Khulna University Studies **Volume 17(1 & 2): 89-104: 2020**

SOCIAL SCIENCE

RESPONSE TO EXTREME CLIMATIC EVENT: A CASE STUDY OF COASTAL COMMUNITY FROM SOUTHEAST BANGLADESH

Afsana Polly*, Sanjoy Kumar Chanda and Tuhin Roy

Sociology Discipline, Khulna University, Khulna 9208, Bangladesh

KUS: 20/07: 23082020

Manuscript submitted: July 20, 2020 Accepted: March 18, 2021

Abstract: This study focused on analyzing the coping strategies[1] of the Aila affected community as response to the cyclone and the impact of it. One hundred and forty-eight household head of Jaliakhali Village of Dacope Upazila in Khulna District were interviewed by administering an interview schedule. The finding of the study revealed that the initial impacts are loss of income, educational disruption, and increase in rate of early marriage, contamination of water and spread of waterborne diseases. Various coping strategies of the households were adopted to mitigate the adverse impacts of Cyclone Aila. Significant portions (67.6 percent) of the respondents were involved in the agriculture before Aila while after Aila the portion was only 37.2 percent. The respondents adopted occupational shifting as a coping strategy. Moreover, around half of the children from the affected households continued to study at home instead of attending school. Planting deep rooted species, afforestation along the coastal belt and plantation in highlands were the indigenous strategies to recover the loss of forest. As health recovering strategies, they changed their water source and started to maintain more hygiene. Raising pond embankment, pond fencing by net, changing species and salinity tolerant species were the strategies to recover the loss of fish. Finally, the present study concluded by identifying the affected household and recommended different risk reduction to mitigate the impacts of cyclone Aila.

Keywords: Income Loss Recovery, Occupational Shifting, Coping Strategy, Agriculture, Cyclone Aila

Introduction

Disaster is a recurrent phenomenon in Bangladesh. The populations of southwestern Bangladesh are vulnerable to specific hazards such as coastal flooding, cyclones and tsunami, among which cyclone and induced surges are the most frequent (Blaikie, Cannon, Davis & Wisner, 2004). More than 70 million people of Bangladesh could be affected by cyclones due to its geographic location, low altitude, poor infrastructure, high population density and acute poverty (UNDP, 2007). The frequent climate change is associated with huge loss of lives, livelihoods and properties (Braun and Birner, 2016). According to 2011 Climate Change Vulnerability Index, Bangladesh is at the top in the list of 170 countries vulnerable to the adverse impacts of climate change (Maplecroft, 2011).

Bangladesh was devastated various times by disasters e.g. Nargis, Rashmi, Bijli, cyclone Sidr and Aila. Some specific areas of the country are much more vulnerable, mainly southwest Bangladesh

*Corresponding Author: <afsanasoc@ku.ac.bd>

1. A series of action or efforts taken by individual in an unpleasant situation to tolerate, reduce or minimize the stress.

DOI: https://doi.org/10.53808/KUS.2020.17.1and2.2007-S

(Hossen, Ahmed & Abedien, 2009). The impacts of climatic events are exposed in the form of irregular rainfalls, increased number of floods, cyclones, droughts and prevalence of rough weather in the Bay (Government of Bangladesh, 2010). The people of this area lose their lives and livelihoods disproportionately due to the tropical cyclones. However, they strive to return to their normal life following any extreme climatic event[2]. The cyclone Aila hit the south-western part of Bangladesh on May 2009 that resulted in 325 deaths and widespread loss of the residence, homesteads, road and embankment (Jahan, 2012). The tidal surge washed away a huge number of houses, livestock, crops and other livelihood resources of the affected region and outnumber of people were killed and injured (Ahmed, Neelormi & Alam, 2009).About 3.9 million people were affected and huge crops lands were destroyed. In these areas, activities of the people are fishing, agriculture, shrimp farming, salt farming and tourism (United Nations, 2010). Vulnerability reaches its most in case of women, children and disabled people since the only earning members of their families either died or migrated to other places to manage their livelihood. Therefore, the severity of *Aila* has left all its impact and affected a large number of populations severely (Jahan, 2012).

People of a cyclone affected area adopt different actions to minimize the loss. The ability of communities to cope in climatic events is determined by the ability to act collectively (Braun and Birner, 2016). The coping strategies of individual and households differ based on the extent to be affected. The household scale has been a focus of study across a range of fields, including poverty reduction, hazard management (Cutter *et al.* 2008), human resilience, and more recently, climate change adaptation (Barr et al. 2014). In case of extreme climatic events, the external agencies such as GOs and NGOs response at slowly while households have been found to adopt coping strategies by themselves quickly (Alam, 2017). Several studies have been conducted during last few years on various issues of natural disasters but still there is little concentration on local knowledge and action thataffect the coping behavior. Response to extreme climatic event is an important part to address the impact. The affected people search new strategies to cope with the changed environment. Low meal taking, early marriage, late start of education and dropout, migration and so on are taken into consideration as coping strategies (Howlader, Roy and Islam, 2011).

The people of disaster affected area have adopted some strategies to cope with the situation. Government of Bangladesh along with different national as well as international NGOs has also taken many strategies to reduce the risks and vulnerabilities. The government is providing safe drinking water, reconstructing the embankment of this area, making the people aware about primary treatment in those areas (Sarwar, 2005). Coping and recovery strategies based on indigenous strategies have been found more substantial in use than the external assistance.

The current study attempts to find out the coping strategies of people considering the extent of impact of the cyclone in the affected regionto formulate an effective program of action by the decision makers. Migration, awareness raising, occupational shifting, planting salinity tolerant trees, dike plantation were found as the recommendations in the study.

