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Socio-economic impact assessment of monsoon trawl ban on marine fisheries sector of Kerala, India

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Abstract

Considering monsoon trawl ban as one of the important regulatory measures for resource conservation, in Kerala State an analysis was conducted to study the socio-economic impact of trawl ban to marine fisheries sector. Growth and instability in landings in the pre and post ban periods were analysed and the results showed the marine fish landings at a stabilised state with a positive growth rate of 0.108 % and a lower instability index of 11.4 in the post ban period. Analysis of the characteristics of ring seine fishery during ban period showed that nearly 10 % of the trawl workers were employed in the ring seine units. The overall employment loss to fishing, fishing related and non-fishing activities during the ban period was assessed and policy suggestions given for alternate employment options for mechanised fisherfolk.

Keywords: Trawl ban, Socio-economics, Ring-seine fishery

1. Introduction

The United Nations Conference on the Law of the Sea in 1982 provided opportunity for all coastal nations to participate fully in the utilisation of marine resources and several nations initiated developmental actions towards increasing food production, foreign exchange earnings, generation of income, employment and resource conservation. Resource conservation became a thrust area after significant growth in landings through adoption of mechanised fishing practices and development of infrastructural facilities. The FAO code of conduct of responsible fisheries also recommends sustainable exploitation of natural resources at national and international levels. With globalisation of trade in the 90^s, resource conservation took a new phase with regulatory measures occupying a key role in product acceptance in various countries. Subsequently several nations enforced regulatory measures for conservation and management of their resources. Mesh size regulation for prevention of capture of juveniles, use of turtle excluder devices in shrimp trawlers, ban on fishing of several species of elasmobranchs, coral reef protection and banning of trawling during monsoon season are important among the regulatory measures of resource conservation in India.

Monsoon season is considered as the breeding season for many of the marine fish species in Indian coastal waters. The practice of suspending the fishing activities during monsoon season voluntarily as a measure of species conservation was followed traditionally in the West Coast of India prior to 1970s itself (Ammuni, P.L, 1999). However, with the intensification of mechanised fishing with more efficient gears, increased demand for fish and enhanced foreign exchange earnings through export of marine products resulted in extending the trawl operations even during the monsoon season. The depletion in the stock of several marine fish species, diminishing catch of traditional fishermen and the adverse effect of bottom trawling on the ecosystem called for resource conservation and management measures through legislation. The violent conflicts erupted on this problem made some of the maritime states to constitute expert committees to review the situation and suggest necessary course of action. Consequently all the maritime states in India except Gujarat have enacted legislation for ban on trawling in various periods of monsoon season.

Kerala is an important maritime State of the country contributing 22.32 % of India's marine fish landings .The annual foreign exchange earnings of Kerala through the export of marine products was to the tune of Rs.1,150 crores in 1999-2000 in which the contribution of trawlers and other mechanised crafts was highly significant (MPEDA, 2001). About 6 lakh people are employed directly and indirectly in the fisheries sector of Kerala. The Govt. of Kerala in 1988 introduced a partial ban on trawling during the monsoon season through a Government order and thereafter the ban was enforced every year at varying intervals during the South West monsoon season (Yohannan *et al.*, 1999). Several controversies also followed this stating there is no scientific background for trawling ban during monsoon period and the ban is adversely affecting the livelihood security of trawl workers and associated labourers. Considering the above aspects, the present study is undertaken in Kerala State with an overall objective of understanding the socio-economic impact of monsoon trawl ban on the marine fisheries sector. Since ring seine operations during "Chakara"(mud bank) is the main source of income for traditional fishers of Kerala during monsoon season, the pattern of landings, fish prices at first sales in ring seine fishery and the employment opportunity of trawl workers in this sector are also taken into consideration. Policy suggestions are given regarding the alternate employment opportunities for mechanised fisherfolk during ban period.

2. Materials and methods

Both primary and secondary data were utilised for the study. Primary data regarding socio-economic parameters of employment and income loss to trawl workers and others engaged in fishing, fishing related and non-fishing activities in the major harbours like Neendakara and Cochin in Kerala were collected by survey method. A socio-economic survey was conducted during the 45 days ban period in selected landing centres in the districts of Kollam, Alleppy, Ernakulam and Thrissur to collect data on landings, price and socio-economic aspects of ring seine fishery during ban. The survey was conducted on alternate weeks in the Southern and Central regions of Kerala State covering the ring seine landing centres. Data on employment opportunities for the trawl workers for fishing, fishing related and non-fishing activities were also collected from these centres. Secondary data on landings during the period from 1962 - 2000 was divided into three phases consisting of intensive mechanisation (1962 - 74) and motorisation phases (1975 - 1987) in the pre ban period and post ban period (1988 - 2000) for determining the growth and instability in landings.

