



SOCIAL IMPACT OF SHRIMP CULTIVATION ON WOMEN IN RURAL BANGLADESH: OPINION OF WOMEN OF TWO SELECTED VILLAGES OF BAGERHAT DISTRICT

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Abstract: This article intends to describe the social impact of shrimp cultivation on rural women of Bangladesh based on empirical study. It was found that social relationship has been affected since the commencement of shrimp farming in the study area. Majority of respondents were unable to maintain their previous social status due to shrimp cultivation. Moreover, shrimp cultivation has created various social problems like increase rate of dowry, divorce, male polygamy, crime in the villages, family conflict, problem of girls wedding, conflict, violence etc. Women's life style has changed and they affected greatly due to shrimp cultivation.

Key words: Shrimp cultivation, Social impact, Women, Rural Bangladesh

Introduction

Shrimp farming has become one of the Asia's fastest growing industries (Chang, 1990). More than 85% of world's farmed shrimp is produced in coastal areas of the Asia-Pacific region with Bangladesh being the fifth largest producer in the world (Anon, 2002). Consequently growing shrimp farming industry has posed several negative impacts on the environment and socio-economic condition in many countries including Bangladesh (Deb, 1998; Monzu, 2000; Primavera, 1997). Shrimp culture significantly changed the livelihood pattern in the coastal belt of Bangladesh. A large number of households are pursuing shrimp related activities as a means of their livelihood. Many of them are pursuing under compulsion as saline water is penetrating in and around their cropland. The negative impacts of shrimp farming are exploitation of the poor, increasing landlessness, environmental degradation, violation against women and children, unequal distribution of gains, reduction of access of rural poor to natural resources, and creation of class conflict (Islam, 2000). Shrimp farming has changed the life style of the people of the coastal belt (Azad, 1999). Areas traditionally used by the local community are turning into private property of the businessmen and thus the landless and marginal peasants with their right on resources increasingly shrinking are facing an unbearable situation (Rahman, 1999). Several studies stated the picture of shrimp farming in Bangladesh (Deb, 1998; Islam *et al.*, 2000; Wahab *et al.*, 2000, 2001, 2003; Rouf and Ali, 2005). Present research discusses the social impact of shrimp cultivation on rural women of Bangladesh in terms of social relationship, social security, male polygamy, violence, dowry, divorce, gender discrimination, family conflict etc. in the shrimp farming areas of Bangladesh.

Materials and Methods

The objective of this study was to assess social impact of shrimp cultivation on the status of women in rural Bangladesh. The data were collected in two points of time, i.e., before and after shrimp cultivation

reflecting social status of women. In February, 1998 data were collected regarding the status of women as a part of another study. At that time there was no shrimp cultivation in the study area. After the introduction of shrimp cultivation land has been used by shrimp farming in a greater extent. Again data were collected on same aspects in October, 2007 to assess the changes in the status of women before and after shrimp cultivation through comparison. The study was conducted on 204 women in rural Bangladesh selected purposively from two villages (Baitpur and Pingoria) of Bagerhat district of Bangladesh. It may be mentioned that although majority of the women were same during study before and after shrimp cultivation some new respondents were included after shrimp cultivation study due to loss of some respondents included in before shrimp cultivation study for various reasons. However, the numbers of respondents remain same in two points of time. Among the respondents 88 were engaged in shrimp cultivation activities and the rest 116 were not involved in shrimp cultivation. Data were collected from the respondents through face to face interview using a schedule. In addition secondary data were collected from various writings related to study, official documents, research documents etc. In selecting the sample of the study the households of the respondents of the selected villages were grouped on the basis of land size as landless (0 to 0.49 acres), small (0.50 to 2.49 acres), medium (2.50 to 7.49 acres), and large (7.5 acre and above). The landholdings statuses of the sample were: large farmer (20), medium farmer (49), small farmer (38), and landless farmer (97).

Results

Socio- demographic profile of the respondents: Socio- demographic profile of the respondents are presented in the Table 1 which indicates that among different age groups, most of the respondents (91.2% in 1998 and 84.3% in 2007) belonged to age group 15-45 years, having varying extent of level of education. The study reveals that, highest proportion (50%) of the respondents were in low income level in 2007 which was 42.7 % before the commencement of shrimp cultivation. More than half of the respondents were involved in agriculture before the inception of shrimp cultivation but it was found to decrease after the introduction of shrimp cultivation. Majority (73%) of the respondents had small to medium family in 2007 whereas the percentage was 79.9 in 1998. In 1998 more than 22% respondents were unmarried and half of them were married but in 2007 the rate of married women has increased to 58.8%.

