Socio-economic Issues of Prawn-seed Collection in an Open Riverene Fishery: A Case Study of Prawn-seed Collectors in West Bengal

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2006

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*[**Abstract**: This paper attempts to examine the socio-economic status of prawn seed collectors, who traditionally live on fishing, in open riverene fishery under 24 Parganas district in West Bengal. The study suggests that the prawn seed collectors' households are the most vulnerable segment among the poorest of the poor and live under BPL (Below Poverty Line) category. There is high incidence of illiteracy, unemployment, poverty, negligence of children's health and high family size among the majority of prawn seed collectors' households. Despite the disliking of this occupation, female and adolescent girls, acting as main earners of their households, are compelled to be engaged in prawn seed collection to support their families in addition to their household duties at the cost of hard labour over day and night; high risks and high occupational health hazard; the monthly income of these families is too low to support their families throughout the year and other members of their families have to supplement them with subsidiary sources of income. The study also suggests that the practice of prawn seed collection under open riverene fishery is economically inefficient, ecologically unsustainable and socially unsound.]*

JEL. Classification: Q22, Q01, Q50

Keywords: Open access fishery, Social optimum fishery, Prawn seed collection, Maximum sustainable yield

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INTRODUCTION

Prawn seed collection is a household occupation in most of the families in the riveraine villages of Sundarban in West Bengal. Anyone visiting the sea-facing blocks in the Sundarban delta will find thousands of men, women and children, who are almost under BPL category, wading through the rivers with nets and bowls in hand to catch prawn seeds. Many sad stories are heard about these prawn seed collectors who are mostly women and girls. Some of them met death; some lost their legs or arms, some sustained injuries, viz., fractures of legs and menstrual problems etc. Govt. departments, particularly departments of Fisheries., Environment and Forests, are campaigning against this activity as it demolishes the growth of its prawn, destroys other fish seeds and damages the riverbanks, the flora and bio-diversity. This practice is economically inefficient because the market price of three or four prawn at its full maturity period during peak-seasons, when the price is usually higher in this area, is approximately equal to the collector's price for one thousand units of prawn seed. Such an open access fishing exploitation is economically inefficient, ecologically unsustainable and socially unsound. The various State Govt. departments, especially the Fisheries, Forests and Environment, are aware of these facts. But there is no concerted effort, particularly on the part of the Govt. of West Bengal, for eradication of this practice and help these helpless families by executing poverty alleviation programmes and creating alternative means of livelihood of these families. About 3.5 lakh people (70,000 families) are engaged in the occupation of prawn seed collection of Sundarban area in West Bengal. The majority of the poor families in the riveraine villages have made the

profession as the prime source of income and sustenance. These families are very poor in literacy, health-care and nutrient level. Unemployment, underemployment, lack of opportunity for work and income generation have compelled these poor people to take up the hazardous occupation of prawn seed collection. Almost all members of these poor families from the age group of 6 years to 65 years, especially the female members, are found to be involved in this occupation. Women and girls constitute the major segment of the prawn seed collectors in Sundarban of West Bengal. They wake up early in the morning and finish the household works like sweeping, washing and cleaning utensils, preparing the tiffin, cooking etc. Then, they go to river with little nets, cloths and bowls for prawn seed collection. While the sun crosses the zenith, they come back for food and take rest and again go to the river in the evening. This is their daily routine. The income level is very poor in proportion to the cost of their hard labour, high risks and hazards involved. Still people are engaged in this occupation because the source of employment is easily accessible with simple technology along with little monetory cost without the interference/ permission / administrative control, the high skill requirement and heavy instruments. In the course of this activity in open fishery, the prawn seed collectors not only destroy the growth of its prawn but also annihilate other fish seeds like spawn, damages riverbanks and harm the flora of riversides. This paper attempts to examine the socio-economic status of prawn seed collectors, who traditionally live on fishing, in open riverene fishery under south 24 Parganas districts in West Bengal.

THEORETICAL FRAMEWORK

The over-fishing problem in open-access fishery had been the basis for fishery management action and the reason behind the creation of two leading

international fishery commissions, viz., the International Pacific Salmon Fisheries Commission (1930) and The International Salmon Halibut Commission (1953). A formal theory of fisheries management based on biological parameters was formulated by Schaefer (1954). Presenting the relationship between sustainable yield, population and fishing effort, he postulates that the biomass of an unexploited fish-stock increases at various rates depending on the initial weight, recruitment, and individual growth and mortality rates; catch responds to changes in population and fishing effort. If the objective of management is to maximize the catch, it should regulate fishing effort at such level where it can reap the maximum net addition to the stock. Maintaining effort at such level ensures the protection of stock as well. As effort increases, catch or harvest increases up to its highest level where catch reaches at its maximum sustainable yield (MSY). If the effort level exceeds the level required at its highest level (MSY), this reduces both the equilibrium catch and the population. Thus the biological theory had ultimately led to the espousal of two of the most fundamental objectives of fisheries management, viz., full utilization and conservation.

