Climate Changing Aquaculture in Bangladesh as Influenced by Agro-Ecological Zones

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Abstract

This paper estimates the impact of climate change on the fisheries and aquaculture sector of Bangladesh by Agro-Ecological Zones. Since "climate change" is a long run phenomenon, its impacts may not be discernable in the short run, cross sections data. Climate change therefore does not have any impact on the fisheries and aquaculture sector at the household level at least in the short run. This research study is descriptive-cum-empirical as well as suggestive in nature. The study is survey type. The present study has been included secondary resources consisting of books, newspapers, periodicals, articles from national and international level. Internet sources have been used for the research. Attempts have been made to include the latest information whenever available. At the same time primary data have been collected through interview with some officials and experts on the topic. The study has been conducted in Mymensing, Jessore, Netrokona, Rajshahi, Sylhet, Comilla and Chittagong of Bangladesh.

Key words: Fisheries, Aquaculture, AEZ, Climate Change, Bangladesh.

INTRODUCTION

Current global fisheries production of 160 million tons is rising as a result of increases in aquaculture production. A number of climate-related threats to both capture fisheries and aquaculture are identified, but we have low confidence in predictions of future fisheries production because of uncertainty over future global aquatic net primary production and the transfer of this production through the food chain to human consumption.

Recent changes in the distribution and productivity of a number of fish species can be ascribed with high confidence to regional climate variability, such as the El Niño–Southern Oscillation. Future production may increase in some high-latitude regions because of warming and decreased ice cover, but the dynamics in low-latitude regions are governed by different processes, and production may decline as a result of reduced vertical mixing of the water column and, hence, reduced recycling of nutrients.

Aquaculture has gone through major changes ranging from small-scale homestead level activities to large-scale commercial farming in the last two decades (Pillay, 2001). In The People's Republic of Bangladesh (Bangladesh) conventional aquaculture has evolved from traditional practice to science-based activities and has become the second largest (6%) contributor to national exports (DoF, 2002). At the same time a variety of noble aquaculture production systems have been developed and spread through innovative approaches to farming communities in Bangladesh, some have already proven to be significant contributors to overall production (Ali, 1996).

However, benefits through involvement of the poor producers and non-producers in servicing aquaculture and formal and informal marketing are unclear and have frequently been ignored. The overall impacts of a dynamic aquaculture sector on producers, consumers, and market channel intermediaries must be better understood if efforts towards targeting benefits to the poorest people are to be effective. This research will analyze the impact of aquaculture production and marketing on rural livelihoods and will test the assumption that aquaculture is benefiting the poor stakeholders throughout the value chain. Since the research is "people centred" the assessment has been carried out in the light of "aquaculture for development and poverty reduction" as a whole.

Fisheries and Aquaculture Sector of Bangladesh

Bangladesh is commonly known as the 'country of rivers' due to the large number of rivers flowing across the country is a prominent and important feature of its landscape (Bundell and Maybin, 1996). The landmass comprises mainly the delta of the three major rivers, the Ganges, the Brahmaputra and the Meghna (Chakraborty, 1998). The freshwater resources consist of 4.92 million ha of open water which includes rivers, estuaries, beels (natural depressions), polders (enclosures) and flood plain, and 0.51 million ha of closed freshwater which includes pond, ditches, oxbow lakes and gher shrimp farms (DoF, 2005). The country is rich with very productive marine and freshwater resources with enormous aquatic biodiversity (Mathias et al. 1998). Among the important aquatic animals, there are 260 freshwater indigenous fish species, 12 exotic species and 24 freshwater prawn, while there are 475 marine fish and 36 shrimp species in marine water (Ahmed, 2001).

The fish and fisheries sector play an important role in the country's economy and socio-cultural life, providing food, employment and foreign exchange (Rahman, 1994a). The sector has been a longstanding and an indispensable part in the life and livelihood of the peoples of Bangladesh and is commonly regarded as part of the country's cultural heritage (Ahmed, 2001). Although the contribution of fish to the country's total animal protein intake has been declining over the years, it is still highly significant in the Bangladeshi diet, contributing about 63% of total animal protein (Ahmed, 2005). In Bangladesh, historically people catch fish from open and unmanaged waters. Even during the 1960s -70s, 80% of the fish consumed were harvested from natural sources

(Ahmed, 2005). However, due to increased fishing effort by the growing population as well as environmental degradation, the harvest from such natural fish stocks has declined to about 34% of total fisheries production in 2005 and that from the culture of fish has increased significantly in enclosed waters over the last two decades (Ahmed, 2005; ADB, 2005). Total fish and fisheries production of in 2002-03 was 2.1 million metric tonnes (t) of which 37% was from inland freshwater aquaculture, 4% coastal aquaculture, 33% inland capture fisheries and 26% from marine capture fisheries (ADB, 2005; DoF, 2005).

