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854 TECHNOECONOMIC ASSESSMENT OF MARINE FISH PRODUCTION, MARKETING AND CAPACITY UTILIZATION OF PROCESSING PLANTS IN GUJARAT

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Introduction

Among the major maritime states of India, Gujarat has the longest coastline (1,600 km) and the largest continental shelf area (1,65,00 sq.km). The current annual catch of marine fish in this state is 6,45,261 tonnes (1994-'95), landed in about 221 coastal fish landing centres by 21,018 fishing units, manned by about 0.75 lakh fishermen. The present study was undertaken with the following objectives.

- To review the marine fish production in the state vis-a-vis the potential yield.
- To assess the economic performance of trawlers and motorised gillnetters.
- To analyse the distribution pattern of marine fish in the internal markets and the performance of marine fishery exports.
- To evaluate the capacity utilisation of processing plants.
- To suggest policy measures for improvements in the production and marketing of marine fish.

Data base

The data pertaining to fishing craft and gear, fish landings and processing plants were collected

from the various publications of the Central Marine Fisheries Research Institute, Cochin and the statistical reports of the Government of Gujarat while the details of export of marine products were collected from the records of the Marine Products Export Development Authority, Cochin -16. The data on initial investment, operational costs and earnings of motorised gillnetters and mechanised trawlers were collected from selected fishing units operating at Veraval and Mangrol during 1993-'94. Appropriate economic and statistical tools were employed in the analysis and interpretation of the data.

Fishing fleet

The number of fishing units has been increasing steadily over the last decade from about 12,300 during 1984-'85 to about 21,000 during 1994-'95 (Table 1). During 1984-'85, 63 % of the fleet was of traditional nonmechanised units which declined to about 40 % during 1994-'95 but the mechanised fleet increased substantially from 4,557 units during 1984-'85 to 12,648 units during 1994-'95. Among the mechanised units, the trawlers, gillnetters and FRP boats increased in number considerably by the addition of 3, 599, 2,243 and 2,319 units respectively, over the last ten years.

TABLE 1. Categorywise fishing fleet in Gujarat (1984-'85 to 1994-'95). Source :Gujarat State Fisheries Statistics 1994-'95

Year	Mechanised				Other boats	Total mech. boats	Total nonmech. boats	Total
	Trawlers	Gill netters	FRP boats	OBM boats				
1984-'85	1,035	867	-	1,566	289	4,557	7,749	12,306
1985-'86	1,919	956	-	1,673	310	4,858	8,018	12,876
1986-'87	2,062	1,050	-	1,854	347	5,313	8,498	13,811
1987-'88	2,230	1,124	226	1,776	359	5,715	8,965	14,680
1988-'89	2,522	1,756	492	1,806	427	7,003	8,966	19,969
1989-'90	2,712	1,770	859	1,822	486	7,649	8,735	16,384
1990-'91	2,814	1,946	1,044	1,838	498	8,140	8,677	16,817
1991-'92	3,055	2,211	1,386	1,862	510	9,024	8,825	17,849
1992-'93	3,456	2,315	1,618	1,957	524	9,870	8,745	18,615
1993-'94	3,941	3,058	2,161	1,813	530	11,503	8,323	19,826
1994-'95	4,634	3,110	2,545	1,814	545	12,648	8,370	21,018

Percapita fishing area

The area available per active fisherman and fishing boat in the inshore and offshore fishing grounds declined drastically over the years from 1961 to 1990 due to the steady increase in the number of active fishermen (Table 2). The area available per fishing unit in the inshore region

TABLE 2. Area (in ha) of inshore and offshore seas available per active fisherman and fishing boat (mech. & non mech.) during successive time periods from 1961 to 1990

Year	Area available per fishing unit (ha)		Area available per active fisherman (ha)	
	Inshore (0-50 m) depth	Offshore (50-200m) depth	Inshore (0-50m) depth	Offshore (50-200m) depth
1961-'62	1,453	2,214	554	843
1976-'77	1,095	1,669	288	439
1980-'81	862	1,314	177	271
1990-'91	499	760	136	207

upto the depth of 50 m decreased from 1,453 ha during 1961-'62 to 499 ha during 1990-'91. Similarly, the fishing area per fishing unit in the offshore region between the 50 and 200 m depths reduced from 2,214 to 760 ha during this period. The area available per active fisherman declined from 554 to 136 ha in the inshore region and 843 to 207 ha in the offshore region from 1960-'61 to 1990-'91.