In the early days of neo-classical school of economists, Marshall articulates a different position regarding river fisheries and sea-fisheries under open fishing exploitation. In river-fisheries, Marshall argues, the extra return to additional application of capital and labour shows a rapid diminution, whereas the law of diminishing returns scarcely applies to sea-fishing [Marshall, 1974 (1890): 138]. He opened a debate on the possible effect to the problems of supply, demand, cost and price of fish in the long run. As the law of diminishing return scarcely applies to sea-fishing, he argues that an increased supply can be produced at lower price after a time sufficiently long to enable the normal action of economic causes to work itself out; the normal price would decrease with an increase in demand. To execute this normal action

fishermen require only trained aptitude, and not any exceptional natural qualities (ibid: 308).

But the above observations of Marshall in The Fisheries Management Theory are diametrically opposed to Adam Smith, a classical economist, particularly when it refers to the long run cost and price of fish. Marshall's forecast of the nature of forces working behind the changes in supply and their effects on long term costs and normal prices were unfounded. Adam Smith argued that it would generally be impossible to supply the great and extended market without employing a quantity of labour greater than in proportion to what had been requisite for supplying the narrow and confined one. With the increase of demand for fish, larger vessels must be employed and more expensive machinery of every kind should be used. The real price of this commodity, therefore, rises with the progress of improvement [Adam Smith, 1937(1776): 51].

In the neo-classical theory of fisheries management, Gordon (1953,1954) pointed out the economic wastes involved in exploiting a fishery under common property system. He suggested the need for limiting effort to maintain optimality in fishery. Scott (1955) put forward Gordon's theory of sole ownership for the effective management of the otherwise over-exploited fishery. The most remarkable and widely discussed treatise on the subject of fisheries management under common property condition came from Christy and Scott (1965). They analyzed the working of the common property system in marine fisheries and found it less than optimum in the long run. They argued that with no restriction on entry in common property system, the fishing effort will continue to increase until there is any true profit to be shared and this, combined with the prevailing natural limits to the productivity (growth) of the stock, will lead to the taking of more fish from the stock and the resulting fall in the sustainable yield from the stock. Consequently, industry's total cost will be rising, given prices and

cost per unit in proportion to the effort and the revenue will be falling with the fall in the sustainable yield. Ultimately these two forces will take the industry to a situation of loss and sometimes even to the extinction of the fishery. The relationship between effort level and total revenue and cost in the common property system in fisheries with no restriction on entry by firms is shown in figure 1.With OD level of effort in the short-run, the industry earns maximum profit GH (DG – DH). This attracts more fishermen in the immediately following period and at OE effort the profit margin (EI – EJ = IJ) is somewhat reduced. But the prevalence of positive net profit still attracts more fishermen and in the long-run, the effort increases to OF, where the industry earns no profit and the total revenue and the total cost are just equal. Beyond the effort level OF the industry takes to a situation of loss, an indication of the extinction of the fisheries.