Analyses were done for determining the employment and income loss in fishing, fishing related and non-fishing activities in the harbours. The employment opportunities for the trawl workers in ring seine units were also studied by using percentage analysis. Compound growth rate were calculated for comparing the growth in landings of major pelagic and demersal fishes during pre and post ban periods. The compound annual growth rate (CGR) is estimated from the equation.

$$Y = ab^x, \text{ where } Y \text{ is the annual landings in } t$$

$$\text{CGR} = (\text{Antilog } b - 1) * 100$$

The instability in landings during the two periods was compared by using coefficient of variation (CV) and Coppock's instability index.

$$\text{Coefficient of Variation (CV)} = (\text{Standard Deviation}/\text{Mean}) * 100$$

Coppock's instability index = $(\text{Antilog } \sqrt{V} \log - 1) * 100$, where V log is the logarithmic variance of annual landings

3. Results and discussion

The results of the analyses under three different heads: i) growth and instability in landings ii) characteristics of ring seine fishery

during ban period and iii) employment and income loss in fishing, fishing related and non-fishing activities in the selected harbours during ban period are discussed below.

3.1 Growth and instability in landings during pre and post ban periods

Analysis of growth in marine fish landings during the three periods, 1962 - 74, 1975 - 87, and 1988 - 2000 showed that the annual marine fish production grew at an average rate of 4.7 % during the period 1962 - 74 which was due to intensive mechanisation of fishing crafts in the 60's, where as during the period from 1975 - 87, the marine fish production showed a declining trend of -0.45 % due to over exploitation by both mechanised and motorised crafts and consequent depletion in stock and positive growth rate of 0.108 % during 1988 - 2000 which might have resulted from the increase in stock after the introduction of ban on monsoon trawling. (Table-1)

Table 1. Comparison of growth in landings in different periods

Period	CGR
1962-74	4.7
1975-87	-0.45
1988-2000	0.108

Fluctuations in landings was analysed by using Coefficient of Variation and Coppock's instability index. Comparison of fluctuations in landings during the three periods showed that the fluctuations were minimum during the post ban period as indicated by the lower CV and instability index during the post ban period. The annual catches varied from 1,92,470 t to 4,45,347 t during 1962 - 74 period, from 2,74,395 t to 4,20,836 t during 1975 - 87, and from 4,68,808 t to 6,62,890 t during 1988 - 2000 (Table-2).

Table 2. Comparison of fluctuations in catches using cv and Coppock's instability index

Period	CV	Coppock's instability index
1962-74	23.82	25.74
1975-87	13.03	16.29
1988-2000	8.48	11.40

3.2 Ring seine fishery during ban period

The biological and socio-economic characteristics of ring seine fishery including quantity and value of different species landed, change in employment and number of crafts operated were studied in

the selected landing centres where the ring seiners were operating during ban period. The centres selected were Kalamukku, Chavakkad & Azhikkode in the Central regions and Puthenthura and Arthungal in the South.

Different types of traditional crafts operating in these centres were *thanguvallam* and *disco vallam* (motorised ring seiner) and *minitrawl* fitted with outboard engines ranging from 9 hp to 40 hp and 60 - 80 ft long crafts fitted with inboard engines. Ring seine was the predominant gear used during the monsoon season. In the selected centres, the phenomenon of *Chakara* was observed only in Chavakkad and Arthungal during the South West monsoon season of 2003. In Azhikkode and Puthenthura, the catch was mainly from inboard fitted ring seiners during ban, which were earlier operating from Munambam and Neendakara fishing harbours respectively during non-ban period. There was an average increase of 222 % in the number of crafts during ban period. The increase in the number of crafts in Chavakkad and Arthungal was due to shifting of traditional crafts from the nearby landing centres due to 'mud bank'. The increase in number of crafts in Azhikkode and Puthenthura during ban period was due to shifting of operation of inboard fitted ring seiners after the closure of harbours (Table-3).