OBJECTIVES OF THE STUDY

1. To identify the climatic factors aquaculture dynamics as per Agro-Ecological Zones (AEZ) parameters.
2. To know the performance of indigenous and exo-carps.
3. To prioritize the extension and training points as to recoup climate effects on aquaculture.

METHODOLOGY OF THE STUDY

The Methods and Materials used in the present studies are sequentially presented in this chapter.

1. Technical Investigative Survey (TIS)
2. Interactive Group Discussion (IGD)
3. Case Studies (CS).

Research Methodology

Research methodology is a collective term for the structured process of conducting research. It usually encompasses the procedures followed to analyze and interpret the data gathered. This research study is descriptive-cum-empirical as well as suggestive in nature. The study is survey type. The present study has been included secondary resources consisting of books, newspapers, periodicals, articles from national and international level. Internet sources have been used for the research. Attempts have been made to include the latest information whenever available. At the same time primary data have been collected through interview with some officials and experts on the topic. The study has been conducted in Mymensing, Jessore, Netrokona, Rajshahi, Sylhet, Comilla and Chittagong of Bangladesh.

Variables

A. Agro-Ecological Zones: Any 5

i. Mymensingh-Tista Brahmaputra Floodplains AEZ 3, 6, 8, 9
ii. Jessore-Ganges Floodplain AEZ 11, 12, 14, 15
iii. Netrokona Mixed Floodplains and Basins AEZ 4, 5, 20, 21
iv. Rajshahi -Barind and Madhupur soils AEZ 25, 26, 27, 28
v. Sylhet -Hill and Piedmonts and Hill: 1, 22, 29, 30
vi. Comilla-Meghna Floddplains AEZ 16, 17, 19
vii. Chittagong Coastal Areas: AEZ 13, 18, 23, 24
viii. Pabna -Alluvium AEZ 2, 7, 10

B. Nature of Aquaculture

i. Open water floodplain
ii. Ponds culture
iii. Capture fish
iv. Gher
v. Migratory

C. Type of Fish

i. Carps
ii. Catfish
iii. Shrimp
iv. Mixed Fisheries
v. Sea Fish

RESULTS AND DISCUSSION

A. Factors Controlling Water Bodies

The results obtained from studies conducted here are given in the Table 1 and Figs. 1 -4.

Table 1: Response % on the factors of water-body dynamics s a function of Agro-Ecological Zones (AZ) of Bangladesh

Parameters	Silting	Convert	Irrig.	Less rain	High evap.	Mean
Mym- AEZ 3.6.8.9	57	35	49	21	73	47
Jes- AEZ 11.12.14.15	45	52	67	32	88	57
Netrok AEZ 4.5.20.21	69	35	41	15	53	43
Rajs. Madh AEZ 25.26.27.28	11	48	62	18	50	38
Sylh Hill-AEZ 1.22.29.30	24	23	36	10	42	27
Com AEZ 16.17.19	76	71	68	34	73	64
Chitt- AEZ 13.18. 23.24	54	37	26	33	51	40
Mean	48	43	50	23	61	45

The data results given in the Table 1 show the response % on the factors of water-body dynamics s a function of Agro-Ecological Zones of Bangladesh. It is evident from results that the overall grand mean illustrate only 45% response indicating that the factor is somehow overlooked at the national level though the other variable means were found highly significant. The response was found to be highest in the Comilla Region AEZ 16.17 and 19. Being 64%, while it was lowest for Sylhet Hill Region measuring 27% response only.

As a factor of causes the mean response in favour of its affects was highest for higher evaporation rates being 61%, and was lowest for less rainfall being 23%.

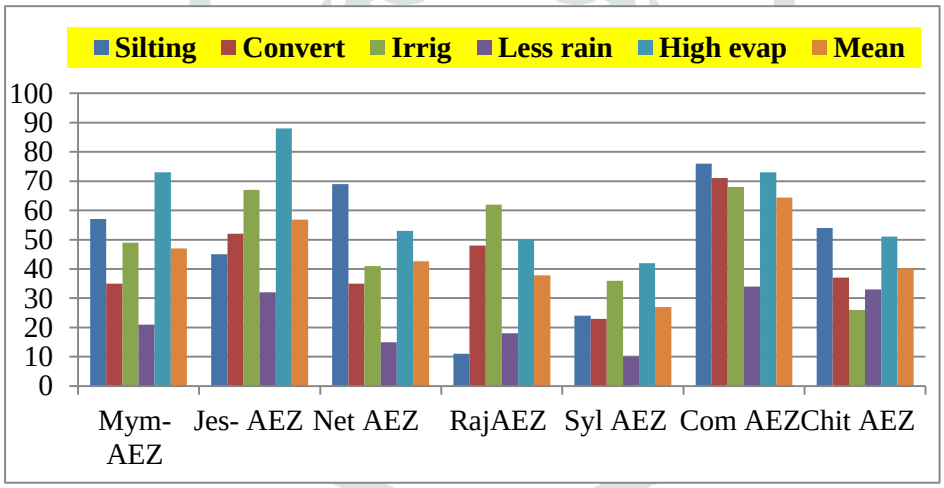

Figure 1: Factors of water-body dynamics s a function of Agro-Ecological Zones of Bangladesh