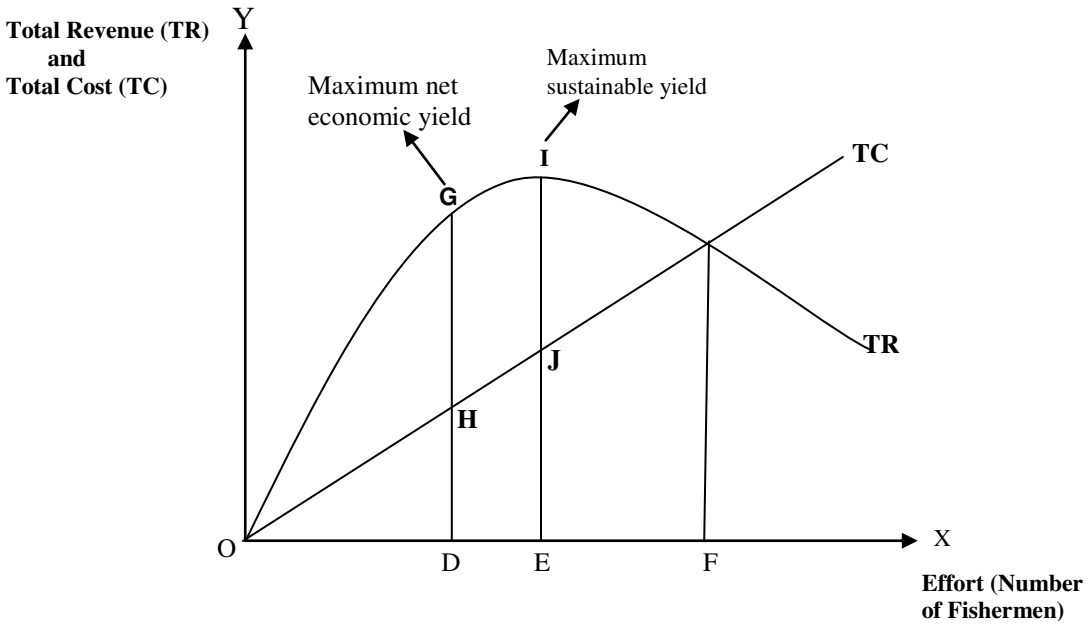

Figure 1: Total revenue, costs and sustainable yield with respect to effort

Christy and Scott also considered the possibility of the industry earning a profit by way of an increase in fish prices and by reduction in costs through

technological improvements. But under common property system with no restriction on effort, none of these changes was considered to be inducing to sustain profits in the long run. If the industry aims at maintaining positive net profit in the long run, they argue, it should abandon the common property system and enforce the private property or sole ownership system which will limit effort at the optimum and maintain maximum net economic revenue. Although the model of fisheries management as propounded by Christy and Scott was criticized by a handful of economists like Smith (1966), Bell (1972) etc, they admitted that these criticisms however do not alter the validity of author's principal conclusion that under conditions of open-access fisheries, the exploitation of the fisheries is economically inefficient.

MARKET MECHANISM

The marketing network of the prawn seeds is totally informal and unorganized in nature. In the marketing tier system (Chart – 1), "Sub agents' collect the prawn seeds from door to door of the prawn seed collectors. They supply the collection to the "Agents" who have collection centres in the villages. The Agents carry the produces to the main markets, viz., Sonakhali of Basanti Block and Ramganga of Patharpratima Block and handover the produce to the "Aratders" having permanent shops in the markets. The dealers collect the prawn seeds from the "Aratders" and supply the same to the "Ultimate users" who use prawn seeds in culture fisheries.

Prawn seed collectors are directly exploited by market middlemen, particularly by the Aratders/Agents .In most of the cases Aratders/Agents take advantage of the poor economic status of the prawn seed collectors and allure them with "Dadan" (advances) during slack seasons to ensure the supply of prawn seeds

throughout the year at a price to be settled by them (Aratders/Agents). Aratders/Agents usually advance to each prawn seed collector within a range from Rs.100 to Rs.300 during lean season. In lieu of this (Dadan) the prawn seed collectors have to sell their collections to the Agents/Aratders who absorb 50% to 60% of the sale's price of prawn seed collectors. In addition to the absorption of major share of sale's price of prawn seed collectors, Agents/Aratders also charge high rate of interest (ranging between 100% and 200% per annum) of the principal the latter lends out to the prawn seed collectors. The "collection" changes several hands before it reaches to the actual users. But, more importantly, the difference between the prices paid by the actual users and the prices received by the prawn seed collectors is never less than 100% of collector's price. For example, during rainy season when the prawn seed collector's price per thousand units of prawn seed usually varies between Rs.250 and Rs.300, the ultimate users 'price (or consumers' price) during this season varies between Rs.500 and Rs.600.These findings, however, suggest that out of different categories of market middlemen, Agents/Aratders enjoy the lion's share of profit appropriated from poor prawn seed collectors in this marketing network.

The practice of prawn seed collection is economically inefficient because the market price of three or four prawns at its full maturity period during peak season of its collection, when the market price becomes usually higher, is approximately equal to the collectors' price of one thousand units of prawn seed. Moreover, while collecting prawn seeds the prawn seed collectors also demolishes many seeds of other fishes by trampling. The plants on the riverbeds get damaged and the riverbanks get eroded by the constant rampage by the collectors. Biodiversities worth several cores of rupees get damaged by the practice of prawn seed collection. The occupational health hazard is very high in prawn seed collection. The collectors walk bare foot on the riverbed while drawing the net. The riverbed is full of broken brick, glass, earthen pots,

metal pieces etc. due to which the prawn seed collectors get injured very often. The high tidal current sometimes breaks the wrists and ribs of the collectors. Many of them have to sacrifice their arms, legs or other limbs by the bites of 'Kamot', and some even meet with fatal accidents .The stormtornado, inundation very often carry them away or capsizes their boats. Apart from all these accidents, the constant exposure to saline water for some hours everyday makes them susceptible to cough and cold, anemia, nausea, TB and kidney trouble. Such open access fishery exploitation is, however, economically inefficient, ecologically unsustainable and socially unsound.