Table 1. Socio- demographic profile of the respondents.

Variables	Measurement	Range	Categories	Respondents (%)	
				After shrimp cultivation (2007)	Before shrimp cultivation(1998)
Age	Years	0- 75	0-15	0	6.37
			15-30	46.57	47.55
			30-45	37.75	37.25
			45+	15.69	8.82
			Mean	=32.86	Mean =29.78
Education	Years of schooling	0-14	Illiterate(0)	17.16	18.14
			Primary(1-5)	20.58	27.94
			Secondary(6-10)	45.1	42.65
			Above secondary (>10)	17.18	11.27
Annual Family Income	Tk.	0-200000	Low (up to25000)	50.0	42.65
			Medium(25001-75000)	27.45	34.80
			High (75001-100000)	9.80	16.67
			Very high (>100000)	12.75	5.88
Occupation	Qualitative	-	Agriculture	32.35	51.47
			Service	23.53	11.27
			Business	18.63	13.71
			Household activities	25.49	23.53
Family size	Number	2-13	Small (2-4)	33.33	44.61
			Medium (5-7)	39.71	35.29
			Large (9 and above)	26.96	20.10

Marital status	Qualitative	-	Unmarried	2.94	22.55
			Married	58.82	50.00
			Divorced	15.20	9.31
			Separated	11.76	7.35
			Widow	11.27	10.78

Social relationship: The social relationships at family and community bonds have become vulnerable after introduction of shrimp cultivation in the study area. The nature of social interaction process is presented in Table 2. Before the introduction of shrimp cultivation most; (71.6%) respondents maintained the balanced relationship within family and outside the family (87.3%). The balanced relation was maintained by those who are satisfied to maintain their interpersonal communication by reciprocity of material goods and interpersonal conversation. And imbalanced relation was maintained by the groups who are not satisfied in this regard. With the introduction of shrimp cultivation, balanced relationship was broken down within family (69.6%) and among relatives and communities (52.9%) and 28.4% and 12.8% before shrimp cultivation respectively.

Table 2. The nature of social relations before and after shrimp cultivation (%).

Social relationship	Interpersonal relationship			
	Within family		Among relatives & communities	
	After shrimp cultivation	Before Shrimp cultivation	After shrimp cultivation	Before Shrimp cultivation
Balanced	30.39	71.57	47.06	12.75
Imbalanced	69.61	28.43	52.94	87.25
Total	100.0	100.0	100.0	100.0

Social security: Social security was measured considering respondent's income, occupation and access to go outside their home. Five response categories considered in this regard were strongly approve, undecided, disapprove, and strongly disapprove, findings show that shrimp cultivation also affects social security of women in the study area.

Table 3 indicates that 78.35% landless, 73.68% small farmers feel more insecure than 25% large and 36.73% medium farmers.

Social security Whether lost	Landholding Category of respondents								Total
	Large farmer		Medium farmer		Small farmer		Landless		
	No.	%	No.	%	No.	%	No.	%	
Yes	5	25.0	18	36.73	28	73.68	76	78.35	127
No	13	65.0	26	53.06	7	18.42	16	16.49	62
No response	2	10.0	5	10.20	3	7.89	5	5.15	15
Total	20	100.0	49	100.0	38	100.0	97	100.0	204

$\chi^2 = 62.97$; $p < 0.05$.

Table 4. Causes of losing security of women in shrimp cultivation area (multiple response).

Causes	No.	(%)
Financial problem	104	81.89
Abuse from <i>gher</i> owner	37	29.13
Unfavorable working environment	28	22.05
Teasing by <i>gher</i> workers	30	23.62
Non co-operation of <i>gher</i> owners	12	9.45
Destruction of trees hampers free movement of women in house	62	48.82
Total	273 (N=127)	

Table 4 shows that 81.9% respondents informed that poor financial condition was the main cause of their insecurity. Poor women are frequently harassed by *gher* owners. While work in shrimp *gher*, the male *gher* workers often tease female workers. For these reasons social security of the respondents has also decreased as reported by 23.6% respondents. In the study area, respondents commonly use materials supplied by trees to maintain boundary and religious restriction of their house. But due to shrimp cultivation the intrusion of salinity degrades the status of trees. So women cannot move easily in their home. About 49% respondents mentioned about the destruction of trees. When they use to walk outside their home young women are also teased by *gher* workers (most of them are outsider of their villages) as a sex object.