Production trends

Marine fish production increased two fold from about 3.1 lakh t during 1984-'85 to 6.5 lakh t during 1994-'95 (Table 3). The annual catch registered steady increase but there was a quantum jump during 1988-'89. The annual growth rate ranged from 1.76 % during 1993-'94 to 26.4 % during 1988-'89, when the landings increased from 3.27 lakh t in the previous year to 4.14 lakh t during 1988-'89, mainly because of the introduction of FRP boats and the intensification of mechanised fishing by adding more gillnetters and trawlers.

The landing centre value of marine fish production which was about Rs.133 crores during

TABLE 3. Marine fish production during 1985-'86 to 1994-'95
Source : Gujarat State Fisheries Statistics 1994-'95

Year	Production (t)	Growth rate (%)	Value in lakhs (Rs.)
1985-'86	3,06,577	5.5	13,302.62
1986-'87	3,15,942	3.1	17,356.00
1987-'88	3,27,560	3.7	19,269.36
1988-'89	4,14,679	26.4	23,487.91
1989-'90	4,32,364	4.1	24,153.63
1990-'91	5,00,462	15.75	31,088.74
1991-'92	5,30,017	5.91	42,590.36
1992-'93	6,09,103	14.93	56,579.32
1993-'94	6,19,836	1.76	59,650.41
1994-'95	6,45,261	4.10	75,988.48

1985-'86 increased to about Rs.760 crores during 1994-'95 indicating a six fold increase in revenue as against only a two fold increase in fish production.

Veraval is one of the three major fishing harbours in Gujarat, the other two being Mangrol (40 km north of Veraval) and Porbandhar (120 km north of Veraval), all located in the Junagadh district of the Saurashtra coast (Table 4). During

TABLE 4. Centrewise marine fish landings in Gujarat during 1994-'95, Source : Gujarat States Fisheries Statistics 1994-'95

Name	Catch (tonnes)	%
Veraval	2,18,217	33.82
Porbander	92,157	14.82
Jafraabad	23,411	3.63
Jakhau	46,147	7.15
Okha	36,197	5.60
Mangrol	39,521	6.12
Rajpara	9,465	1.47
Nava Bander	27,506	4.26
Umarsadi	11,559	1.79
Rupen Dwark	14,134	2.19
Other centres	1,26,947	19.67
Gujarat	6,45,261	100.00

the period 1983-'88, the annual catch at Veraval remained more or less stable ranging only narrowly between 33,827 t (1983) and 55,144 t (1984). Thereafter, it increased steadily from 72,370 t (1989) to the maximum of 2,18,217 t (1994-'95). The Junagadh district of 256 km coastline (with 3 fishing harbours and 24 village landing centres) accounted for 398,961 t (62 %) of marine fish landings in 1994-'95 (Table 5). Out of the

TABLE 5. Districtwise marine fish landings (tonnes) in Gujarat. Source : Gujarat State Fisheries Statistics 1994-'95