Table 3. Changes in the number of fishing units in the selected landing centres during ban and non-ban periods

Centres	Inboard fitted ring seiners		Country crafts with ring seine		Thanguvallam with thanguvala		Minitrawl with gillnet		Total		%Increase
	Non-ban	Ban	Non-ban	Ban	Non-ban	Ban	Non-ban	Ban	Non-ban	Ban	
Puthenthura	nil	17	20	50					20	67	235
Arthungal			100	300	5	15	10	40	115	355	208.69
Chavakkad			30	250			50	100	80	350	337.5
Azhikkode	10	60	2	3	6		40	55	72	151	109.72
Kalamukku	50	50									AV 222.47

Analysis of change in employment in major landing centres in the study region, where ring seiners were predominant showed an average increase of about 22 % in crew size in the motorised ring seiners in the selected centres during ban period. On an average 1- 2 workers from the mechanised units were found employed in the obm fitted ring seiner and 5-10 members in ibm fitted ring seiner during ban period which accounts for about 10 % of the unemployed workers

in the mechanised fishing units in Neendakara, Cochin and Munambam fishing harbours. (Table 4)

Analysis of catch and value realized by the ring seine units during the ban period showed that sardines and shrimps (*P. indicus* & *M.dobsoni*) dominated the catch. In the case of large inboard fitted ring seiners, the average catch of *P. indicus* varied from 265 kg craft⁻¹ in Puhenthura landing center to 873 kg in Azhikkode. Oilsardine catch varied from 620 kg in Puhenthura to 1975 kg in Azhikkode. Analysis of price at different landing centers during ban period showed that the average price of oil sardines (medium sized) varied from Rs.2 kg⁻¹ in Chavakkad to Rs.9.5 kg⁻¹ in Arthungal. For *P. indicus* (big) the price varied from Rs.240 kg⁻¹ in Azhikkode to Rs.280 kg⁻¹ in Chavakkad. For *M.dobsoni*, it varied from Rs.68 kg⁻¹ in Puhenthura to Rs.75 kg⁻¹ in Azhikkode (Table-5).

Table 4. Change in employment in ring seine units during monsoon period in the selected harbours of Kerala

Type of craft	No. of crafts		Crew size			Total employment	
	Ban	Non-ban	Ban	Non-ban	Increase (%)	Ban	Non-ban
Puthen thura							
Large inboard fitted ring seiners	17	nil	65	60	8.33	1,105	Nil
Obm fitted ringseiners	150	20	40	30	33.33	6,000	600
Arthungal							
Obm fitted ringseiners	300	100	20	15	33.33	6,000	1,500
Chavakkad							
Obm fitted ringseiners	250	30	40	35	14.29	10,000	1,050
Azhikkode							
Large inboard fitted boats	60	10	45	35	28.57	2,700	350
Obm fitted ringseiners	36	22	20	16	25.00	720	352
Kalamukku							
Large inboard fitted ring seiners	50	50	60	50	20.00	3,000	2,500
Total	863	232	290	241	22.41	29,525	6,352

Table 5. Average catch of different fishing units and fish prices in the selected centres during ban period

Name of landing centre	Name of species	Catch (kg/craft)	Size range	Price/kg
Puthenthura				
Large inboard fitted boats	<i>P.indicus</i>	873	Big	265
	<i>M.dobsonii</i>	45	Medium	68
	Sardines	1975	Medium	7
	Mackerel	50	Medium	17.5
	Tunas	75	Medium	35
Obm fitted ring seiners	Sardines	200	Medium	7
Arthungal				
Obm fitted ring seiners	<i>M.dobsonii</i>	500	Medium	70
	Sardines	300	Medium	9.5
Minitrawl boats with gillnet	Sardines	200	Medium	9.5
Chavakkad				
Obm fitted ring seiners	Sardines	3,000	Medium	2
	<i>P.indicus</i>	100	Big	280
Minitrawl boats with gillnet	Sardines	300	Medium	2
Azhikkode				
Large inboard fitted boats	Sardines	620	Medium	9
	<i>P.indicus</i>	265	Big	240
	<i>M.dobsonii</i>	25	Medium	75

3.3 Socio-economics of fisher folk in the selected harbours in Kerala during ban period

Socio-economic data were also collected from major fishing harbours like Neendakara and Cochin where the trawler operations are concentrated. Different types of mechanised crafts including trawlers, gillnetters and purse-seiners were operating in Cochin harbour. In Neendakara, gillnetters and trawlers were operating. In addition, 15-24 m crafts fitted with inboard engine and small marine plywood boats fitted with OBM with capacities ranging from 9.9 hp to 40 hp were also operating from both these harbours. During ban period, all the operations were stopped in these harbours. Considering a loss 39 fishing days excluding Sundays and fishing holidays, the overall employment loss in man days and labour income loss from stoppage of

fishing, fishery related and non-fishery activities in the harbours and for the state as a whole were worked out for the entire ban period.

