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Analysis of Socio-economic Variables and Impact of Tsunami among the Mechanized Boat Operators in Tamilnadu

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Abstract

The post-Tsunami fisheries scenario and socio-economic conditions among the mechanized boat operators in Tamilnadu were studied. The data were collected from a randomly selected sample of 60 mechanized boat operators from Cuddalore and Nagapattinam districts (30 per district) in Tamilnadu. The average fishing days in a year was 217 and 213 for Cuddalore and Nagapattinam respectively. The average investment on fishing unit was Rs 15.50 and Rs 16.38 lakhs respectively in both the centres. Almost all the respondents in both the districts reported no change in various parameters *viz.*, demand for fish, price of fish, change in the taste or quality of fish, urbanization/migration and changes in health, sanitation, nutritional status and outbreak of any disease after Tsunami. Increased fishing pressure, introduction of steel trawlers, ring seine operation, large mesh trawls, double-rig trawling, single-day to multi-day fishing, larger boats and usage of electronic instruments were found to be the major changes in the post-Tsunami period. Significant changes could be observed in the present value of craft and gear, investment and indebtedness in the pre and post-Tsunami periods. Majority of the respondents in both the study areas expressed satisfaction with the adequacy of mitigation measures such as supply/replacement/repair of fishing devices, technological assistance, credit facilities, health and hygiene.

Key words: Tsunami, mechanized boats, steel trawlers, mitigation measures, livelihood, socio-economic status

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Introduction

The Indian Ocean Tsunami, which struck the nations in south and southeast Asia on 26 December 2004, brought incalculable damage to both human beings and the environment. The high intensity waves devastated Tamilnadu coast from Chennai to Kanyakumari and the effect was much pronounced in Cuddalore, Nagapattinam and Kanyakumari districts (Edward, 2005). Nagapattinam was the worst affected district where 6051 people died while 824 in Kanyakumari and 612 in Cuddalore were reported dead (Banerjee & Chaudhury, 2005). The Tsunami left a marked effect on the coast in many areas, devastating the coastal communities, destroying houses, boats, fishing gear, agricultural lands, salt pans and wiping out millions of livelihoods. Several significant changes followed the Tsunami, influencing many facets of coastal livelihood. With respect to fisheries, besides several being rendered homeless, many fisherfolk lost their fishing inputs such as craft, gear, engines and accessories (Sridhar, 2005). However, there has been a very limited focus on socio-ecological and socio-economic aspects of the Tsunami and the subsequent reconstruction and rehabilitation measures (Rodriguez, 2007). The post-Tsunami scenario of mechanized boat operators in Tamilnadu with reference to fishing technology and socio-economic conditions are focused in this study. The data presented in this study also analyses various impacts of the Tsunami on fish landing, marketing and other social consequences and adequacy of mitigation measures as perceived by the respondents.

Materials and Methods

The study was conducted during 2006-08, covering the two worst affected fishing centres *viz.*, Cuddalore and Nagapattinam in Tamilnadu. The data were collected from a randomly selected sample of 30 mechanized boat operators each in Cuddalore and Nagapattinam districts. A random method of

selection, giving each of the 'N' units in the population a calculable probability of being selected (Snedecor & Cochran, 1971) using the random table, was made for the study.

Both qualitative and quantitative tools were used. The data on the socio-economic variables and other quantitative parameters were collected using structured and pre-tested interview schedules. Qualitative observations and the findings from available literature and the records of Department of Fisheries, Government of Tamilnadu were also used. Based on relevancy rating, sixteen independent variables were selected for this study. The variables *viz.*, age, occupation, experience in the field, number of fishing days in a year, investment on fishing craft and gear, ownership pattern, family size, type of houses, material possession, average annual family income and expenditure, social participation, mass media exposure, extension agency contact and innovativeness were measured through the scoring procedures followed in earlier studies (Jeeva et al., 2011; Reddy, 2003; Supe, 1969). Perceived impact on fish landing, marketing and social consequences, impact on livelihood and socio-economic status and adequacy of mitigation measures were expressed as mean scores and percentages. Multiple responses on the constraints perceived by the respondents were also reported. The data were analyzed by using standard statistical tools *viz*., percentage, mean, standard deviation and 't' test, using the statistical packages for social sciences (SPSS Ver. 16.0).