Materials and Methods

The study was conducted following survey research design and was carried out in Jaliakhali Village of Dacope Upazila in Khulna District of Southwest Bangladesh. About 265 households live in Jaliakhali village with a population of 770 (Kamarkhola Union Parishad, 2016). But the specific criteria for selection of respondents were: they must be the head of the household, must be affected by cyclone Aila and must live in the study area for more or equal to five years. Following the mentioned criteria, a total population of 240 household heads was identified through conducting household census.

[2.] Occurrence of a weather event that is above the normal and breaks the recorded weather history (e.g. flood or extreme rainfall)

Finally, 148 respondents were selected from 240 households by using systematic random sampling from the inventory list after completion of household census. Considering a 95 percent confidence level, the samples were calculatedly selected (Survey system, 2012).

A semi-structured interview schedule containing both open and close ended questions was used to collect the data from May to July, 2016 focusing on questions regarding socio-demographic and economic condition, impact of cyclone on lives and coping strategies taken by the respondents as response to the situation. The interview schedule in English was used to collect the data but during data collection the questions were translated into Bengali. Primary data were collected by the investigator for conducting the research through face-to-face interview. Data were analyzed and interpreted through descriptive as well as inferential statistical techniques.

Results

Socio-demographic Profile of the Respondents: Table 1 represents the socio-demographic profile of the respondents and shows that majority (37.2%) of the respondents belong to the age category of 31-40 years, followed by the age group of 41-50 years (30.4%) whereas 23.6% were in the age category of 20-30 and only 8.8% were found between the age group of 51-60 years. Male respondents were 88.5% and the rest (11.5%) were female. Majorities (95.3%) of the respondents were married and only 2.7% were unmarried where 2.0%respondents were divorced. The findings in the Table also revealed the religion of the respondents where 95.3% of the respondents were Hindu and only 4.7% were Muslims. The family pattern of the respondents showed majority (83.8%) of the respondents were from extended family, 16.2% were of nuclear family. Between 8 and 12 number of family member are majority (70.9%) and 36.5%respondents had family member ranging between 5 and 7 and the rest (5.4%) had 2 to 4 family members. Average number of family member was 8. Majority (81.8%) of them had educational qualification of Secondary category; only 14.2% had higher secondary education whereas 4.0% had primary education.

Table 1. Socio-demographic Profile of the Respondents

Demographic Variables	Categories	Number	Percentage
Age	20-30	35	23.6
	31-40	55	37.2
	41-50	45	30.4
	51-60	13	8.8
	Total	148	100
	Average age: 39 Standard Deviation: 8.82271		
Gender	Male	131	88.5
	Female	17	11.5
	Total	148	100
Marital Status	Married	141	95.3
	Unmarried	4	2.7
	Divorced	3	2.0
	Total	148	100
Religion	Hinduism	141	95.3
	Islam	7	4.7
	Total	148	100
Family patterns	Extended	124	83.8
	Nuclear	24	16.2
	Total	148	100

Member of households	8-13	86	58.1
	5-7	54	36.5
	2-4	8	5.4
	Total	148	100
	Average member: 8	Standard Deviation: 2.14239	
Educational Status	Primary (1-5)	6	4.0
	Secondary (6-10)	121	81.8
	Higher secondary (11-12)	21	14.2
	Total	148	100

Residential Pattern: Data in the figure 1 explored that majority of the respondents (62.2%) lived in own house, 18.9% of the respondents lived in relatives house, 8.1% live in room on embankments and only 3.7% lived in the shelter house for long. The data in the figure 2 pointed up the maximum respondents (70.3%) lived in semi-pacca house, 15.5% live in the pacca house and the rest (14.2%) had kacha house to live in.