Respondents' opinion about impact of shrimp cultivation on some social events:

Table 5. Whether the proportion of social events have increased due to shrimp cultivation.

Social events	Increased	No.	(%)
Dowry	Yes	134	65.69
	No	70	34.31
Divorce	Yes	168	82.35
	No	36	17.65
Male polygamy	Yes	158	77.45
	No	46	22.55
Problems in girls' wedding	Yes	152	74.51
	No	52	25.49
Violence	Yes	185	90.69
	No	19	9.31

More than 65% respondents said that shrimp cultivation caused the increasing demand of dowry and dowry money. According to 82.4% respondents the incidence of divorce has increased due to introduction of shrimp cultivation in the locality. It is noticed that the tendency of polygamy among the males has increased in the survey area. About 77.5% respondents opined this. More than 90% respondents informed that, different kinds of violence have emerged due to shrimp cultivation.

Causes of increased dowry: Table 6 indicates multi- various reasons of increasing dowry rate due to shrimp cultivation.

Table 6. Causes of increasing demand of dowry in the shrimp farming area (multiple response).

Reasons	No.	(%)
Salinity intrusion	114	85.07
Poor road communication	53	39.55
Increased financial power of bride's family	24	17.91
Illiteracy	38	28.36
Demand of money by the groom to cultivate shrimp	21	15.67
Total	250 (N=134)	

More than 85% of the respondents mentioned problem of salinity as cause of increased dowry. They said that saline water affects girl's body color and due to black color grooms demand unreasonable amount of money as dowry. More than 39% women mentioned that poor road communication is another cause of demands for dowry. Increased financial power of bride's family due to shrimp cultivation is also a cause for increasing dowry rate which was mentioned by 17.9% respondents.

Causes of increased divorce:

Table 7. Causes of increasing incidence of divorce in the shrimp farming area (multiple response).

Causes	No.	(%)
Increased financial power of male	81	48.21
Scarcity of money	36	21.43
Family conflict	108	64.29
Housewives involved in shrimp cultivation	27	16.07
Poverty	22	13.10
Conflict due to shrimp cultivation	10	5.95
Total	284 (N=168)	

The causes of increasing divorce rate are also mentioned by respondents which are shown in the Table 7. About 48.2% respondents informed that due to shrimp cultivation, the male members of households are able to earn more money and marry to others. As a result of male polygamy divorce rate has increased. More than 64% women mentioned family conflict that arose due to shrimp cultivation. The main income sources of women in the study area were livestock and poultry rearing, trees and paddy cultivation. But the status of these sources has degraded after commencement of shrimp cultivation. About 21% respondents argued that the scarcity of money degrades the status of women and they have no say about their family decision.

Causes of increased male polygamy: Respondents stated that the tendency of polygamy among the males has increased in the survey area due to shrimp cultivation. Table 8 shows the reasons for increasing male polygamy in the study area.

Table 8. Causes of increasing incidence of polygamy in the shrimp cultivation area (multiple response).

Causes	No.	(%)
Increased financial power of male	96	60.76
Increased household activities	30	18.99
Increased Family conflict	28	17.72
Demand of money to cultivate shrimp	19	12.03
Increased social power of male	67	42.41
Total	278 (N= 158)	

Table 8 indicates 60.8% respondents opined that increased income of male from shrimp *ghers* was the key factor behind the increased rate of polygamy. More than 12% respondents mentioned this reason. About 18% women informed about higher rate of family conflict due to shrimp cultivation.

Causes of problems in girls' wedding: Respondents mentioned about the problem in organizing their daughters' marriage due to shrimp cultivation. The causes for the problem of arranged marriage is presented in the Table 9.

Table 9. Causes of problem in arranging marriage of daughter in the shrimp cultivation area (multiple response).

Causes	No.	(%)
Financial problem	128	84.21
Disturbances by <i>gher</i> owner and <i>gher</i> workers	72	47.37
Salinity	65	42.76
Poor road communication	53	34.87
Total	342 (N= 152)	

Table 9 represents that 84.2% women identified problem of money as the important cause of problem in arranging daughters' marriage. More than 15% respondents mentioned about increasing incidence of terrorism due to shrimp cultivation, which is the cause of such situation. Problem of salinity and disturbance by *gher* owners are also causes of problems in conducting arranged marriage.