District	1984-'85	1985-'86	1986-'87	1987-'88	1988-'89	1989-'90	1990-'91	1991-'92	1992-'93	1993-'94	1994-'95
Valsad	14,570	12,831	11,446	20,556	15,525	30,072	35,125	45,050	50,229	55,559	58,760
Surat	625	858	1,859	1,009	1,531	2,057	4,484	4,399	6,415	3,996	7,765
Baruch	1,575	712	1,427	1,879	1,912	2,114	2,111	2,319	2,428	3,068	3,397
Kheda	1,586	1,280	994	843	2,315	1,516	988	774	881	976	1,018
Bhavanagar	873	585	737	1,203	1,240	2,454	5,904	4,106	5,101	1,958	4,693
Amreli	54,917	33,887	22,792	27,872	30,896	49,564	49,488	35,019	78,715	72,040	33,610
Junagadh	1,50,915	1,94,095	2,16,871	2,03,761	2,63,769	2,47,215	2,80,840	3,10,387	3,35,100	3,58,629	3,98,961
Jamnagar	31,521	25,238	27,998	40,232	44,161	45,354	54,299	63,452	66,202	58,887	58,912
Rajkot	701	1,674	504	463	2,825	2,452	1,845	2,681	1,058	1,489	1,318
Kutch	34,295	35,417	31,314	29,743	46,896	49,566	63,378	61,830	62,974	63,234	76,827
Total	2,90,708	3,06,577	3,15,942	3,27,560	4,14,073	4,32,364	5,00,462	5,30,017	6,09,103	6,10,836	6,45,261

Gujarat total of 645,261 t (1994-'95), the bulk of the landings was at Veraval (218,217 t in 1994-'95) while the remaining was contributed by Mangrol, Porbandhar and the other 24 village landing centres, located in the district. The Amreli district of 112 km coastline (a part of which is sandwiched within the arch-like Junagadh district) and the Jamnagar district of 396 km coastline (immediately north of Junagadh district) landed 33,610 t (5.2 % of state total) and 58,912 t (9.1 % of state total) respectively in 1994-'95. Thus the districts constituting the Saurashtra coast landed 491,483 t during 1994-'95, which formed 76 % of the state total of 645,261 t.

The estimated annual maximum sustainable yield (also referred to as the potential yield) of fish (including the crustaceans and the cephalopods) from the Gujarat continental shelf (upto the depth of 200 m from the shore line) of 165,000 sq. km is 567,000 t (385,000 t from the inner shelf area of 65,000 sq. km upto 50 m depth and 1,82,000 t from the outer shelf area of 99,000 sq. km between 50 m and 200 m depth). As against this annual potential of 567,000 t, the current yield of 6,45,261 t (1994-'95) suggests absolutely no further scope for increasing the annual catch any further.

The species composition of the catch from 1990-'91 to 1994-'95 is given in Table 6. More than 70 % of the catch is accounted for by low

priced fishes like the small sciaenids (36 %), Bombayduck (11 %), ribbonfishes (10%), small sized shrimps (6 %), small clupeids like *Collita* sp. (4 %) and various other items shown in the table. The landings of other sciaenids increased from 1.8 lakh t during 1990-'91 to 2.4 lakh t during 1994-'95 while the Bombayduck peaked at 1.0 lakh t during 1992-'93. Ribbonfish catch increased gradually from 0.4 lakh t during 1990-'91 to 0.6 lakh t during 1994-'95 while the small sized shrimps increased from 0.2 lakh t during 1990-'91 to 0.4 lakh t during 1994-'95.

Pomfrets, sharks, clupeids, catfishes, seerfishes, perches, medium and jumbo prawns, cephalopods (squids and cuttle fishes) and other miscellaneous fishes also increased steadily during 1990-'91 to 1994-'95. Exportable items like the prawns and the cuttlefishes showed marked increase in their landings during this period. The former increased from 5,724 to 17,782 t and the latter from 12,380 to 26,448 t. The pomfret catch increased from 12,835 to 15,168 t, the catfish from 0.12 to 0.24 lakh t, the seerfish catch increased from 6,331 to 8,459 t and the perches from 3,805 to 6,988 t during this period. However, the jewfish (sciaenids) reduced from 13,010 to 10,178 t the hilsa from 2,075 t to 2,138 t, the leather jacket from 1,743 to 769 t, the Indian salmon from 1,530 to 1,093 t and the rock lobster from 875 to 578 t during this period.