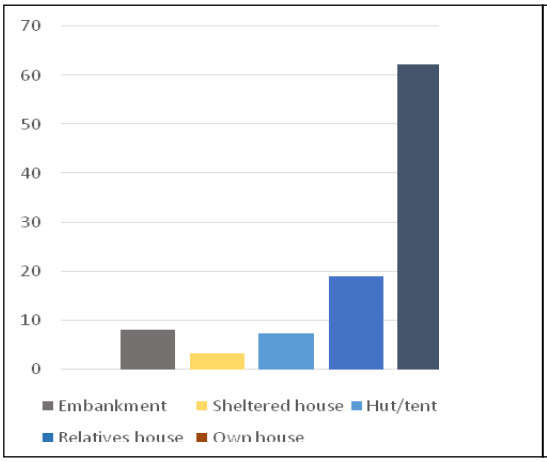

Figure 1. Living Place

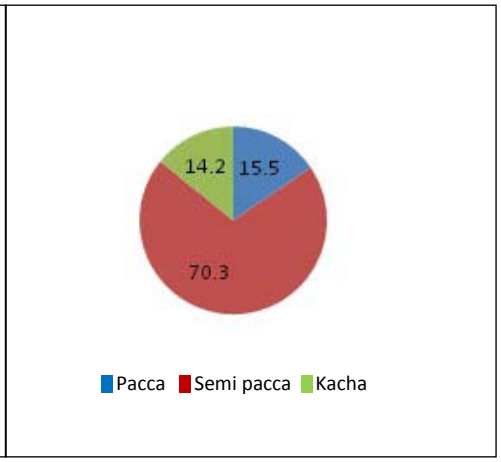

Figure 2. Pattern of Present House

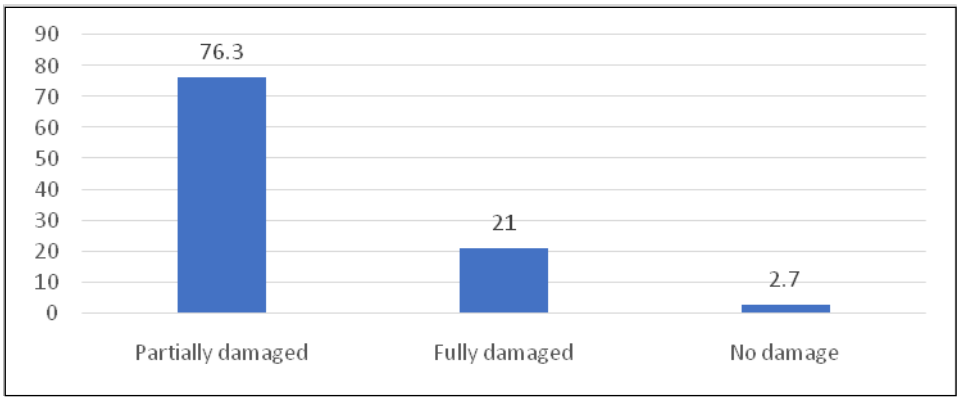

Figure 3. Measurement of Residential Damage

Data in the figure 3 showed that most of the respondent's experience destruction of house and among them, majority (76.3%) experience damage of house partially, other 21.0% had fully damaged and the rest had no damage in their house.

The findings in the Figure 4 revealed that majority of the respondents received aid money to repair house. Among them, majority (87.7%) got aid of 1000-2000 taka, 8.5% got aid of 2001-3000 and 3.8% got between 3001-5000.

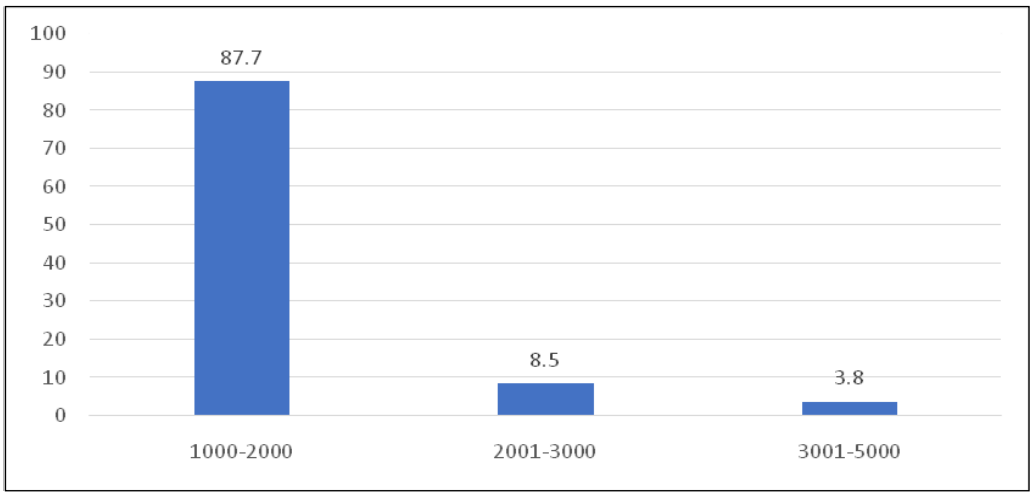

Figure 4. Amount of Financial Aid for Reconstruction of Residential house

The findings in the table 2 reveal that majority of the respondents (53.3%) borrowed money from their relatives when the aid is not enough to adapt disaster situation. Moreover 20.0% respondents got support from their relatives, 19.0% sold their lands to repair their house and the rest (7.6%) took others way to repair their house.

Table 2. Indigenous House Reconstruction Strategies

Indigenous House Reconstruction Strategies	Number	Percentage
Support from relatives	21	20.0
Borrowing from moneylenders	56	53.3
Selling land	20	19.0
Others	8	7.6
Total	105	100.0

Occupational Distribution and Income Loss Recovery Strategies: Data presented in the figure 5 showed the monthly income of the respondents before and after cyclone Aila where majority (48.6%) of the respondents' monthly income ranged at 6001-9000, 34.5% were in category of 9001-12000 and only 8.1% were in category of 3000-6000. But after Aila majority (43.9%) of the respondents was in category of 3000-6000, 39.2% were in 6001-9000 and no one was in range of 12000-15000. There was a negative change in income of the respondents.

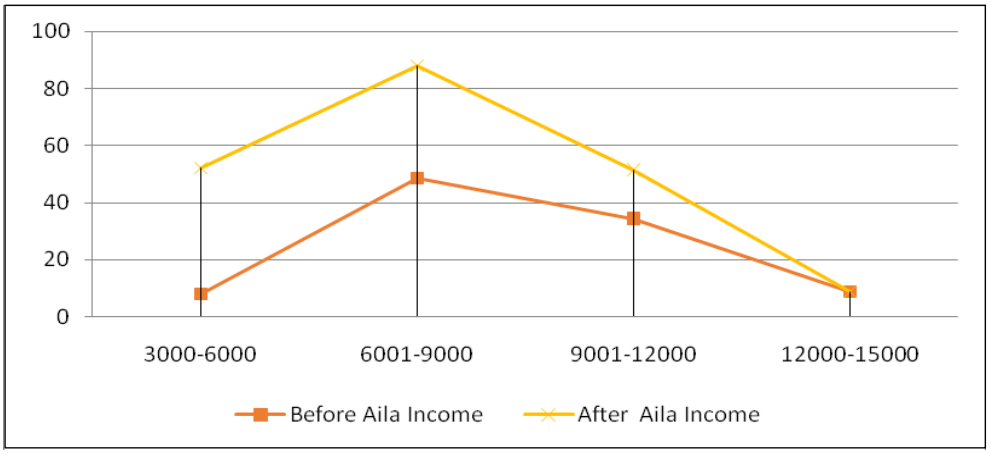

Figure 5. Monthly Income of the Respondents during Pre- and Post-Aila Period

Data presented in the figure 6 showed the occupational mobility of the participants before and after cyclone Aila where majority (67.6%) of the respondents were involved in agriculture, 16.9% were in fishing, 5.4% were in service and only 1.4% were in other occupation. But after Aila majority (37.2%) of the respondents were involved in agriculture, 26.4% were in fishing, 17.6% were involved in day labor, 5.4% in service and only 4.1% were in business. There was a significant change in occupation. This occupational shifting worked as an adaptation strategy.