Causes of increased violence: From the Table 5 it is identified that in the study area criminal activities also increased due to shrimp cultivation. *Momena*, a housewife of the village *Pingoria* mentioned that, 'Before the introduction of shrimp cultivation the villagers hardly face any criminal activities but soon after the commencement of shrimp cultivation such incidence occurs now.' Table 10 has a detailed breakdown of criminal activities, which have increased due to shrimp cultivation. Among the cases theft, looting, robbery and kidnapping are much more prevalent.

Table 10. Different kinds of violence increased due to shrimp cultivation (multiple response).

Causes	No.	(%)
Theft	118	63.78
Robbery	12	6.49
Kidnap	18	9.73
Rape	5	2.70
Terrorism	24	12.97
Murder	3	1.62
Looting	46	24.86
Total	226 (N= 185)	

Table 11. Types of problems facing by the respondents in the shrimp farming area (multiple response).

Problems	No.	(%)
Out-side insecurity	122	65.95
Teasing by <i>gher</i> workers in shrimp <i>gher</i>	26	14.05
Harassment by the criminals	24	12.97
Stilling from households in absence of respondents	76	41.08
Involvement of children in criminal activities	28	15.14
Demands of money by husband at regular interval	7	3.78
Oppression by the criminals	43	23.24
Others	27	14.59
Total	353 (N= 185)	

Table 11 indicates that 66% respondents face problem of insecurity while going out side home due to fear for criminal activity. More than 23% women argued that the criminals often oppress them. About 15% women informed about the involvement of their children in criminal activities.

Table12. Percentage distribution of respondents who are teased by shrimp related people.

Teasing	Number & percentage									
	Large farmer		Medium farmer		Small farmer		Landless		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Affected	0	0	15	30.61	17	44.74	52	53.61	84	41.18
Non affected	20	100	34	69.39	21	55.26	45	46.39	120	58.82
Total	20	100.0	49	100.0	38	100.0	97	100.0	204	100.0

$\chi^2 = 27.12$; $p < 0.05$.

The difference in teasing among the land holding category is tested by chi-square at 5% level of significance. Here the calculated value of chi-square is 27.12, which is greater than the tabulated value (9.49). Therefore null hypothesis is rejected. The null hypothesis of chi-square was there is no relationship between harassment of women by shrimp cultivation related people and landholding category of respondents. But especially poor women are much more affected by this incident.

Discussion

The southwestern parts of Bangladesh mainly Satkhira, Khulna and Bagherhat suffer serious land degradation due to salinity. Shrimp culture has become the major business of these areas instead of crop cultivation. On the other hand, the modern infrastructural development and implication of various technologies also touches the rural people and lead to modification of agricultural patterns. As a result, the socio- economic conditions of these people have been modified and gradually leading to a change in their lifestyle (Khan *et al.*, 2006). In the study area the highest number of respondents was within the age group 15-30. The respondents of this age group face great problem as a sex object. Occupation is one of the determinants of one's social status. After the introduction of shrimp cultivation involvement of landless women in agriculture has decreased. More women were rendered their services as housewives which is unpaid job. This situation denotes the lower status of women. Education is the most important factor determining consciousness of rural women about impact of shrimp cultivation. But many of the respondents are illiterate and in class I-V. The effect of shrimp cultivation on rural women varies depending on marital status. Generally unmarried women face the problem of wedding, teasing by the *gher* people, educational problem and many other serious problems due to shrimp cultivation. Divorced and separated women fall in greater problem due to shrimp cultivation. They are the vulnerable group. They face economic, political, socio-cultural and many other problems. Family type is an important factor related to impact of shrimp cultivation on rural women. Nuclear family faces great problem being divided by cultivable land. They can not cultivate paddy in order to fragmentation of land. So they are forced to provide small pieces of land to the shrimp cultivators.

Azad (1999), observed that the worst suffers of unplanned shrimp cultivation worsely affects the lower class families and marginal farmers of the cultivation belt. Present study indicates that shrimp cultivation affects the social relationship (including both interpersonal relationship within the family and among relatives and communities) of the respondents. The relationship among the villagers has also been disintegrated due to shrimp cultivation. As the *gher* owners harass the villagers in most cases the relationship between these two groups is not so good.