POLICY MODEL

What is the policy prescription capable of overcoming the economic inefficiency, environmental instability and social harvest of open-access fishery under our study? We may present this in a dynamic mathematical model of fishery exploitation where the rate of catch can change through time under two types of fishery —— open-access and socially optimal. It is important, because this model is of help in defining a more realistic social optimal which can be used as a benchmark against which an open-access fishery can be compared and towards which policies to regulate an open-access fishery may be executed. The following assumptions are taken for this model:-

(i) We consider a fishery in which a fixed number of N firms exploit the fish stock.

(ii) All firms are identical .The firm's production functions is a generalized form of Schaefer model. The firm's production function is

$$V(e_i, s) \qquad \text{for } i = 1,2,\ldots\ldots\ldots, N$$

The function **V (.)** is twice continuously differentiable and jointly concave in

e_i (effort) and s (stock).

(iii) The harvest cost functions (since cost functions are identical for all firms)

$$\mathbf{C(e_i)} \qquad \mathbf{for\ i = 1,2,\ldots\ldots\ldots, N}$$

are assumed to be twice continuously differentiable and convex in effort, e_i. In this case effort stands as a proxy for the amount of labour and capital employed in fishing.

(iv) The firm possesses an initial stock of fish so as to maximize profits over a time interval which runs continuously from **t = 0** to **t = ∞** .

(v) We take λ(s) as the logistic growth function such that

$$\lambda(s) = \delta\left(1 - \frac{s}{y}\right) s$$

where **δ** is the intrinsic growth rate of production and $\delta = b_r - m_r$; b_r is the birth rate of population and m_r is the mortality rate and y is the environmental carrying capacity. The growth function is concave as $\delta_s > 0$ and $\delta_{ss} < 0$.

(vi) In the case of open-access fishery, the equilibrium marginal stock valuation is zero (or shadow price of stock is zero)[3] .In the case of socially optimal fishery the equilibrium marginal stock valuation is positive.

(vii) The fishery manager seeks to maximize the present value of the profits of all firms in the industry.

The problem for the fishery is to maximize the present value of the profits of all firms in the industry:

$$\underset{e_i}{\text{Maximize}} \int_0^{\infty} N\,\pi(e_i, s, p)\,\alpha^{-rt}\,dt$$

$$\text{subject to} \quad \dot{s} = \lambda(s) - N\,V(e_i, s) \;;\; s(0) = s_0$$

where **p** is the price per unit and α^{-rt} is discount factor , **r** is discount rate , **π (.)** is the profit function of identical firms, which depends on effort (e_i),stock (**s**) and price (**p**).

The current value Hamiltonian for the problem is

$$H = N[p\,V(e_i,s) - C(e_i)] + \mu\,[\lambda(s) - N\,V(e_i, s)] \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

The first order condition for each identical firm are to choose the level of effort, **e** for all firms so that

$$pV_e - C_e - \mu\,V_e = 0$$

$$(p-\mu)V_e = C_e \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

where the net marginal benefit of effort comprises the marginal benefit of selling fish at the market price less the imputed shadow price of the stock.

Now the equation of motion for the costate variable (Chiang, 1992: 188)is

$$\dot{\mu} = [\,r - \acute{\lambda}(s)\,]\,\mu - (p - \mu)\,N\,V_s \qquad \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

The equilibrium solution of this equation is formed by setting the population (fish) growth rate equal to total harvest $\lambda(s) = N\,V(e, s)$ .In equilibrium the rate of return from the numeraire asset must be equal the rate of return from the fishery

Substituting (2) for μ into (3) and setting $\dot{\mu} = 0$ gives

$$\lambda'(s) + \frac{C_e V_s N}{pV_e - C_e} = r \qquad \ldots\ldots\ldots\ldots\ldots\ldots(4)$$

From (4) the rate of return on holding the marginal unit of stock can be decomposed into two parts: the return from increased stock growth, **λ´(s)** and the return from reduced costs. This implies that the optimal level of stock is greater in the presence of costs than would be the case for zero cost. The shadow price of stock in equilibrium from (3) is

$$\mu = \frac{pV_s N}{r + V_s N - \lambda'(s)} \qquad \text{.....(5)}$$

Equation (5) implies that if other functions [like r, $\lambda'(s)$, Vs, p] remain constant, the shadow price of stock (or the marginal valuation of stock) is invariant with the number of firms (N) operating in the fishery. But usually as N increases, marginal valuation of stock (μ) gradually decreases for the significant decrease of almost all factors and in the limit μ tend to zero as N increases. Thus in the dynamic model of fishery exploitation, equation (4) determines the optimum level of effort which determines maximum benefit in terms of sustainable fish production.

We now consider a case of fishery where a single manager controls the stock and the outcome is identical to sole ownership. Arnason (1990) argues that if a firm is rational, this will include a valuation of the stock; this valuation will vary inversely with the number of firms operating in the industry and is only identical to the socially optimal valuation when there is sole ownership (Hanley *et al.*, 1997: 292).