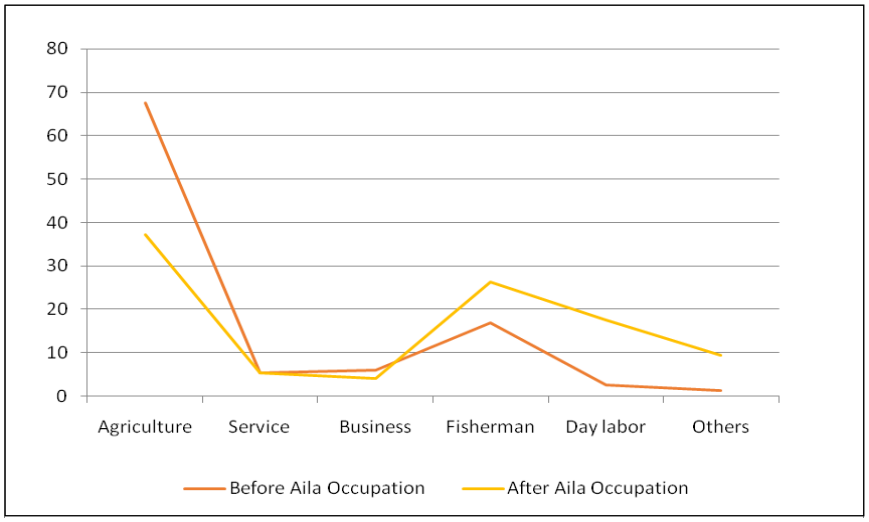

Figure 6. Occupational Mobility of the Respondent during Pre- and Post-Aila Period

Data in table 3 explored the relationship between occupational shifting as an adaptation strategy and Gender construction of the respondents. Here $p<0.003$ represents that there is a positive relationship between occupational shifting as adaptation strategy and gender construction of the participants. Occupational shifting was more common among male respondents.

Table 3. Gender-wise Occupational Shifting as Adaptation Strategy of the Aila Victims

Gender of the Respondents	Occupational Shifting as Adaptation Strategy		Total
	Yes	No	
Male	80	51	131
%	61.1	38.9	100.0
Female	4	13	17
%	23.5	76.5	100.0
Total	84	64	148
%	56.8	43.2	100
Pearson Chi-Square= 8.640	Table value= 5.024	DF=1	Asymmetric Sig.= .003

The findings in the figure 7 revealed that 42.6% of the respondents maintain their family to overcome income loss by borrowing money from others, 27.2% respondents maintain by reducing meal taking, 16.2% depended on aid whereas 6.8% of the respondents accepted early marriage as a strategy to maintain family to overcome income loss.

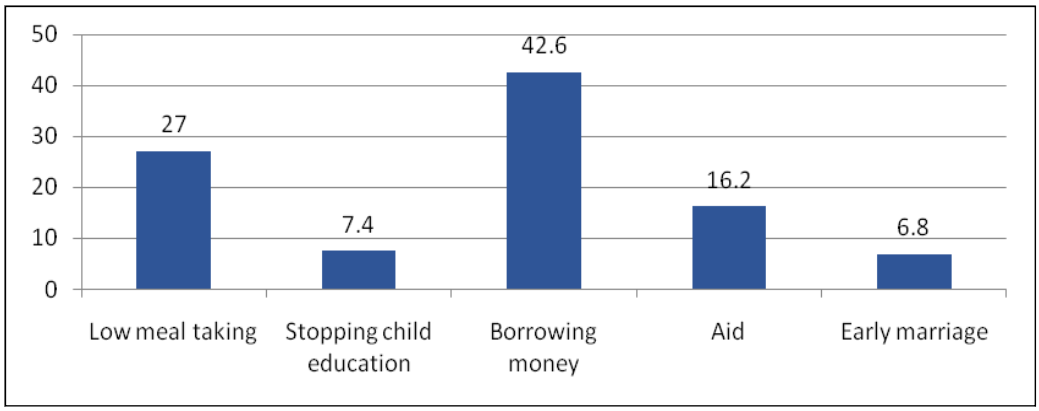

Figure 7. Indigenous Strategies Undertaken by the Respondents in Reducing Aila Induced Income Loss

The data in the figure 8 represented that the affected people adopted low meal taking as an adaptation strategy and the poverty strike people to minimize number of taking meals. The findings showed that 61.5% took meals three times a day now where the percentage was 100 before Aila; again, none took meals two times before Aila but now 38.5% take meals two times. the negative effect of Aila left people with no choice.