Table 6. Employment loss in fishing during ban in the selected harbours

Name of the harbour	Category: Mechanised units						Total Employment loss (MD)	Loss in labour income (Rs. lakhs)
	Trawlers & Gill-netters (No)	Crew size	Employment loss (MD)	Purse-seiners (No)	Crew size	Employment loss (MD)		
Neendakara	1,300	7	3,54,900	-			3,54,900	1,733.55
Cochin	380	7	1,03,740	0	30	72,540	1,76,280	647.4
Total	1680		4,58,640	0		72,540	5,31,180	2,380.95

Table 7. Employment loss in mechanised fishing in Kerala State during ban

Category	No. of units	Loss of fishing days during ban period	Crew size	Total employment loss in mandays)	Total loss in labour income (Rs.lakhs)
Trawlers	4,484	39	7	12,24,132	4,284
Purse-seiners	76	39	30	88,920	177.84
Gillnetter	499	39	7	1,36,227	578.96
Liner (<30')	5	39	5	975	2.92
Liner (>30')	24	39	30	28,080	56.16
Total	5,088			14,78,334	5,099.88

The analysis showed that 17 inboard fitted boats and 350 OBM fitted marine plywood boats operating from Neendakara harbour prior to ban period were operating from Puthenthura and Thangasserry landing centres during the ban period. The average number of trawlers operating in the harbour during pre ban period per day was 1,300 with average of 7 labourers per boat. Thus there is a total employment loss of 3,54,900 man days in fishing. In Cochin fisheries harbour, 300 trawlers and 80 gillnetters with an overall employment of 2,660 and

622 purse seiners with an average employment of 28 - 30 per boat were not operating during the ban period. The total employment loss in mechanised units due to ban is worked out to 1,76,280 mandays (Table- 6). The total number of mechanised units in Kerala is 5,088. The overall employment loss in mechanised fishing units due to ban is worked out based on the total number of mechanised crafts operating in the State, average crew size and average fishing days lost during ban period. The overall employment loss in mechanised fishing sector alone was to the tune of 15 lakh mandays, which accounted to a loss in labour income of Rs.51 crores during the entire ban period. (Table-7).

3.3.1 Employment loss in fishery related activities

Different types of labourers operating in the harbour include those who shift fish from the boats into buckets and baskets, head load workers, weighing persons, auctioneers, packers, ice workers and cleaners. In the case of trawlers the members of the crew themselves will undertake the operations of transferring fish from the boats into buckets/baskets, cleaning the boats and supply of ice and water to the boats. The head load workers carry baskets to the landing centre and undertake loading and unloading into lorries and other vehicles for transporting to distant places.

In addition, different types of commission agents including fish auctioneers, agents of exporters, agents of ice and lorry brokers are also functioning in the harbours. In Neendakara harbour, about 1000 fish auctioneers including 14 agents of the Matsyafed are functioning. The commission agents mainly collect a fixed percent of the returns ranging from 3 % for inboard to 5 % for out board for the capital invested in crafts and gears. Those who do associated work like, washing the boats, ice and water supply will get 1 % share. In addition, there are about 15 private moneylenders who finance the operational expenses of the crafts. The auctioneers and agents of the exporters are getting 1 % commission on the value of the produce. The mainly affected categories are small retailers including women and men vendors undertaking fish sales either by head load, or using motorcycles and cycles. The overall employment loss in fishery related activities is estimated as 1,31,586 mandays in Neendakara and 2,67,891 mandays in Cochin harbour (Table-8). The overall employment and labour income loss to the State in fishery related activities is estimated at 7,70,748 mandays and Rs.14.33 crores respectively.

Table 8. Employment and income loss in fishing related activities in the harbours

Category	Neendakara			Cochin		
	Average number operating per day	Employment loss (ManDays)	Income loss (Rs.lakhs)	Average number operating per day	Employment loss (ManDays)	Income loss (Rs.lakhs)
Auctioneers/ commission agents	1,000	39,000	195	100	3,900	19.5
Agents of exporters	100	3,900	39	40	1,560	15.6
Head load workers	1000	39,000	97.5	450	17,550	43.87
Packers	50	1,950	1.95	750	29,250	29.25
Ice sellers	44	1,716	8.58	45	1,755	8.77
Small Retailers	1420	27,690	41.53	800	15,600	23.40
Others	470	18,330	18.45	430	16,770	16.77
Total	4084	1,31586	402.01	2,615	86,385	157.16

3.3.2 Employment loss in ancillary sectors

The employment loss in ancillary sectors like ice plants, diesel dealers, shops operating within the harbour, retailers and vehicles entering the harbour are included under this. About, 64 hotels cum teashops, 2 diesel dealers operating inside the harbour and 25 ice factories in the nearby areas in Neendakara and 12 ice factories, 30 hotels and 2 diesel dealers in Cochin were closed down due to ban. The employment loss per day is worked out to 10,647 mandays in Neendakara and 5,226 in Cochin. In addition to this, a number of hotels and stationery shops working outside the harbour are also affected due to ban, even though not closed down completely.