Results and Discussion

The data on socio-economic profile of mechanized boat operators in Cuddalore and Nagapattinam districts are presented in Table 1.

The mean age of the respondents was 41 and 40 years and the experience was 19.60 and 18.53 years while the number of fishing days in a year was 217 and 213 in Cuddalore and Nagapattinam respectively. The average investment on craft and gear was Rs 15.50 and Rs 16.38 lakhs respectively. All the respondents were owners of the fishing boats and almost eighty percent of them had fishing alone as their primary occupation. Only about 20 percent of the respondents in both the study areas had subsidiary occupations in addition to fishing. There was no significant difference among them on the variables *viz*., occupational status, experience, number of fishing days, investment on fishing craft and gear, ownership pattern, family size, type of houses, material possession, family income, family expenditure, extension participation, innovativeness and economic motivation. All the respondents in both the districts owned the house. However, significant differences could be observed among the respondents between the two districts pertaining to the variables *viz*., social participation (p<0.01) and mass media exposure (p<0.05). The net annual income among the respondents ranged from Rs 60 000 to Rs 2 00 000 in Cuddalore and from Rs 60 000 to Rs 2 40 000 in Nagapattinam districts.

All the respondents of this study owned mechanized craft with 100-140 horse power (hp) engines. The major types of gear used were trawl nets and depending on the target catch, different types of trawl nets were used. The investment on a fishing unit ranged from Rs 10.60 to Rs 20.90 lakhs which was inclusive of the cost for one mechanized boat (15-18 m L_{OA}), one engine of 100-140 hp and 8 - 12 trawl nets costing Rs 20 000 net^{-1}. On an average, they consumed 700-900 l of diesel and three tonnes of ice for the stay-over fishing trip of three days and three nights. They carried out four to seven fishing trips in a month with an approximate operational expenditure of Rs 30 000 to 50 000 trip^{-1}. The area of operation ranged from 150 to 250 m depth and the major landings included cuttlefish, shrimp, crab, threadfin bream, barracuda and other fin fishes.

The impact of Tsunami on fish landing, marketing and social consequences as perceived by the respondents are presented in Table 2.

More than eighty percent of the respondents in Cuddalore district reported that there was no drop in the landings after the Tsunami, whereas more than fifty percent of the respondents from Nagapattinam reported otherwise. Almost all the respondents in both the districts reported that there was no drop in demand for fish, price of fish, change in the taste or quality of fish, urbanization/migration and changes in health, sanitation, nutritional status and outbreak of any disease after Tsunami. However, according to Gomathy (2006), the fishing villages in Gulf of Mannar reported reduction in the amount of catch as well as variety of fish after the Tsunami while Nagapattinam and Karaikal villages reported no such reduction. Another study by Rodriguez (2007), reported an initial increase in catch and income for three to four months immediately after the Tsunami and the reason for the initial increase in catch and income could be

Table 1. Socio-economic profile of the mechanized boat operators in Cuddalore and Nagapattinam districts