TABLE 6. Specieswise marine fish production (tonnes) in Gujarat Source : Gujarat State fisheries statistics 1994-'95

Name of fish	1990-'91	1991-'92	1992-'93	1993-'94	1994-'95
White pomfret	10,694	9,053	6,925	8,158	11,615
Black pomfret	2,141	3,838	2,009	2,968	3,553
Bombay duck	72,712	66,389	1,04,039	84,093	70,890
Threadfin	2,328	2,444	2,590	4,369	3,170
Jewfish	13,010	9,602	15,130	18,361	10,178
Hilsa	2,705	2,082	1,613	1,899	2,138
Clupids	7,773	8,003	9,628	16,399	11,693
Collia	16,648	18,261	21,314	19,274	23,788
Shark	9,580	15,707	16,301	17,645	15,395
Mullet	4,008	2,905	3,823	3,229	4,427
Catfish	12,435	17,046	17,597	2,20,022	24,218
Eel	3,443	2,331	3,328	3,392	3,278
Leather jacket	1,743	2,006	1,162	1,485	769
Seerfish	6,331	7,225	6,143	7,999	8,459
Indian salmon	1,530	1,250	1,703	1,561	1,093
Ribbon fish	40,906	38,684	46,167	49,362	61,818
Silver bar	4,690	4,913	4,760	4,276	4,386
Perch	3,805	6,264	6,486	7,256	6,988
Small sciaenids	1,84,851	1,96,500	2,10,173	2,21,728	2,35,934
Shrimp	18,463	27,560	31,815	29,483	38,063
Prawn (medium)	4,360	8,759	10,117	9,576	15,794
Prawn (Jumbo)	1,364	1,648	3,056	2,246	1,988
Lobster	875	1,141	939	832	578
Crab	1,690	1,640	659	1,229	1,697
Levta	1,809	791	553	670	1,529
Cuttle fish/squids	12,380	18,078	21,536	20,142	26,448
Miscellaneous	53,198	55,935	60,553	6,81,382	65,382
Total	5,00,462	5,30,017	6,09,103	6,19,836	6,45,261

Per capita production

The fishing fleet consists of 12,648 mechanised units and 8,370 nonmechanised units, totalling to 21,018 units operated by about 75,000 active fishermen during 1994-'95. The annual

catch of 645,261 t for 1994-'95 indicates the average catch to be 31 t per unit and 8,603 kg per active fisherman. Assuming 200 actual fishing days a year, the per capita production per active fisherman worked out to 43 kg per day during 1994-'95.

Economic performance of fishing units

The economic performance of small trawlers and motorised gillnetters operating along the Gujarat coast is furnished in Table 7. The initial

TABLE 7. Economic performance of motorised gillnetters and mechanised trawlers in Gujarat (1993-'94)

Economic parameters	Trawlers	Gill netters
Average initial investment (Rs. in lakhs)	5.25	1.20
Annual catch (tonnes)	68.00	16.95
Value (Rs. in lakhs)	9.25	1.50
Operating cost (Rs. in lakhs)	6.85	1.15
Fixed cost (Rs. in lakhs)	1.15	0.20
Total cost (Rs. in lakhs)	8.43	1.35
Net operating income (Rs. in lakhs)	2.40	0.35
Net income (Rs. in lakhs)	0.82	0.15
Rate of return (%)	33.60	28.00
Payback period (in years)	3.62	4.10
Value realised per kg of fish (Rs. per kg)	13.60	8.85
Average total cost per kg of fish (Rs. per kg)	12.40	7.96
Average operating cost per kg of fish (Rs. per kg)	11.79	6.78

investment on small trawlers (32 to 36 feet overall length) operating in the inshore waters ranges from Rs. 3.5 to 8.0 lakhs, depending on the year of purchase. Most of the trawlers operating in Veraval are old and their average initial investment works out to Rs. 5.25 lakhs. The average annual catch of a trawler during 1993-'94 was 68 t, worth Rs. 9.25 lakhs in gross earnings; the annual operating cost which worked out to Rs. 6.85 lakhs, was mainly on account of fuel and labour charges, while depreciation and interest on initial investment formed the annual fixed cost of Rs. 1.15 lakhs; the net operating income was Rs. 2.4 lakhs and the net profit Rs. 0.82 lakhs; the payback period is 3.62 years and the rate of return 33.6 %. Although the average annual catch of trawlers has been declining over

the years, the operation has been viable due to the overall increase in the price of the catches.