The average number of vehicles and retailers entering in the harbour per day is 2,246 in Neendakara and 1,160 in Cochin harbour. Heavy vehicles including lorries, tempos, and minilories incur only a partial employment loss as they are shifting their operations to non-mechanised centres and neighbouring States during ban. Repair and maintenance shops and net dealers are getting maximum employment and profit during ban period, since most of the boat owners do maintenance of craft and gears during ban period. The employment loss in ancillary sectors for the State is worked out as 46,685 mandays with a loss in labour income of Rs. 73 lakhs.

Table 9. Employment and income loss in ancillary sectors in the selected harbours

Category	Neendakara				Cochin			
	Average number operating per day	Average no. of workers	Employment loss (MD)	Income loss (Rs. lakhs)	Average number operating per day	Average no. of workers	Employment loss (MD)	Income loss (Rs. lakhs)
Ice factories	25	6	4,875	5.85	12	5	2,340	2.80
Diesel dealers	2	6	468	.94	2	5	390	.78
Hotels & pan shops	64	2	4,992	12.48	30	2	2,340	.3
Telephone booth	3	1	117	.58	-	-	-	-
Stationery shops	1	2	78	.39	-	-	-	-
Cosmetic/leather goods/cloth sellers	3	1	117	.35	4	1	156	.46
Total	98		10,647	20.59	48		5,226	4.34

The overall employment loss for the State in fishing, fishery related and ancillary sectors together is estimated as nearly 23 lakh man days contributing to a loss in labour income of Rs. 66 crores during the entire ban period.

Table 10. Overall employment and labour income loss to different sectors in the State

Category	Fishing		Fishing related		Ancillary sectors		Total	
	Employment loss (man days)	Loss in labour income (Rs. lakhs)	Employment loss (man days)	Loss in labour income (Rs. lakhs)	Employment loss (man days)	Loss in labour income (Rs. lakhs)	Employment loss (man days)	Loss in labour income (Rs. lakhs)
Neendakara	3,54,900	1,733.55	1,31,586	402.01	10647	20.59	4,97,133	2,156
Cochin	1,76,280	647.4	86,385	157.16	5226	4.34	2,67,891	809
Kerala	14,78,334	5,099.88	7,70,748	1,433.67	46,685	73	22,95,767	6,606.55

4. Conclusion and policy recommendations

The results of the compound growth rate analysis showed that the annual marine fish catch grew at an average rate of 4.7 % during the intensive mechanisation phase, negative growth of -0.45 % during the intensive motorisation stage and thereafter a positive growth of 0.108 % in the post ban period. Analysis of the fluctuations in

landings showed less fluctuations in landings during the post ban period as depicted by the lower coefficient of variation and Coppock's instability index. Hence it could be concluded that the ban on trawling has had a favourable effect on resource conservation.

The overall employment loss in fishing, fishing related and ancillary sectors in the selected harbours was respectively 3,54,900, 1,31,586 and 10,647 mandays in Neendakara and 1,76,280, 86,385 and 5,226 mandays in Cochin. The overall employment loss in the State is estimated as nearly 23 lakh mandays accounting to a labour income loss of Rs. 66 crores during the entire ban period.

Currently only 10 % of the mechanised workers are found employed in fishing in the traditional sector during ban period. The incentives given by the trawl owners during the ban period is very less and many of the trawl workers are depending on the private moneylenders during this period. Since the only source of livelihood for the mechanised workers is from fishing, some alternatives should be found out for this sector during ban period. Alternate employment opportunities in repair and maintenance of fishing equipments and in the processing sector may be created for protecting the livelihood security of mechanised workers. As there is an increase in landings after the ban and the wages for the workers is based on the returns realised, the workers are supposed to get the benefit due to ban. Hence creation of a savings cum relief scheme using the additional income generated in the non-ban periods is suggested for providing a regular income for trawl workers in the ban period. Since the analysis is based on a one time survey, a comprehensive analysis of the catch and revenue realised by different mechanised units and income earned by the trawl workers during different seasons of ban, pre and post ban periods is essential for developing a long term policy strategy for this sector. Further, awareness campaigns on resource conservation through community participation should be undertaken among fisher folk for avoiding conflicts related to implementation of monsoon trawl ban.

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