Variables	Cuddalore (n=30)		Nagapattinam (n=30)		't'
	Mean ± SD	%	Mean ± SD	%	
Age (Years)	41.97 ± 6.13	-	40.13 ± 8.00	-	0.997
Occupation					
a) Fishing alone	-	80.00	-	80.00	-
b) Fishing + others	-	20.00	-	20.00	-
Experience in the field (Years)	19.60 ± 6.95	-	18.53 ± 8.54	-	0.531
Number of fishing days in a year	217.00 ± 28.64	-	213.00 ± 25.04	-	0.576
Investment on fishing craft and gear (Rs in lakhs)	15.50 ± 3.27	-	16.38 ± 7.75	-	0.574
Family size (No.)	5.33 ± 1.35	-	5.70 ± 1.86	-	0.874
Type of house					
a) Concrete	-	76.67	-	70.00	-
b) Tiled	-	23.33	-	30.00	-
Material Possession (Value in Rs Lakhs)					
a) Assets	7.50 ± 3.79	-	8.42 ± 3.57	-	1.255
b) Household articles	1.67 ± 0.46	-	1.40 ± 0.38	-	0.642
Average annual net family income (Rs in Lakhs)	0.89 ± 0.35	-	0.81 ± 0.36	-	0.135
Average annual family expenses (Rs in Lakhs)	0.64 ± 0.13	-	0.66 ± 0.19	-	0.385
Social participation (Scores in the range of 1-10 & Index in %)	1.40 ± 0.56	14.00	2.00 ± 0.87	20.00	3.168**
Extension participation (Scores in the range of 1-6 & Index in %)	1.80 ± 0.85	30.00	1.67 ± 0.71	27.83	0.660
Mass media exposure (Scores in the range of 1-20 & Index in %)	12.17 ± 2.32	60.85	10.93 ± 2.08	54.65	2.166*
Innovativeness (Scores in the range of 1-3 & Index in %)	2.23 ± 0.57	74.33	2.13 ± 0.78	71.00	0.569
Economic motivation (Scores in the range of 6-30 & Index in %)	24.97 ± 3.57	83.23	23.63 ± 2.71	78.77	1.630

(** Significant at 1% level; * Significant at 5% level)

Table 2. Perceived impact on fish landing, marketing and social consequences

Impact factors	Cuddalore district (n=30)		Nagapattinam district (n=30)	
	Agree (%)	Disagree (%)	Agree (%)	Disagree (%)
Drop in fish landings after Tsunami	13.33	86.67	53.33	46.67
Hike in fish landings after Tsunami	36.67	63.33	23.33	76.67
Drop in demand for fish after Tsunami	0.00	100.00	0.00	100.00
Drop in price of fish after Tsunami	0.00	100.00	6.67	93.33
Hike in price of fish after Tsunami	40.00	60.00	56.67	43.33
Change in the taste/quality of marine fish after Tsunami	0.00	100.00	0.00	100.00
Urbanization/ migration after Tsunami	6.67	93.33	20.00	80.00
Changes in health, sanitation, nutritional status and outbreak of any diseases after Tsunami	0.00	100.00	0.00	100.00

attributed to the gap in resumption of fishing. The drop in income and catch in the subsequent months was reported to be 60-70% of the previous months. However, continuous catch data need to be monitored along with details of species and income. This needs to be correlated with the catch effort and operational expenditure to get a clear picture of the status of resources, income and fishing patterns in the post-Tsunami period.

The impact on livelihood and socio-economic status as perceived by the respondents is presented in Table 3.

In the case of the respondents from Cuddalore, significant changes could be observed in the value of craft and gear (Rs 11.75 and 15.50 lakhs), investment (Rs 0.00 and 4.67 lakhs) and indebtedness (Rs 0.00 and 4.32 lakhs) in the pre and post-Tsunami periods (p<0.01). The same trend was observed in the case of Nagapattinam district also. Significant differences could be observed in the value of craft and gear (Rs 9.46 and 16.38 lakhs), investment (Rs 0.30 and 1.07 lakhs) and indebtedness (Rs 0.20 and 6.98 lakhs) (p<0.01). No significant differences were reported between pre and post-Tsunami periods pertaining to the variables *viz*., value of assets, value of household articles, ownership pattern, annual family income and expenditure.