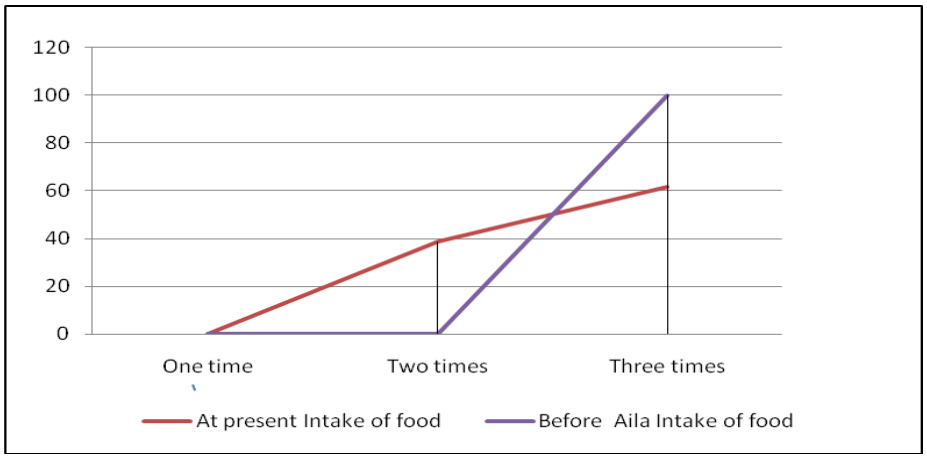

Figure 8. Number of Meal Taking by Respondents during Pre- and Post-Aila Period

Agricultural Loss Recovery Strategies: Finding in table 4 depicts that majority (48%) of the respondents started to fish cultivation and a large number (45.9%) started to cultivate hybrid paddy as strategies to overcome the damage of crops.

Table 4. Indigenous Strategies Undertaken by the Respondents in Reducing Aila Induced Crop Damage

Indigenous Strategies undertaken to reduce damage of crop	Number	Percentage
Cultivation of hybrid paddy	68	45.9
Crop diversification	9	6.1
Fish cultivation	71	48.0
Total	148	100.0

The findings in the table 5 depicted the indigenous coping strategies of the respondents to recover the loss of forest to adapt. 43.9 percent of the respondents started Dyke plantation that are more capable to pace with adversity and thus they help to protect soil. Again (33.1%) of them started afforestation among coastal belts and the rest (23%) planted in highlands.

Table 5. Indigenous Coping Strategies Undertaken by the Respondents to Recover the Loss of Forest

Strategies Undertaken to Recover the Loss of Forest	Number	Percentage
Planting deep rooted species (Dyke plantation)	65	43.9
Afforestation along the coastal belt	49	33.1
Plantation in highlands	34	23.0
Total	148	100

The findings in the table 6 showed that 49.3 percent of the respondents raised their pond embankments where 45.3 percent respondents fenced their ponds by net and only 2.7% adopted salinity tolerant fish species to reduce loss of fish as adaptation strategy.

Table 6. Indigenous Coping Strategies Undertaken by the Respondents to Recover the Loss of Fish

Strategies Undertaken to Recover the Loss of Fish	Number	Percentage
Raising pond embankment	73	49.3
Pond fencing by net	67	45.3
Changing species	4	2.7
Salinity tolerant species	4	2.7

Health Recovery Strategies: The data in table 7 represents that the affected people, majority of the respondents (81.1%) took water from tube well for cooking where for other purpose they use the water is 4.1%. Again 61.5% of the respondents use pond water for other purpose and it is also used for cooking purpose among 16.9%. 27.0 percent use river water for household chores but none use this for cooking purpose.

Table 7. Source of Water for Cooking, Drinking and for Other Purposes

Source of water	For Cooking and Drinking		For Other Purposes	
	Number	Percentage	Number	Percentage
Pit/well	3	2.0	11	7.4
Tube-well	120	81.1	6	4.1
Pond water	25	16.9	91	61.5
river/canal	0	0	40	27.0
Total	148	100	148	100

The findings in the figure 9 depicted the indigenous strategies taken by Aila affected individuals to purify contaminated water for their safety. The data showed that 50.0% of the respondents purified water by boiling, 26.4% do this by using alum, 12.5% purified by using purification tablets and the rest (10.8%) set tube-wells to get purified water.

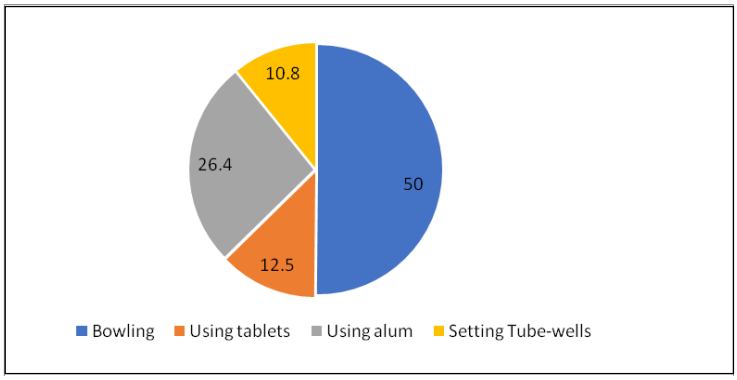

Figure 9. Indigenous Strategies by the Respondents to Purify Water

Figure 10 depicts the pattern of latrine is a determinant to evaluate sanitation facilities of the participants. The data in the figure revealed that majority (92.6%) of the participants use sanitary latrine, 5.4% use open latrine and the rest 2.0% use hanged latrine.

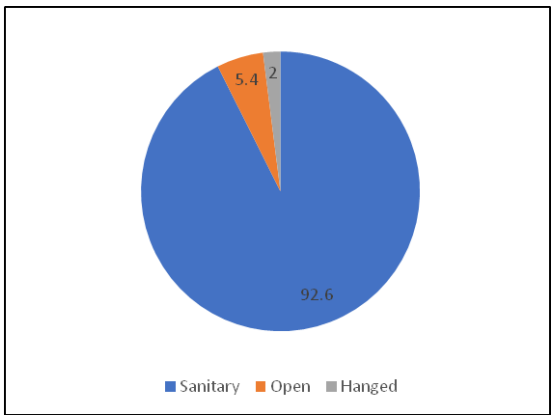

Figure 10. Pattern of Latrines of the Respondents Household

The findings in the figure 11 reveal that majority (68.0%) of the participants affected by suffered from diarrhea as aftermath of cyclone Aila, 21.3% of the participants suffered from dysentery, 6.4% of them suffered from skin diseases whereas only 4.3% of the participants suffered from typhoid as aftermath of Aila.