Then, the firm's problem is to

$$\underset{e}{\text{Maximize}} \int_0^{\infty} \pi (e_i , s , p) \alpha^{-rt} \, dt$$

$$\text{subject to} \quad \dot{s} = \lambda (s) - N V (e_i , s) \quad ; \quad s(0) = s_0$$

Here N is retained in the stock constraint because fish stock define a fishery production function in which the stock term is identical in both production functions - individual firm and industry; that is by depleting the stock, a firm imposes an externality on other firms in the industry (Hanley et. al. 281-2).

The stock constraint includes the fishing effort of all firms .The current value Hamiltonian for the problem is

$$H = N [p\, V (e_i, s) - C (e_i)] + \eta [\lambda (s) - N\, V(e_i, s)] \qquad \text{.....(6)}$$

where **η** represents the valuation of the stock to the individual firm. The first order conditions are

$$(p - \eta)\, V_{e_i} = C_{e_i} \qquad \text{.....(7)}$$

which is identical to (2) with η substituted in place of μ.The costate condition is

$$\dot{\eta} = [\, r - \lambda' (s)\,]\, \eta - (p - \eta)\, N\, V_s \qquad \text{.....(8)}$$

In equilibrium the rate of return for the firm is

$$\lambda' (s) + \frac{C_e V_s N}{p V_e - C_e} = r \qquad \text{.....(9)}$$

and is identical to that for the socially optimal catch; however, the equilibrium marginal stock valuation is different [The marginal valuation of stock in equilibrium is from equation (8) i.e. equation (8) = 0]**:**

$$\eta = \frac{p V_s}{r + V_s N - \lambda' (s)} \qquad \text{.....(10)}$$

The marginal valuation of stock is only equal to the socially optimal valuation when **N =1**, that is **η = μ**, otherwise the marginal valuation of stock in social fishery will be greater than that of in open-access fishery [4]. The implication of this model can be examined for the specific case of identical, symmetrical firms, the Schaeffer function for effort, **V = θes [** where Schaefer assumes that the harvest is proportional to the stock level **(** $\frac{v}{e}$ **=θs)**; i.e., catch per unit of effort is a constant

proportion **θ** of the stock **]** the total cost function **TC =Ce** and a logistic growth function $\lambda(s) = s - 0.01s^2$. One may compare between the stock and the growth under open-access and socially optimal fishery for following arguments:

First, in the case of open-access equilibrium, the marginal valuation of the stock is zero, Then from (7) we have

$$p V_e = C_e$$

i.e., **η =0** (or shadow price of stock is zero).

Considering Schaefer function for effort and cost function we get

$$p \theta s = C$$

If **p = 1, θ =0.**2 and **C=1** the stock is 5 units and the growth function $\lambda(s) = s - 0.01s^2$ has a maximum sustainable yield of 50 units.

Second, in the case of social optimal fishery as the marginal valuation of stock (**η**) is positive, from (7) we have

$$(p - \eta) V_e = C_e$$

Considering Schaefer model for effort and cost function again, we have

$$s = \frac{C}{(p - \eta)\theta}$$

Here, the socially optimal stock is much higher than the open-access stock.. However, the dynamic model of fishery exploitation suggests that the marginal value of stock is zero for open-access fishery where an infinite number of firms have access to the stock; conversely, the marginal valuation of the stock is positive,

when there is sole ownership (and is identical to the social optimal valuation).When a single manager controls the stock and the outcome are identical to sole ownership. However, as the number of firms increases, the equilibrium stock declines towards open-access equilibrium (Figure 2).

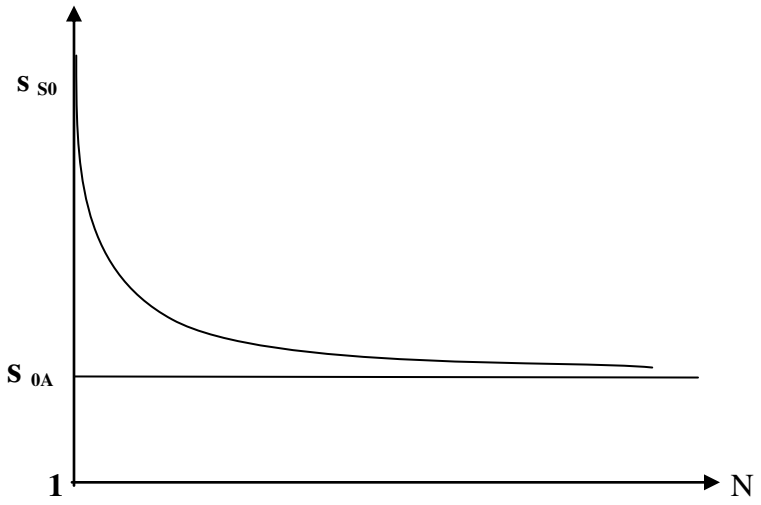

Figure 2 : Equilibrium stock and the number of firms

Two extreme cases are identified, sole ownership stocks s_{S0} and shadow price η_{S0}, and open-access stock s_{oA} and shadow price η_{oA}.Similarly, as the number of firms increases the shadow price of the resource to the firms declines to zero. By definition, in an open-access fishery the marginal value of stock is zero (Figure 3).