Increased fishing pressure, introduction of steel trawlers, ring seine operation, double-rig trawling, single-day to multi-day fishing, larger boats, large mesh trawls, and use of electronic instruments *viz*., echo sounder and GPS were the major changes in the post-Tsunami period due to the competition for better catches and survival. Before Tsunami, only 40% of the vessels were using electronic instruments while in the post-Tsunami scenario, the use of electronic instruments has gone upto 96%. The duration of fishing trip increased from single-day fishing to voyage trip of three nights and three days. Trawl nets with larger mesh sizes were in use, to reduce the drag. Depending on the target species, large mesh nets of sizes ranging from 2000, 800 and 400 mm to 30 mm at codend were used. Steel trawlers have come into existence after Tsunami as about 75% of the fishing vessels introduced after Tsunami was steel trawlers, constructed with the technical manpower and design from Cochin. Wide fluctuations in availability of fish and the relatively better landings of cuttlefish were also reported in the post-Tsunami era. The other changes in the post-Tsunami period were increased fishing time, introduction of inboard *vallams* and ring seine operation from Kerala. Changes in craft and gear designs were also observed as larger crafts of 15-18 m L_{OA} were in operation, compared to 10-12 m L_{OA} crafts in the pre-Tsunami period. Benchila & Prabhu (2005)

Table 3. Impact on livelihood and socio-economic status

Item	Cuddalore district (n=30)			Nagapattinam district (n=30)		
	Before Tsunami Mean ± SD	After Tsunami Mean ± SD	't'	Before Tsunami Mean ± SD	After Tsunami Mean ± SD	't'
Asset value (Rs in Lakhs)	7.03 ± 3.85	7.50 ± 3.79	0.473	8.13 ± 3.69	8.42 ± 3.57	0.302
Value of household articles (Rs in Lakhs)	1.60 ± 0.44	1.67 ± 0.46	0.571	1.33 ± 0.40	1.40 ± 0.38	0.660
Value of craft and gear (Rs in Lakhs)	11.75 ± 3.76	15.50 ± 3.27	4.119**	9.46 ± 1.56	16.38 ± 7.75	4.798**
Average annual net family income (Rs in Lakhs)	0.89 ± 0.40	0.89 ± 0.35	0.085	0.67 ± 0.40	0.81 ± 0.36	0.489
Average annual family expenditure (Rs in Lakhs)	0.61 ± 0.15	0.64 ± 0.13	0.395	0.52 ± 0.20	0.66 ± 0.19	1.706
Investment (Rs in Lakhs)	0.00 ± 0.00	4.67 ± 6.29	4.062**	0.30 ± 1.12	1.07 ± 4.07	1.995**
Indebtedness (Rs in Lakhs)	0.00 ± 0.00	4.32 ± 3.77	6.275**	0.20 ± 0.61	6.98 ± 7.44	4.976**

(** Significant at 1% level; * Significant at 5% level)

reported that the main changes in the post-Tsunami era were unpredictability of winds, changes in currents, appearance of new species such as white fish after 20 years, inability to predict weather patterns, inability to predict fish aggregation and changes in fishing grounds.

Regarding the number of crafts, Salagrama (2006) reported that immediately after the Tsunami due to the impact of rehabilitation, the total number of crafts exceeded pre-Tsunami levels. However, this trend did not occur in the mechanized sector and it was interesting to note that the number of trawlers had reduced. This was due to the fact that many trawler owners did not reinvest but shifted to small scale fishing and gillnetting with motorized FRP crafts as they considered trawling was no longer viable. Though this was the case immediately after Tsunami, later on, the number of mechanized craft have increased and it was also felt that actual number of craft were definitely more than the official figures. Comparing with pre-Tsunami levels, the data collection on fleet strength was virtually impossible as many of the boats of pre-Tsunami period were not registered and it was not known whether all the boats have been registered in post-Tsunami period. In the case of nets, another study (Bhalla, 2006) reveals that there is a significant increase in the mesh size of nets being used.

The perception of the respondents on the adequacy of mitigation measures is presented in Table 4.