Azad (1999), observed woman's fear of insecurity especially the women of poor and vulnerable groups. They have lost their social status for the same reason. In the study area it is observed that poor farmers face more problem of social insecurity than rich farmers. The reason is that women of these categories were used to ask for livelihood when they face insecurity by the workers and owners of shrimp *gher* (local name of shrimp cultivation area). From the Table 3 it is noticed that calculated value of chi-square is 62.97, which is greater than the tabulated value (9.49) at 5% level of significance. Therefore null hypothesis is rejected. Null hypothesis of chi-square was 'there is no significant relationship between social security and category of respondents due to shrimp cultivation'. In the study area, respondents commonly use materials supplied by trees to maintain security of their house. But with the

introduction of shrimp cultivation tree has destroyed and decreased due to salinity and stagnant water over garden. As a result women face *pardah* related problems.

Respondents reported that saline water affects girls' beauties and it creates problem for girls' wedding. So the grooms want unreasonable amount of money as dowry. As shrimp cultivation is profitable, naturally the grooms want money from bride's fathers especially from those who are shrimp cultivators. It is a great problem for bride's wedding. In the study area the *gher* workers face more problem of divorce. Because shrimp *gher* workers, represent the lower status in the society. *Panna*, a divorced woman of the village *Baitpur* informed that, "I was compelled to leave husband's house due to disturbance of workers of shrimp *gher*." Farmers need higher capital to operate shrimp *gher* in comparison to paddy cultivation. In many cases, dowry is the way to collect money. So the male are influenced to practice polygamy. Problem of money is the important cause of problem of arranged marriage for daughter. In general, the village people face financial problems. With the introduction of shrimp cultivation these problems have aggravated by destructing trees and to limit the access of poultry rearing facilities.

Shrimp cultivation in the area not only caused environmental degradation but also increased social tensions involving lands depute, quarrels over the theft of shrimps and violation of women by outside laborers engaged in shrimp farming (Rahman, 1999). Monzu (2000), argued that the violence against the women are reported mainly rape, kidnap, torture etc. He showed how women's time-use pattern has changed due to the introduction of shrimp culture. He pointed out two qualitative variables. Firstly, moral degradation and lack of responsibilities of the man and secondly, increase of social authority of the fry and shrimp traders, which increase in authority is much more women apathetic than before. In his study Monzu (2000), emphasized that organized and effective leadership can improve the situation of women in the community. Survey in the study area reveals that there are some general and special aspects in the background of violence against women. In the prevailing system any objection to the exploitation placed upon women cause oppression. Not only women are exploited as laborers, women themselves are considered as 'enjoyable commodities'. It has become a general characteristic of the powerful peoples of the patriarchal society to be the owners of this commodity and to occupy it. Terrorism is another problem. Social terrorism ends in violence on women. Multiple reasons are responsible for violence of women regarding this specific issue. When the external *gher*-owners occupied *gher* by force then different forms of violence against women e.g. rape, kidnap and torture became common. The open violence against women has decreased because different classes of people are now engaging themselves in shrimp cultivation. But the extent of violence not reduced. As the reasons there are two qualitative variables. Firstly, moral degradation and lack of responsibilities of the man and secondly, increase of social authority of shrimp cultivators. To explain the first variable, the women in the study area have discussed that, in shrimp cultivation area addiction to wine, gambling and its related problems has increased. In the past women received protection from the traditional ethics. Now they do not have this protection. This is evident through the extreme increase of dowry rate. Apart from this, number of divorced women and women-headed families are increasing. The second variable is social authority. Women said that *gher* owners possess the authority of rural arbitration. They are against women by nature. They do not show any proper justice to women. Rather their workers, *gher*-guards are the main culprits of violence against women. Table 12 shows that there is a variation of teasing and it is the women of landless poor and small farmer households who fear much more than those women of large and medium framers. The control of shrimp cultivation by outsiders has broken the traditional safety prevailing in the locality. Outsiders have no obligation to the local people particularly the local poor women which go together with kinship, patronage and various forms of social networking. They are dominated by male person of their family and by shrimp cultivation related people.