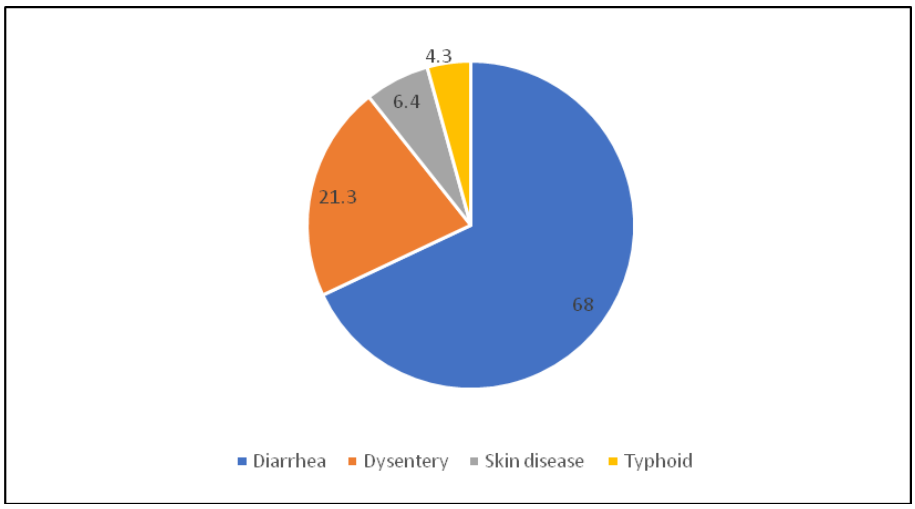

Figure 11. Diseases Prevalence among the Respondents

The findings in the figure 12 revealed that majority (41.2%) of the respondents go to hospital for treatment, 33.8%) go to quacks for treatment whereas 12.2% go to traditional healer for treatment and the rest (12.8%) go to other sources for treatment. All over majority go to hospitals as they are now much more conscious about health.

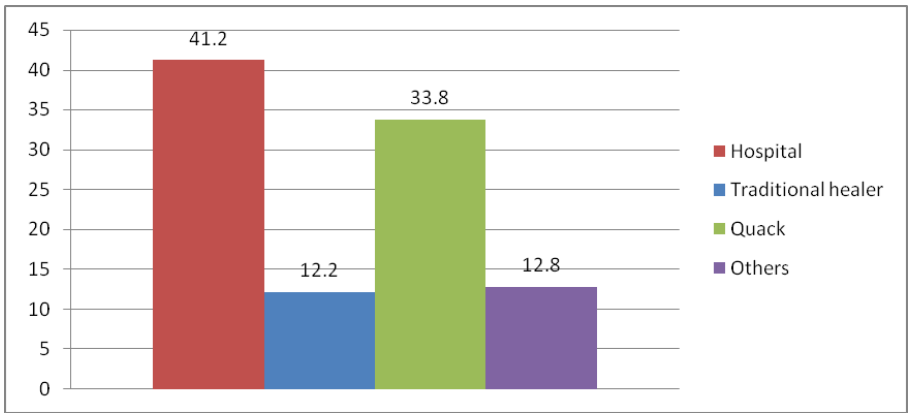

Figure 12. Treatment Seeking Behaviors of the Respondents

Education Recovery Strategy and Knowledge Sharing: Figure 13 showed that the rates of school going activities were minimized by the adverse effect of Aila. To compensate the absence of school, the Aila affected individual adopted some strategies. Majority of them (50.0%) started to read at home, 25.0% accepted the late start of school to adjust school absence and only 2.7% of the participants changed children school to reduce school absence.

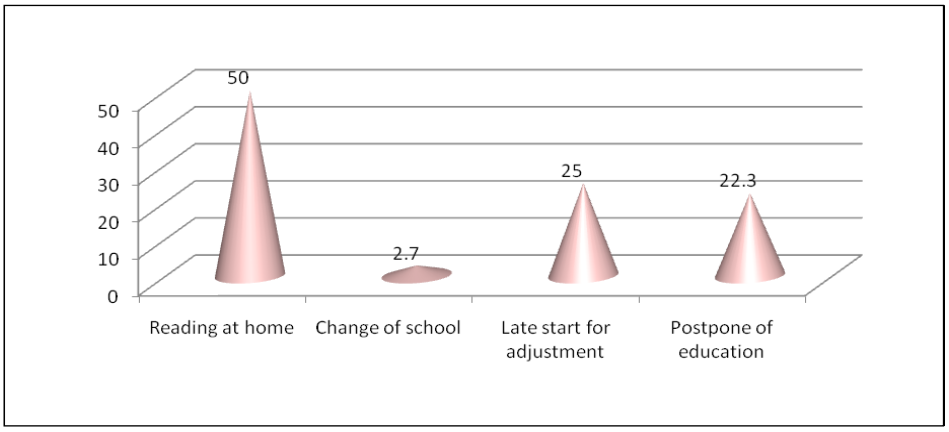

Figure 13. Indigenous Strategies Undertaken by the Respondents n to Recover the Absence of School

Table 8 explored the relationship of sharing knowledge with others with getting training and information facilities to cope disaster situation. Here the Pearson Chi Square value is 100.87 and the table value of chi-square for 1 degree of freedom is 5.02. Comparing the calculated and table value of chi-square, it is found that the calculated value is greater than the table value with asymmetric significance of .00. The statistically significant test predicts there is a highly positive relationship between sharing knowledge with others and getting training and information facilities of the participants.

Table 8. Knowledge Sharing by the Respondents and Training and Information Facilities to Cope with Disaster Situation.