Majority of the respondents in both the study areas were satisfied with the adequacy of mitigation measures such as supply, replacement and repair of fishing devices, technological assistance through public/private/NGO sectors, credit facilities and health and hygiene. This is supported by the findings of Banerjee & Chaudhury (2005) that the fishing communities got more attention compared to other communities in terms of post-Tsunami relief. Some NGOs have given as many as five boats to bigger fishing families yet hardly any aid to lesser-known groups. About 70 to 80% of aid has come to the communities as a loan package and the remaining in the form of subsidies. It could be found that the Tsunami assistance provided by the Government of Tamilnadu for the mechanized sector included 35% of assessed value or Rs 5 lakhs whichever was less as subsidy and 65% as bank loan for fully damaged vessels and 60% of assessed value or Rs 3 lakhs whichever was less as subsidy and 40% loan for partly damaged vessels. The mitigation measures such as restoration of infrastructural facilities and environmental protection *viz.*, construction of seawall and planting of mangroves were not satisfactory for majority of the respondents (Table 4). In the case of Nagapattinam district, 43.33 and 66.67% of the respondents expressed dissatisfaction with the technological assistance provided and environmental protection *viz.*, construction of seawall and planting of mangroves. Edward (2005) reported that the Tsunami had made vast changes in shoreline in almost all affected areas in Tamilnadu coast, particularly transgression (up to 250 m) in many areas. Necessary remedial measures have to be initiated to minimize and stop further sea erosion in those areas. Construction of sea walls and

Table 4. Perceived adequacy of mitigation measures

Mitigation measures	Cuddalore district (n=30)		Nagapattinam district (n=30)	
	Satisfied (%)	Not satisfied (%)	Satisfied (%)	Not satisfied (%)
Supply and replacement of fishing devices	100.00	0.00	96.67	3.33
Repair of fishing devices	100.00	0.00	100.00	0.00
Restoration of infrastructure facilities	0.00	100.00	0.00	100.00
Technological assistance through public/ private/ NGO sectors	100.00	0.00	56.67	43.33
Credit facilities	100.00	0.00	100.00	0.00
Environmental- construction of seawall and planting of mangroves etc.	0.00	100.00	33.33	66.67
Health and hygiene	100.00	0.00	60.00	40.00

deployment of rock boulders and artificial reefs (concrete structures) in those affected areas would serve the purpose very effectively.

Inadequate diesel subsidy, indebtedness and competition for the limited resources were reported as significant constraints by majority of the respondents in both the study areas. The mechanized boats get a diesel subsidy of 1500 l month^{-1} whereas the average fuel consumption was around 3500 l month^{-1}. In the case of the respondents from Nagapattinam, 73% reported the livelihood threat from the Srilankan Navy as a major constraint for fishing operations. The other constraints reported were lack of cold storage facilities, silting problem in the harbour, frequent repair and maintenance of craft, inadequacy of governmental schemes and extension programmes, fluctuations in returns, increasing operational expenditure especially the fuel prices, unpredictable seasonal availability of catches and lack of information on innovations in fisheries. It could be found that most of the respondents had already lost their fishing vessels worth of Rs 10 lakhs in the Tsunami and indebted to the tune of six to twelve lakh rupees. Another constraint perceived by the respondents was the non-existence of any association for the mechanized boat operators, and only the village *panchayaths* have control over them. 'Double-rig trawling' (*Rettai madi*), *viz.*, operation of a single trawl net by two fishing boats was in practice, which was reported as a threat by some of the respondents. The needs as perceived by the respondents were barriers such as seawall and mangrove plantations, permanent solution for the threat from Srilankan Navy, minimum support price for their catches, need for cold storage facilities at fishing harbours, subsidy schemes, frequent dredging operations and waiver of loans.

The study revealed more positive changes in the post-Tsunami scenario in terms of the adoption of technological innovations. Increased fishing pressure and competition forced the fishers to adopt the innovations such as fuel efficient fishing craft, steel trawlers, larger boats, improved fishing gears, large mesh trawls, adequate use of ice and use of electronic instruments. Attitudinal changes were also observed in terms of their innovativeness, economic motivation and readiness to accept the latest innovations in fisheries. It was also felt that regular studies need to be conducted at periodic intervals on fishing pattern, population of fishing craft and gear, operational expenses, fuel consumption, number of fishing trips, catch and income in all the Tsunami affected areas to get a comprehensive picture about the post-Tsunami fisheries scenario. This would help to draft suitable policy interventions and management measures.

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