The initial investment on a motorised gillnetter ranges from Rs. 1 to 3 lakhs, the average being Rs. 1.2 lakhs ; the average annual catch during 1993-'95 was 16.95 t, fetching a gross income of Rs. 1.50 lakh; the annual operating cost Rs. 1.15 lakhs, the major expense being fuel and labour charges, the annual fixed cost comprising depreciation and interest on the initial investment was Rs. 0.20 lakh; the net operating income was Rs. 0.35 lakh and the net profit Rs. 0.15 lakh; the payback period is 4.1 years and the rate of return 28 %.

Marketing

Internal marketing : The major quantity of marine fish produced is channelised into the internal marketing system for domestic consumption within the country. 29.1 % of the catch is distributed as fresh and 39.8 % in dried condition 29.4 % of the catch is converted into fishmeal, 1.6 % is used as manure while 0.1 % is of fins and maws. Fresh fish consumption has substantially increased from 18.5 % in 1992-'93 to 29.1 % in 1993-'94 (Table 8).

TABLE 8. Distribution pattern of fish in the internal markets in Gujarat. Source : Gujarat State Fisheries Statistics (1994-'95)

Item	1992-'93 Quantity (%)	1994-'95 Quantity (%)
Fresh fish	18.5	29.1
Dried fish	39.9	39.8
Fishmeal	41.5	29.4
Fish manure	0.1	1.6
Fins & maws	-	0.1
Total	100.0	100.0

Export : Export of marine products has increased steeply from 6,204 (2 % of the total catch) during 1984-'85 to 86,987 (13.5 % of the total catch) during 1994-'95. There has been a quantum jump in the exports since 1990-'91 due to the increase in the export of frozen fish (Table 9). The ports of exports include Veraval, Por-

TABLE 9. Marine fish production and export from Gujarat during 1984-'85 to 1994-'95

Year	Annual production (tonnes)	Export (tonnes)	% of export in production
1984-'85	2,90,708	6,204	2.1
1985-'86	3,06,577	7,983	2.6
1986-'87	3,15,942	8,513	2.7
1987-'88	3,27,560	7,025	2.1
1988-'89	4,14,679	7,819	1.9
1989-'90	4,33,264	8,815	2.0
1990-'91	5,000,462	22,155	4.4
1991-'92	5,30,017	30,547	5.8
1992-'93	6,09,103	44,478	7.3
1993-'94	6,19,836	59,897	9.7
1994-'95	6,45,261	86,987	13.5

andar, Okha and Kandla (Table 10). Out of the 86,987 t of marine products exported during 1994-'95, 62.5 % was sent through the Porbandar port and the rest through the Kandla port. The export through the Veraval port reduced

TABLE 10. Portwise export from Gujarat (tonnes) during 1984-85 to 1994-'95

Year	Okha	Veraval	Porbandar	Kandla	Total
1984-'85	-	2,170	4,034	-	6,204
1985-'86	321	1,385	2,871	3,406	7,983
1986-'87	645	1,218	3,586	3,064	8,513
1987-'88	-	497	2,093	4,436	7,025
1988-'89	-	448	1,863	6,508	7,819
1989-'90	-	121	1,210	7,484	8,815
1990-'91	-	-	11,189	10,966	22,155
1991-'92	-	-	19,150	11,397	30,547
1992-'93	826	308	26,084	17,260	44,478
1993-'94	-	-	32,428	27,469	59,897
1994-'95	-	-	54,406	32,581	86,987

gradually from 2,170 t during 1984-'85 to 121 t during 1989-'90 and after a gap of two years it increased to 308 t in 1992-'93 but remained stagnant at the level thereafter. Similarly, the Okha port which was not functioning after 1987-'88 exported 826 t during 1992-'93 but stopped exports again. Fresh or frozen fish constitute

the major item forming about 70 % of total marine product export, cephalopods (squids and cuttlefishes) form 20%, shrimps 9 % and lobster tails and other items including live items 0.5 % each (Table 11).