Getting Training and Information	Sharing Knowledge with Others		Total
	Yes	No	
Yes	97	5	102
%	95	5	100
No	6	40	46
%	13	87	100
Total	103	45	148
%	70	30	100
Pearson Chi-Square= 100.873	Table value= 5.024	DF=1 Asymmetric Sig.= .000	

Table 9 depicted the relation between strategies taken by respondents to adapt disaster situation and getting training and information facilities about disaster situation. Here the Pearson Chi Square value is 12.63 and the table value of chi-square for 2 degree of freedom is 7.37. Comparing the calculated and table value of chi-square, it is found that the calculated value is greater than the table value with asymmetric significance of .002. The statistically significant test predicts there is a positive relationship between strategies taken by participants to adapt disaster situation and getting training and information facilities to cope with disaster situation.

Table 9. Knowledge Sharing Strategies of the Respondents and Training and Information Obtained Knowledge Sharing Strategies to Cope with Aila by the Obtained Training and Information

Obtained training and information	Knowledge sharing Strategies Taken by participants to cope with disaster situation			Total
	Raising awareness by knowledge sharing	Getting updated by information	Emergency response	
Yes	43	33	26	102
%	42	32	26	100
No	9	29	8	46
%	20	63	17	100
Total	52	62	34	148
%	35	42	23	100
Pearson Chi-Square= 12.639	Table value= 7.378	DF=2 Asymmetric Sig.= .002		

Others: The findings in the table 10 revealed that 73.6% of the respondents did not migrate from their home place and the rest (26.4%) of them migrated to different places. Among them who migrated, 48.71% of them migrated for storm, 46.15% migrated for earning money and only 5.12% migrated for security.

Table 10. Reason behind Migration of Family Members

Reason of Migration	Number	Percentage
Homeless by storm	19	48.71
To earn money	18	46.15
For security	2	5.12
Total	39	100

The finding in the table 11 represented the opinion about child marriage and the reason behind this increasing child marriage. Majority of the respondents said about increased rate of child marriage and they showed reason behind this. Among them 31.3% of the respondents showed the girl as a burden that can be escaped by married the girl off. Then 28.8% of the participants viewed the lack of food as reason to child marriage as Aila left them in poverty and only 5.9% of them married their child off for other response.

Table 11. Reasons behind increasing child marriage in Aila affected area

Reasons of increasing child marriage	Number	Percentage
Seems to be burden	37	31.3
Lack of food	34	28.8
Pressure	24	20.3
Lack of shelter	16	13.5
Others	7	5.9
Total	118	100

Discussion

Climatic events and their impact on agriculture and other socio-economic activities cannot be neglected to ensure sustainable development in Bangladesh. The impact of cyclone Aila on society is clear at Dacope upazila in Bangladesh. Households developed several coping strategies over the years to mitigate the risk of climatic events (Shuaibu, Akpoko & Umar, 2014). Individuals and households developed coping strategies combined to responses to the impacts of natural disaster on livelihood (Thomas *et al.,* 2005). The study found that as the income sources of the participants were basically agriculture, forest or fishing, various agricultural strategies were taken to overcome the loss of crop planting deep rooted trees (Dyke Plantation) was one of the responses to overcome the loss of forest by majority of the participants (65%). Rashid *et al.* (2014) suggested strategies to cope in the context of agriculture and in this study majority of the participants (67.6%) shifted their occupation from agricultural activities to something else to minimize the dependency on agriculture. Raising pond embankment, pond fencing by net and adopting salinity tolerant species were the strategy to recover the loss of fish.

Changing the lifestyle is another important strategy by rural families for survival and in order to improve their standard of living (Ellis, 1998). The study found that majority of the participants took water from tube well while one fourth of them use pond water and half of all participants' boiled water as a strategy to purify. Half of participants made their children to read at home to recover the loss of academic courses. 26.4 percent participant migrated from affected area and child marriage was also prevailed among participants as coping strategy. Only a little number of participants got the amount of highest 3000-5000 BDT. as financial aid to reconstruct residence but most of them repaired the house by borrowing money from others. The study also found that after cyclone Aila majority of the participants (67.6%) shifted their occupation from agricultural activities to something else where occupational shifting was more common in men than women.

Various diseases broke out that increased the vulnerability and decreased the capability to adapt to climatic events (Rahman, 2008). Haque *et al.,* (2013) identified individuals to seek for health coping strategies to cope with climate sensitive diseases and sickness. They identified 90 percent of the respondents took treatment from unqualified providers as their first choice but the study found that majority (41.2%) of them go to hospital for their treatment and they changed the mode of treatment as a coping strategy in disaster situation. They also mentioned self-medicating and seeking the health

service of unqualified private health care providers as the most common and widely used climate health coping strategies among the participants. 68 percent of the participants got affected by diarrhea after Aila and most of the participants (92.6%) used sanitary latrine. In case of housing condition, the study exposes that houses have been fully damaged of a number of participants (21 %) and hence 8.1 percent of the family live on the embankments and others in their relatives or in sheltered house. Osberghaus, Finkel & Pohl (2010) focused on providing information on climate change effects that is more personally relevant to the individual. The study also revealed that there is a highly positive relationship between sharing knowledge with others and getting training and information facilities of the participants.

Various interventions regarding reliefs were made by GOs and NGOs to mitigate the sufferings of the affected people (Masud-All-Kamal, 2013).The role of microfinance was appreciated highly in the process of adaptation by the affected households in the post-cyclone situation and a way was suggested to implement a comprehensive strategy and make assessment of loss and damage (Khan, Khalily & Scheyvens, 2015). Taking loans from the relatives was found as one of the coping strategies to repair the house and to continue daily livelihood (Quisumbing & Maluccio, 2003). Similarly, it is found in the study that 87.83 percent of the participants received the aid money to get the financial support to recover income loss.