Conclusion

Shrimp cultivation has its negative effect upon rural people. Especially, rural women are badly affected by this. From the study it is observed that social relationship within family and among relatives and

communities was maintained in balanced way before the inception of shrimp cultivation. But respondents were found unable to maintain their previous social relation due to shrimp cultivation. Moreover shrimp cultivation creates various social problems like increase of dowry money, divorce, male polygamy, crimes in the villages, family conflict, problem of girls' wedding, violence etc. Respondents who work in shrimp *gher* face the problems like insecurity, harassment, sexual abuse in their working place. So women's livelihood has been worsely affected in rural society due to shrimp cultivation. As shrimp cultivation is a profitable business and earn a lot of foreign currency, Bangladesh would face great problem if farmers do not cultivate shrimp. On the other hand, especially poor rural women have been facing great problem due to shrimp cultivation. So the study will be helpful to inform GOs, NGOs and the general people of our country about the fearfulness and harmful social impact of shrimp cultivation on the status of women in rural areas of Bangladesh and formulation of proper policy thereby to reduce these problems.

References

- Anon. 1994. *Statistical Yearbook of Bangladesh*. Bangladesh Bureau of Statistics, Ministry of planning, Dhaka, Bangladesh.
- Anon. 2002. *FAO Yearbook of Fishery Statistics*. Aquaculture production, Vol. 90/2. Food and Agricultural Organization of the United Nations, Rome, Italy.
- Azad, D. 1999. The other side of shrimp cultivation. *The Observer Magazine*, Dhaka, July 16, p. 3.
- Chang, K.C. 1990. Asian shrimp aquaculture at cross-roads. *INFOFISH International*, 5/90: 40-47. In: Muthuwan, V., Nutrient budget and water quality in intensive marine shrimp culture ponds. August 1991, M.Sc. Thesis, Asian Institute of Technology, Bangkok.
- Deb, A. K. 1998. Fake blue revolution: environmental and socio-economic impacts of shrimp culture in the coastal areas of Bangladesh. *Ocean and Coastal Management*, 41: 63-68.
- Islam, M.S.; Sarker, M.J.; Yamamoto, T.; Wahab, M.A. and Tanaka, M. 2004. Water and sediment quality, partial mass budget and effluent N loading in coastal brackishwater shrimp farms in Bangladesh. *Marine Pollution Bulletin*, 48: 471-485.
- Islam, Q. 2000. *Bangladesh State of Environment Report 2000*. Forum of Environmental Journalists of Bangladesh, Dhaka, Bangladesh 45 pp.
- Khan, S.A.K.U.; Haider, M.M.; Islam, A.K.M.K. and Ahmed, M. 2006. Impact of infrastructural development and shrimp culture on traditional agro-based rural house pattern in the southwestern regions of Bangladesh. *South Asian Journal of Agriculture*, 1 (2): 64-71.
- Likert, R. 1932. A Technique for the measurement of Attitudes. *Archives of Psychology*, No. 140; G. Murphy and Likert, Public Opinion and the Individual, Harper, Newyork, 1937.
- Monzu, T. H. 2000. Commercial Shrimp: Environment, Gender and Socio-Economic Changes. OXFAM (GB), Dhaka, Bangladesh, pp. 23-35.
- Primavera, J.H. 1997. *Socio- economic impact of shrimp culture*. South- east Asian Fisheries Development Centre, Iloilo, Philipines, pp. 815-827.
- Rahman, A. 1990. *Environmental Impact of Shrimp Culture in Bangladesh*. BIDS, Dhaka, pp. 1-28.
- Rahman, A. 1999. Shrimp : a field day report. *The Bangladesh Observer*, Dhaka, November, 7, p. 7.
- Rouf, M.A. and Ali, M.S. 2005. Shrimp (*Penaeus monodon*, Fabricius) culture in Satkhira coastal area of Bangladesh. *Journal of Subtropical Agricultural Research Development*, 3(2): 75-79.
- Wahab, M.A.; Bergheim, A. and Braaten, B. 2003. Water quality and partial mass budget in extensive shrimp ponds in Bangladesh. *Aquaculture*, 218: 413-423.
- Wahab, M.A.; Bergheim, A.; Braaten, B.; Islam, M.S. and Rahman, M.M. 2001. Observation on some of the environmental parameters of selected shrimp farms in Khulna, Bangladesh. *Bangladesh Journal of Fisheries Research*, 5(1): 75-84.
- Wahab, M.A.; Braaten, B. and Bergheim, A. 2000. Water quality in extensive and semi-extensive shrimp ponds in Bangladesh. Third Aquaculture Millenium Conference, 20-25 Feb. 2000, Bankok, Thailand, 7 pp.