TABLE 11. *Marine products export from Gujarat during 1994-'95*

Item	Quantity (tonnes)	Value (Rs)		Value/kg.(Rs)	
		%	crores	%	
Frozen shrimp	7,773	8.94	122.12	29.23	157.11
Fr. lobster tail	410	0.47	16.16	3.87	394.15
Fr. cuttle/fillet	7,614	8.75	45.07	10.79	59.19
Fr. squids	9,990	11.48	46.14	11.04	46.19
Fresh/Fr. fish	60,741	69.83	186.46	44.62	30.70
Others	459	0.53	1.89	0.45	41.18
Total	86,987	100.00	417.84	100.00	48.03

During 1994-'95 the maximum income (44.62 %) was generated from the export of fish items while the revenue from shrimp export formed only about 29.23 % and that from cuttlefish 22 %. The gross income from marine product export increased from Rs. 37.46 crores during 1989-'90 to Rs. 417.84 crores during 1994-'95.

Capacity utilisation in processing plants

During 1994-'95, 86, 987 t of finished marine products comprising fishes, cephalopods (squids and cuttlefishes), shrimps, lobsters and other items including live varieties have been exported from Gujarat.

The 33 freezing plants registered with the Marine Products Export Development Authority, Cochin as per their 1994-'95 records have a total capacity of 1,221 t per day, at the average capacity of 37 t per day per plant. The quantity of 86,987 t of marine products processed and exported during 1994-'95 from these plants works out to 2,636 t per plant, indicating only 19.52 % capacity utilisation. At full capacity utilisation average annual product output should be 365 days x 37 t = 13, 505 t per plant. In other

words, the plants could be said to have worked effectively at full capacity only for a period of 71 days out of 365 days.

If sufficient raw materials were available for the normal functioning of the processing plants, they could bring out about 4.5 lakh t of finished products per year. The current marine fish production (1994-'95) of 6.5 lakh t including fishes, crustaceans and cephalopods would not be able to provide sufficient raw materials to cater to the needs of the processing plants already existing in the state. Stiff competition among the freezing plants would normally have led to the marketing of raw materials from the nearby states as in Kerala where raw materials are brought from the nearby states like Karnataka, Tamil Nadu and Andhra Pradesh. Nonavailability of raw materials, which is the only reason for the 80% idle capacity of the freezing plants in the state warrants serious consideration of the government to concede to the demand of the industry to supply them for export after value addition.

There are 3 fishmeal plants (of 18 t capacity per day) and 44 fish pulverisors (of 80 t capacity per day) which also compete for the limited raw material supplies. Under these circumstances addition of freezing plants, fishmeal plants and pulverisors should be discouraged, otherwise the idling of freezing plants will exceed the present 80 %; domestic supplies will suffer severe setbacks, aggravating the problems of malnutrition; employment situation in the internal marketing system will be further disturbed and the processing sector will suffer still worse returns.

During 1992-'93 the fresh and frozen fish accounted for 28,133 t (64.16 %) out of a total of 43,578 t of marine products exported. Since 1993 these fish items began to register phenomenal increase not only in Gujarat but also in all the other maritime states (Table 12 & 13). The current (1994-'95) penaeid prawn (shrimp) export

TABLE 12. Export from Gujarat and its percentage in all India export (quantity in tonnes and value in crores) Source : Marine Products Export Development Authority

Year	Gujarat		All India		Percentage in all India	
	Qty.	Value (Rs)	Qty.	Value (Rs)	Qty.	Value (Rs)
1992-'93	43,578	185.4	2,09,025	1,768.56	20.87	10.48
1993-'94	59,793	269.46	2,43,960	2,503.62	24.50	10.77
1994-'95	86,986	417.84	3,07,337	3,575.27	28.30	11.69

TABLE 13. Itemwise export from Gujarat, Source : Marine Products Export Development Authority. (Quantity in tonnes and value in crores of rupees)