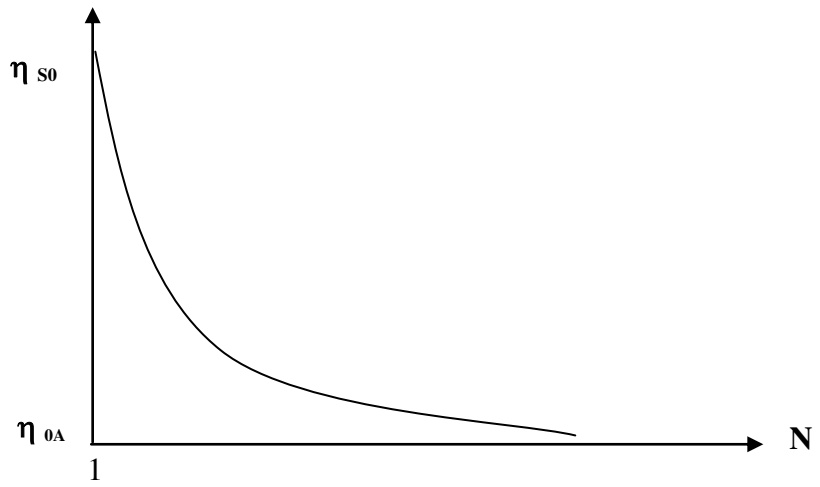

Figure 3 : Equilibrium shadow price against the number of firms

The example indicates the outcome in a fishery with and without a socially optimal policy. The model suggests that the solution moves farther from the socially optimal stock as the number of firms increases. But if the firms take into account the socially optimal value of the stock, the increase in the number of firms is not a problem and the solution is independent of the number of the firms who have access to the fishery.

DATA AND FINDINGS

This paper is based on the data from secondary study conducted by Save the Depressed Children (S.D.C.), an NGO, under CARE, West Bengal, in 2001-2002. To examine the socio-economic status of women prawn seed collectors they took 1,400 sample families of prawn seed collectors from six selected blocks — Patharpratima, Kakdwip, Namkhana, Basanti, Canning-1 and Gosapa, under South 24 Parganas district in West Bengal. Collection of prawn seeds is the primary occupation of these sample households, and women and children are the main earners of these households. All of these sample households were traditional fishermen families. The primary data were

collected by interviewing the members of those families with structured questionnaire, interacting with them and with the experienced persons living in concerned villages.

Literacy rate/ educational level is one of the most important yardsticks for measuring socio-economic level of a society. It is by far the greatest input in the development of any individual adult or child. The role of education in the development of the rural people has been very well stressed by educationists and sociologists. From this point of view, Table 1 shows that the literacy rate of sample women prawn seed collectors is 45% which is poor as compared to female literacy rate at 59.73% in South 24 Parganas district as per 2001 census. It, however, suggests that the target community is very backward in education and literacy. The reasons for poor education level, low literacy rate and high rate of dropout were discussed with the respondents. The major reasons were severe poverty and unemployment/ underemployment of the family members, low level of awareness about the importance of education, sex discrimination, and poor educational infrastructure and transport bottlenecks.

As regards social background of the respondents, out of 1,400 respondents, 48% belong to SC/ST, 18%, Muslim community and remaining 34% belong to other communities. The data of Table 2 indicate that the activity of prawn seed collection is mainly undertaken by households belonging to SC/ST and minority community (about 60% of total households). The involvement of SC/ST households in prawn seed collection alone shares a little less than 50% of total households (48% of the total households) who are the vulnerable segment of the society.

Relating to the household size, Table 3 reveals that 65% of the surveyed families have members between 5 and 8. It might imply that the effect of family planning is not satisfactory in these villages and the awareness level of the families regarding family planning is also very poor. Regarding the study of age composition of

sample households, Table 4 reveals that in the 1,400 surveyed families the members of the prawn seed collectors are 3,682, out of which 1,131 belong to the age group of 6 –14 (30.7%) and 1,418 belong to the age group 15 – 18 (38.5%). This indicates that in most of the families, one or two adolescent girl(s) regularly accompany the senior family members in prawn seed collection. Within the higher age group, women in the age group of 61 and above numbering 62 (1.7%) are observed to engage themselves in prawn seed collection. This result is, however, very miserable in that the major chunk of the women prawn seed collectors belong to the adolescent and children category.

