
		Porbandar	Veraval	Mangrol	Overall
1	Quantity of fish treated as miscellaneous/ low value (young fish)	0.0	0.0	0.0	0.0
2	Quantity of fish treated as miscellaneous/ low value (due to spoilage) in tons	0.31	0.28	0.30	0.30
3	Percentage is classified as by-catch (use for fish meal)	66.95	58.22	58.75	61.32

Source: Field Survey Data.

Table 7: Important Post-harvest Facilities to Minimize Losses of Fishes

Sl. No.	Particulars	Important Post harvest facilities to minimize losses of fishes-ALL															
		Porbandar				Veraval				Mangrol				Overall			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
1	A cleaner landing platform with washing and drainage facilities	35.0	35.0	30.0	0.0	65.0	25.0	10.0	0.0	40.0	30.0	30.0	0.0	46.7	30.0	23.3	0.0
2	Insulated storage boxes on board the fishing vessel	10.0	40.0	50.0	0.0	5.0	35.0	60.0	0.0	35.0	40.0	20.0	5.0	16.7	38.3	43.3	1.7
3	Cold storage/chill plants with in the FH premises	55.0	25.0	20.0	0.0	30.0	40.0	30.0	0.0	25.0	20.0	50.0	5.0	36.7	28.3	33.3	1.7
4	Cold Chain facility network	0.0	0.0	0.0	100	0.0	0.0	0.0	100	0.0	10.0	0.0	90.0	0.0	3.3	0.0	96.7

Note: *Rank is given by the respondent (most important to relatively less important- rank I to IV)*

Source: *Field Survey Data.*

this range. Thus, fishermen were at more loss than boat owner due to inadequate facilities. Therefore, necessary post harvest facilities need to be created on war footing basis.

The major problems cited by the fishing households were storm, cyclone, tsunami, high wave, raining, bathing, poor facilities for bathing and drinking water and incidence of skin diseases. The non availability of cold storage facility was major problem under storage category. Non availability of additional subsidy on fuel and inadequate supply of fuel were other problems cited.

CONCLUSION

The marine fisheries enterprise exploits a large number of species using different crafts and gear in different localities. Trawl and purse nets aroused in these boats and were operated by a larger group consisting of more than 5 fishermen on a single boat. The details on season-wise hourbour-wise fishing activities by selected boat owners and fishermen shows that on an average, the fishing days per season were estimated to be 64.9 days, (ranges between 65-69 days in three selected seasons during 2014-15). Across both the groups, more than 95 percent of respondents had used motorized boat for fishing.

On an average, around 14 tonnes fish per trip was caught in selected harbors. The maximum fish was landed at Veraval harbor by selected boat owners and fishermen, i.e. 14.65 tonnes/trip and the lowest was in Porbandar (12.23 tonnes/trip). The economic losses in terms of low market value of fish due to poor post-harvest infrastructure have been estimated to ₹ 18.10 per kg. The major reasons for losses at this stage were physical damage during fishing and spoilage due to improper icing, whereas very minimal share was loss due to fish being eaten away by birds. The motorized trawlers followed by gill netters are major causes for fish losses. Therefore, there is a need of expansion of harbor regions as well as constructions of more number of jetties/ landing platforms, along with proper maintenance of those infrastructures for minimizing economic losses. Some of the measures for minimizing the losses are proposed as below:

- The fishermen and boat owners should be provided training on proper handling, transport and processing of fishes by the government and cooperative organization.
- Fishing harbours are being developed at both major and minor ports. However, the condition of washing and cleaning facilities available at selected harbours was unsatisfactory at Porbandar and Mangrol while same was very poor at Veraval harbor. Thus, the facilities like clear landing platform and cold storage/ chill plants within the harbour premises and availability of insulated storage boxes on board the fishing vessel need to be ensured.
- The dredging problem i.e., the problem in loading and unloading of fish due to non-navigable depth near sea shore has been faced by fishermen. Therefore harbors dredging needs to be carried out regularly.

- It was reported that the prices of fish generally drop down sharply when there is glut in the market mostly during the rainy season (October to December). Therefore, marketing and processing activities need to be strengthened by the government. Balancing technical interventions to improve fish quality with the potential increase in selling prices, associated with better quality fish with the demand for cheaper fish by low income consumers, is an important dilemma.
- The harbors like Porbandar and Veraval are overcrowded due to less space in harbor region and large number of boats parked there than its capacity. Because of same, fish catch exceeds the capacity of harbor. Therefore, there is a need of expansion of harbor regions as well as constructions of more number of jetties/landing platforms.
- Though it is prohibited by the law, the catching of young fish is still continuing on larger scale which affects the future growth of fish volume and thus fish management in region. Therefore, strict monitoring of catching of young fish at harbor level needs to be undertaken.
- Governments and development agencies should ensure that changes in post-harvest fisheries-related policy and practices take stock of the loss assessment tools, information generated and experiences of the programmes being implemented. The fish loss assessment should be incorporated into national data collection systems and used regularly to inform policy.

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