Year Item	1992 - '93		1993 - '94		1994 - '95	
	Qty.	Value (Rs)	Qty.	Value (Rs)	Qty.	Value (Rs)
Frozen shrimp	4,808	55.64	5,275	78.72	7,773	122.12
Fr. lobster tails	632	16.78	518	14.18	410	16.16
Fr. cuttle/fillet	3,195	12.62	6,100	33.28	7,614	45.07
Fr. squids	6,714	26.17	5,066	22.58	9,990	46.14
Fresh/Fr. Fish	28,133	74.08	42,498	119.34	60,741	186.46
Others	96	0.11	356	1.36	459	1.89
Total for Gujarat	43,578	185.40	59,793	269.46	86,987	417.84
Total for all India	2,09,025	1,768.56	2,43,960	2,503.62	3,07,337	3,575.27
% All India	20.87	10.48	24.50	10.77	28.30	11.69

from Gujarat is 7,773 t, which is only 43.7 % of the 17,782 t of the landings of medium and jumbo prawns (Table 14). This component would not increase further, as the bulk of the 38,063 t of penaeid prawns landed is undersized owing to the dismally small mesh (5 to 10 mm) in the codend of the trawls operating for this fishery. This situation will not improve unless the trawler fishermen decide to keep the minimum mesh size of codend at 30 to 35 mm, as required by the law in their own interest and of the stocks. Since there are many species stocks involved,

the trawlers land in each operation enormous quantities of tiny shrimps, squid and various demersal finfish species which are discarded at sea or onshore. The country as well as the state seem to be totally oblivious to the damage already caused to the precious stocks and the danger it portends to the community, the traders and the exporters.

In the case of the cephalopods (squids and cuttlefishes) also the present (1994-'95) export of 17,604 t (7,614 t of cuttlefish fillets and 9,990 t of squids), which form 66.6 % of the current yields of 26,448 t, is not likely to increase. The bulk of the catch is of the undersized ones and not worthy of export. Here also mesh size regulation is very crucial in sustaining the exploited stocks.

As the exports of shrimps, lobsters, squids and cuttlefishes have already reached the stable (plateau) level, the expected increase in the export has to come essentially from the finfish categories. The present export of fresh/frozen fish is mainly in the form of bulk items (scaled/headed/gutted/whole) depending on the size and species. While there is scope for bulk frozen fish export, value added products like IQF fillets (piece or blocks) for the western market merit consideration. The bulk of the frozen fish exported includes ribbonfishes and croackers (mainly Chinese markets) followed in small quantities by lizardfishes, perches, carangids, seerfishes and tunas. Since IQF items have emerged as highly demanded products in the affluent European, American and Japanese markets, it is essential to progressively shift from bulk to IQF products.

Therefore, the current (1994-'95) annual catch from Gujarat has been listed specieswise or groupwise under about 7 or 8 different size-cum-morphological categories (Table 14) so that the quantities of filletable items under each category (indicated by F) would give an idea of the potential raw material that could help in the capacity utilisation of the existing processing plants in Gujarat.

TABLE 14. Marine fish landings (tonnes) in Gujarat during 1994-95 arranged in arbitrary product groups

Group "A" (Crustaceans)	
1. Penaeid prawns	17,782
2. Nonpenaeid prawns	38,063
3. Lobsters	578
4. Crabs	1,697
5. Stomatopods	3,458
Total	61,578

Group "B" (Cephalopods)	
1. Squids & cuttle fishes	26,448

Group "C" (Pomfrets)	
1. Black pomfret	3,553
2. Silver pomfret	11,615
3. Chinese pomfret	549
Total	15,717

Group "D" (Seerfishes, tunas & billfishes)	
1. Seerfishes	8,959
2. <i>Euthynnus affinis</i>	1,185
3. <i>Auxis</i> sp.	951
4. <i>Thunnus tonggol</i>	4,580
5. Other tunnies	3,071
6. Billfishes	356
Total	19,102

Group "E" (Perches, croakers etc.)	
1. Rockcod is (F)	1,759
2. Snappers (F)	1,018
3. Pigface breams (F)	756
4. Threadfin breams (F)	8,324
5. Other perches (F)	5,817
6. Goatfishes (F)	2,343
7. Threadfins	3,170
8. Croakers	2,35,934
9. Mulletts	4,427
10. Big jawed jumper	2,403
Total	2,65,951