Conclusion

People suffered the most in the south western region of Bangladesh by cyclone Aila and the impacts of the cyclone were devastating. As disasters are unavoidable coping can be the best solution to survive there. The individuals of affected household adopted collective strategies to mitigate the risk and to recover the cyclone induced shock. The participants were more likely to focus on improved healthcare services, occupational shifting, well-built house and home study as the coping strategies to survive. Again, low meal taking, loan taking and aid, support from the relatives was observed as coping strategies to recover economic loss. Finally, in agriculture, raising pond embankment and introducing salinity tolerant species hybrid paddy crop cultivation, diversified fish and dyke plantation were found to be the strategies to recover the loss. Though they have limited options, people are increasingly searching for alternative strategies to adapt to the situation. The extent of coping strategies varied with the impact of the cyclone. Vulnerable households should be identified to uphold coordinated disaster risk reduction programs. Risk reduction strategies, therefore, need to be upheld on the basis of the capacities of the communities.

References

Ahmed A. U., Neelormi S., Mukta Z. H., & Alam S. (2009). Swelled sufferings: Challenges after 3 months of Aila. http://www.ecbproject.org/ Bangladesh. Accessed 16 October 2016

Alam E. (2017). Food Security and Household Coping Strategies During Disasters in Bangladesh. *International Journal Natural Disaster Health Security, 3*(1), 30-35.

von Braun, J., & Birner, R. (2016). Designing Global Governance for Agricultural Development and *Food and Nutrition Security. Review of Development Economics,* 21.doi: 10.1111/rode.12261

Barr, C. E., Preston, B. L., Thomsen, D. C. and Smith, T. F. (2014). Toward a new conceptualization of household adaptive capacity to climate change: applying a risk governance lens. *Ecology and Society, 19*(4), 12.

Blaikie, P., Cannon, T., Davis, I., Wisner, B. (2004). At Risk. London: Routledge, https://doi.org/10.4324/9780203714775

Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change, 18*(4), 598-606. doi: https://doi.org/10.1016/ j.gloenvcha. 2008.07.013

Ellis, F., (1998). Livelihood strategies and rural livelihood diversification. *Journal of Development Studies, 35*(1): 1-35.

Government of Bangladesh (2010). National Plan for Disaster Management 2010-2015. Dhaka: Disaster Management Bureau. http://extwprlegs1.fao.org/docs/pdf/bgd146945.pdf

Haque, U., Hashizume, M., Kolivras, K. N., Overgaard, H. J., Dasd, B. and Yamamotoa, T. (2012).Policy & practice: Reduced death rates from cyclones in Bangladesh: what more needs to be done? *Bull World Health Organ, 90*, 150–156.

Hossen, A., Ahmed, S. U. and Abedien, M. Z. (2009). Good Practices for Community Resilience. Practical Action - Bangladesh, Dhaka, Bangladesh.

Howlader, H., Roy, T. and Islam, S. (2011). *Adaptation Strategies of the Aila affected people in Bangladesh: A study on Satkhira District Paperback*. LAP LAMBERT Academic Publishing.

Jahan, I. (2012). *Cyclone Aila and the Southwestern Coastal Zone of Bangladesh: In the Context of Vulnerability*. Centre for East and South-East Asian Studies, Lund University

Khan, T. F., Khalily, B. and Scheyvens, H. (2015). Loss and Damage, Caused by Cyclones Sidr, Aila and Mahasen: Coping Strategies, Adaptation and the Role of Microfinance. Institute of Microfinance (InM).

Maplecroft (2011). World's fastest growing populations increasingly vulnerable to the impacts of climate change-4th global atlas reports. http://maplecroft.com/about/ news/ccvi_2012.html

Masud-All-Kamal Md (2013). Livelihood coping and recovery from disaster: The case of coastal Bangladesh. *Current Research Journal Social Science 5*(1): 35-44

Osberghaus, D., Finkel, E. and Pohl, M. 2010. Individual Adaptation to Climate Change: The Role of Information and Perceived Risk. Retrieved From: [ftp://ftp.zew.de/pub/zew-docs/dp/dp10061.pdf], Accessedon 13 June 2016.

Quisumbing, A.R. and J.A. Maluccio, (2003). Resources at marriage and intra-household allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa. Oxford Bull. Econ. Stat., *65*(3):283-327.

Rahman A (2008). Climate change and its impact on health in Bangladesh. Regional Health Forum *12*(1): 16-26

Rashid, M.H., Afroz, S., Gaydon, D., Muttaleb, A., Poulton, P., Roth, C. and Abedin, Z. (2014). Climate Change Perception and Adaptation Options for Agriculture in Southern Khulna of Bangladesh. *Applied Ecology and Environmental Sciences*, *2* (1), 25-31.

Sarwar, M. G. M. (2005). *Impacts of Sea Level Rise on the Coastal Zone of Bangladesh,* Lund University, Sweden.

Shuaibu H. *, Akpoko, J. g. and Umar, S. (2014). Farm Households' Coping Strategies to Climate Change: A Review. *British Journal of Applied Science* & *Technology 4*(20): 2864-2877,

Survey System. (2012). The Sample Size Calculator. Creative Research System, California. Accessed on November 16, 2011. Retrieved from [http://www.surveysystem.com/sscalc.htm]

Thomas D, Osbahr H, Twyman C, Adger N, Hewitson B. (2005). Adaptive: Adaptations to climate change amongst natural resource-dependant societies in the developing world: across the Southern Africa climate gradient. Tyndall Centre for Climate Change Research. Technical Report.;35.

UN (United Nations). (2010). *Cyclone Aila: Joint UN Multi-Sector Assessment and Response Framework,* United Nations (UN), New York.

UNDP (United Nations Development Programme) (2007) Human Development Report 2007/2008. http://hdr.undp.org