As regards the hours of working in prawn seed collection by the prawn seed collectors it is very difficult to pinpoint the working hours of prawn seed collection, as the duration of work depends on the availability of prawn seeds. However, the data available from the secondary source (Table 5) reveal that the majority of the prawn seed collectors (51%) work untiringly for more than six hours a day for earning their livelihood. The operation mainly depends on the tidal flow. An important feature is that they do not work at a stretch. The duration of work is divided into two shifts. Normally they work three hours in every shift. As regards the hours of work, the children and the adolescent girls are not lagging behind their adult counter-parts. In most of the areas the prawn seed collectors have been found to work even at midnight to maximize their catch. In Jharkhali of Basanti Block, Amlamethi of Gosapa Block, “G”-plot of Patharpratima block or Itkhola of Canning-I Block, the women prawn seed collectors often work at midnight.

The Sundarban is a backward area in the South 24 Parganas district and the southern-most Sundarban Blocks, where the study was conducted, have the lowest level of development. The prawn seed collectors’ community in these blocks is the most vulnerable segment among the poorest of the poor. Almost all the families belong to the BPL (Below Poverty Line) category. As is revealed from data (Table 6),

each of the 27% respondents has earnings between Rs. 100 – 300 per month, 45% earn between Rs. 301 – Rs. 600 per month, 24%, between Rs. 601 – Rs. 1,000 per month. The remaining 4% earn between Rs. 1,001 and above per month. This income has also seasonal variation. The rainy season is the peak season for supply of plenty of prawn seeds in the rivers and estuaries, and the prawn seed collectors usually get the price higher - Rs. 250 to Rs.300 per thousand. But during summer the collectors' price varies between Rs. 150 and Rs. 200 per thousand. From the point of view of flow of prawn seeds the area can be divided into "Core Zone"[1] and "Buffer Zone"[2]. In "Core Zone" the flow of prawn seeds is higher and prawn seed collectors belong to higher income brackets. In G-plot of Patharpratima Block under "Core Zone" each of the prawn seed collector families has earning between Rs. 1,001 and above.

Concerning to the asset- base of prawn seed collectors, Table 7 shows that the most of the prawn seed collectors' families have been found to have very little asset -base. The table indicates that 7% of the surveyed families are landless (squatting on public land), 59% have land between 1 and 6 cottah, 29% have land between 6.1 and up to 1 bigha, 5% of families are having lands 1 bigha and above.

Regarding the occupational structure of prawn seed collectors' households, collection of prawn seeds is the primary occupation of the surveyed families; but it is supplemented by one or more subsidiary occupations like, daily labour, petty business, offshore fishing, cultivation practiced by their family members. An important feature is that the male members of some prawn seed collectors' families have seasonal assignments in cold storage of Hooghly and Burdwan districts of West Bengal. So, seasonal migration for employment is very much prevalent in the families, because prawn seed collection alone cannot provide them with sufficient livelihood throughout the year and they have to supplement this with the earnings from subsidiary sources. According to secondary data Table 8 reveals that apart from prawn seeds collection,

working male members of 52% families opt to work as daily labour. The sectors where they work as daily labour are brick making, construction works and so on. Male members in 24% families are engaged in traditional fishing; in 17% families they are engaged in cultivation and the rest 7% are associated with other jobs and self-employment. More importantly, despite the fishing being the traditional occupation of all prawn seed collectors, only about one-fourth of them take fishing as their primary as well as secondary occupation at present.

Information relating to job satisfaction and type of works preferred by the prawn seed collectors' households, Table 9 shows that 91% of the respondents do not enjoy the job well due to hazards and drudgery, while the rest 9% enjoy it well because it begets liquid cash money, whatever small it may be, without any interference/administrative control.

CONCLUSION

This study, based on 1,400 sample prawn seed collectors in open riverene fishery under North 24 Parganas district in West Bengal, suggests that the prawn seed collectors, who traditionally live on fishing, are the most vulnerable segment among the poorest of the poor and almost all of them belong to BPL category. In these families, women and adolescent girls are the main earners; they have to earn for their families from prawn seed collection, manage their household chores, look after the children and aged members of the families .A large percentage of prawn seed collectors' households belong to SC/ST and minority community. There is high incidence of illiteracy, unemployment, poverty, child labour and high household size among the majority of prawn seed collectors' households. Despite fishing being the traditional occupation of all the prawn seed collectors, only one-fourth of them still take to fishing as