Group "F" (Carangids)	
1. Horse mackerel (F)	1,776
2. Scads (F)	525
3. Leather jackets (F)	2,185
4. Other carangids (F)	3,067
Total	7,553

Group "G" (Flatfishes)	
1. Halibut	1,284
2. Soles	277
Total	1,561

Group "H" (Ribbon fishes etc.)	
1. Ribbon fishes	61,818
2. Halfbeaks & fullbeaks	18
3. Lizardfish	2,279
Total	64,115

Group "I" (Clupeids)	
1. Wolf herring (F)	4,386
2. Sardines	16
3. Indian mackerel	529
4. <i>Hilsa</i> shad (F)	2,138
5. Other shads (F)	515
6. <i>Thryssa</i> (F)	6,628
7. Anchovies	23,788
8. Other clupeids	7,451
Total	45,451

Group "J" (Eels, catfishes & barracudas)	
1. Eels	3,278
2. Catfishes (F)	24,218
3. Barracudas (F)	804
Total	28,300

Group "E" Elasmobranchs

1. Sharks (F)	15,395
2. Rays (F)	3,914
3. Skates	205
Total	19,514

Group "L" (Others)

1. Bombayduck	70,890
2. Silverbellis	1,842
3. Miscellaneous	17,239
Total	89,971

(F) : Filletable

Scope for open sea mariculture and brackish-water aquaculture

There is good potential for coastal land-based shrimp culture and open sea mariculture in Gujarat to help supplement the production for exports. The CMFRI is popularising commercial seafarming of pearl oyster, edible oyster, mussels, sea cucumbers, lobster, seaweeds, prawns and finfishes. Gujarat has a potential brackish-water area of 1.87 lakh ha for shrimp culture but only a negligible area is currently utilised. There is good scope for mariculture development after the passage of the Aquaculture Bill in the Parliament. Composite culture of mudcrab in cages in upgraded extensive farms growing prawns, milkfishes, pearlspot and mullets would be more appropriate than monoculture of shrimps. A recent survey conducted by the CMFRI in central Kerala has revealed composite culture of mudcrab with prawns and fishes to be very profitable.

Conclusions

Over the last one decade there has been a two fold increase in marine fish production in Gujarat State concurrent with the doubling of the effective effort. During this period, the revenue earned by the fishermen at the landing centre level increased remarkably by almost six

times. This indicates that the continuous increase in price has induced the fishermen to shift to mechanised and motorised fishing resulting thereby in higher level of production. With continuous increase in price, effort is found to increase in the absence of regulations, pushing the production to beyond the level of the maximum sustainable yield and then to the open access equilibrium, where the total revenue becomes equal to the total cost. The present annual landings of 6.5 lakh t in Gujarat as against the potential yield of 5.7 lakh t indicate that effort should not be further increased.

Since the mechanised trawlers are engaged largely in multiday operations for prawns and cephalopods, the bycatches are discarded in large quantities. These bycatches can be better utilised in the internal markets by introducing a suitable transportation system using carrier boats.

Currently there is substantial idle capacity of processing plants mainly because these plants are utilised only for export marketing. This excess capacity could be diversified for domestic marketing also so that the processed fish could be made available to the consumer centres in the internal marketing system for all the season. Seafarming and mariculture practices should be encouraged to increase the production and reduce the idling excess capacity in the processing plants. In spite of the greater thrust on the mechanisation of fishery, 75 % of the total marine fish landings in Gujarat is of low priced fish which are sold in the domestic market. Among the high priced fish, almost 50 % is sold in the internal markets. Hence, the infrastructure for internal marketing needs to be improved substantially. Since about one-third of the marine fish catch is landed at Veraval, post-harvest facilities need to be developed here on priority. Gujarat has a comparatively better fishery cooperative network which could be well utilised for domestic marketing in the interior areas of the neighbouring states of Rajasthan and Madhya Pradesh also. □