their primary as well as secondary occupation. The monthly money income from the exploitation of prawn seeds is so low that prawn seed collection alone cannot provide them sufficient means of livelihood throughout the year and they have to supplement this with their earnings from subsidiary sources. The market exploitation for prawn seed collectors is also high. Although the overwhelming majority of prawn seed collectors dislike this job, they are compelled to take to this job for supporting their families at the cost of hard labour over day and night, high risk and high occupational health hazards. The study also suggests that the practice of prawn seed collection under open fishery is economically inefficient, ecologically unsustainable and socially unsound. The Environment and Forest Departments have been regularly campaigning for eradication of this practice. The Govt. feels that prawn seed collection is detrimental to the maintenance of the ecological balance and hence they have turned their face from this poor community. But the task of socio-economic empowerment of about 3.5 Lakh people (about 70,000 families), who almost all live under BPL category, cannot be denied. Both Govt. and Non-govt. agencies should make action plan in order to improve the socio-economic status of prawn seed collectors. To this end, the scope of suggested alternative income generating activities like animal husbandry, mushroom cultivation, mulberry cultivation, crab culture, Algae culture, village/cottage industrial activities etc. can be extended for prawn seed collectors along with the introduction and execution of social fishery system. They should arrange training/skill development for the prawn seed collectors in alternative income generating activities feasible in the area. They should also promote the community to approach for the integrated development through the formation of self-help group and development of self-financing or micro-financing system. Together with it, both Govt. and non-govt. agencies should provide support for improvement of literacy, education and health care, which will instill confidence and self-dependence in the community.

NOTES

1. and 2."Core zone" and "Buffer Zone": Technically, from the point of view of concentration/ flow or availability of prawn seeds, the areas may be divided into two zones —— Core & Buffer. The areas, which are in close proximity to the sea and bear the onslaughts of turbulent high tides have high concentration on prawn seeds, are termed as "Core Zone". The other areas have lower concentration and constitute the "Buffer Zone". The catch rate of prawn seeds is much higher in core areas than that of in buffer areas; and hence the average money income of prawn seed collector is higher in "Core Zone".

3. In the case of open-access fishery, a large number of firms is inclined to take into account their own direct costs, but not the cost they impose upon other users of the resource. No value is placed on conserving the resource, because there is no guarantee that an individual firm benefits from showing restraint.

4. The equilibrium in open-access for the firm may be characterized as Nash – Cournot equilibrium where each firm correctly predicts the catch of other firms and then chooses its own optimal level accordingly.

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TABLES

Table 1

EDUCATION STATUS OF THE RESPONDENTS

Level of education	Number of families	%
Illiterate	770	55
Literate	223	16
Classes I - IV	224	16
Classes V-VII	168	12
Classes IX & Above	15	1
TOTAL	**1,400**	**100**

Table 2

CASTE / COMMUNITY STATUS OF THE RESPONDENTS

Caste/ Community	Number of families	%
SC/ST	671	48
Moslim	252	18
Others	477	34
TOTAL	**1,400**	**100**

Table 3

DISTRIBUTION OF RESPONDENTS ACCORDING TO FMILY SIZE

Family size (Members)	Number of families	%
1 – 4	433	31
5 – 8	910	65
9 & Above	57	4
TOTAL	**1,400**	**100**

Table 4

AGE COMPOSITION OF PRAWN SEED COLLECTORS IN 1,400 SURVEYED FAMILIES

Age (Years)	Number of Prawn seed collectors	%
0 – 5	0	0
6 – 14	1,131	30.7
15 –18	1,418	38.5
19 – 60	1,071	29.1
61 & Above	62	1.7
TOTAL	**3,682**	**100**

Table 5

HOURS OF WORKING PRAWN SEED COLLECTION

Daily working hours	Number of families	%
2 – 4	294	21
5 – 6	392	28
More than 6	714	51
TOTAL	**1,400**	**100**

Table 6

DISTRIBUTION OF RESPONDENTS BY THEIR MONTHLY INCOME

Level of income	Number of families	%
100 – 300	378	27
301 – 600	630	45
601 – 1000	334	24
1001 & Above	58	4
TOTAL	**1,400**	**100**

Table 7

DISTRIBUTION OF RESPONDENDENTS BY ASSET- BASE

Land (in cottah)	Number of families	%
Nil	97	7
1 - 6	827	59
6.1 - 9	86	6
From 9.1 upto One Bigha	320	23
One Bigha and above	70	5
TOTAL	**1,400**	**100**

1 cottah = 0.0165 acre; 1 bigha =0.33 acre

Table 8

OCCUPATION STRUCTURE OF THE MALE WORKING MEMBERS OF THE PRAWN SEED COLLECTORS' FAMILIES

Occupation	Number of families	%
Daily Labour	727	52
Fishing	333	24
Cultivation	241	17
Other Jobs/Self - employment	99	7
TOTAL	**1,400**	**100**

Table 9
PERCEPTION ABOUT PRAWN SEED COLLECTION

Nature of Perception(good/bad)	Number of families	%
Good	128	9
Bad	1,272	91
TOTAL	1,400	100

CHART -1

MARKETING TIER SYSTEM