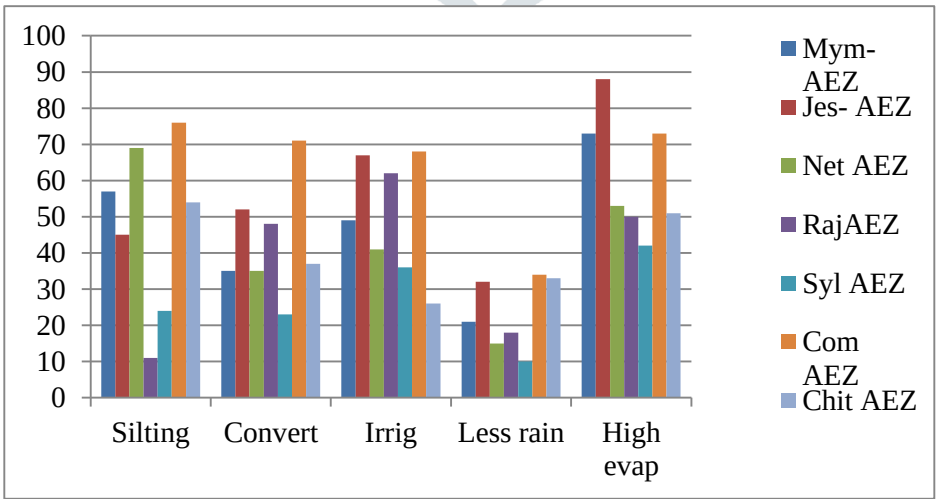

Figure 2: Factors of water-body dynamics s a function of its causes

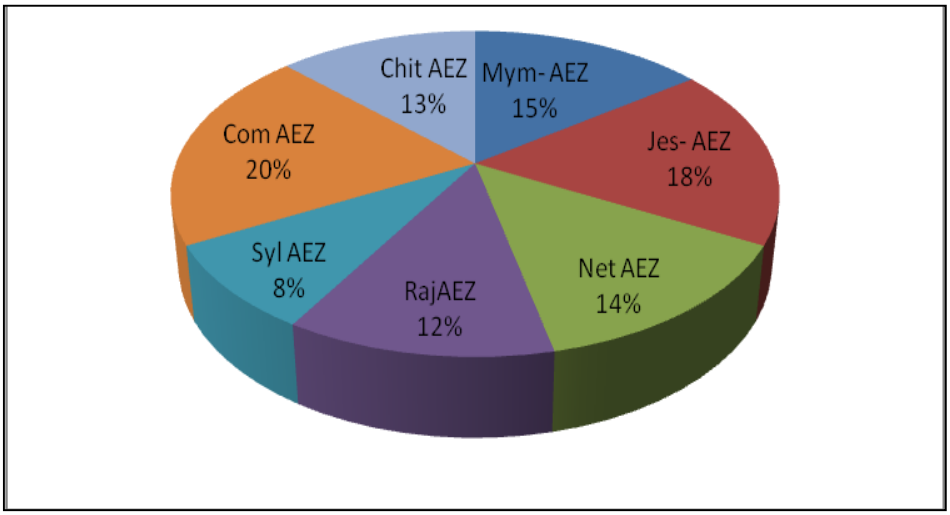

Figure 3: Pie chart showing the mean of water-body dynamics s a function of Agro-Ecological Zones of Bangladesh

Source: Survey

B. Priority Action for Increasing Fish

The data collected and analyzed for priority action for increasing fish production specially of high yielding exotic carps are given in the Table 2 and the Figs. 4-6.

Table 2: Percent response in favour of priority action for increasing Exotic carp fish growth

AEZ	Water quality	Balanced feed	Short duration	Poor Species	Early harvest	Mean
Mym- AEZ	29	65	19	22	44	36
Jes- AEZ	16	85	67	52	56	55
Net AEZ	14	45	24	15	14	22
RajAEZ	23	78	62	18	50	46
Syl AEZ	27	63	36	72	42	48
Com AEZ	35	71	68	74	73	64
Chit AEZ	24	24	26	52	26	30
Mean	24	62	43	44	44	43

The results show that the response given prioritizing production action show that the grand mean response was 43%. But the individual AEZ based response was highest for Comilla Region being 64%, followed by Jessore Region being 55%. The lowest response was 22% for Netrokona. The response in favour of factor was 63 % for balanced feed, the lowest being for water quality.

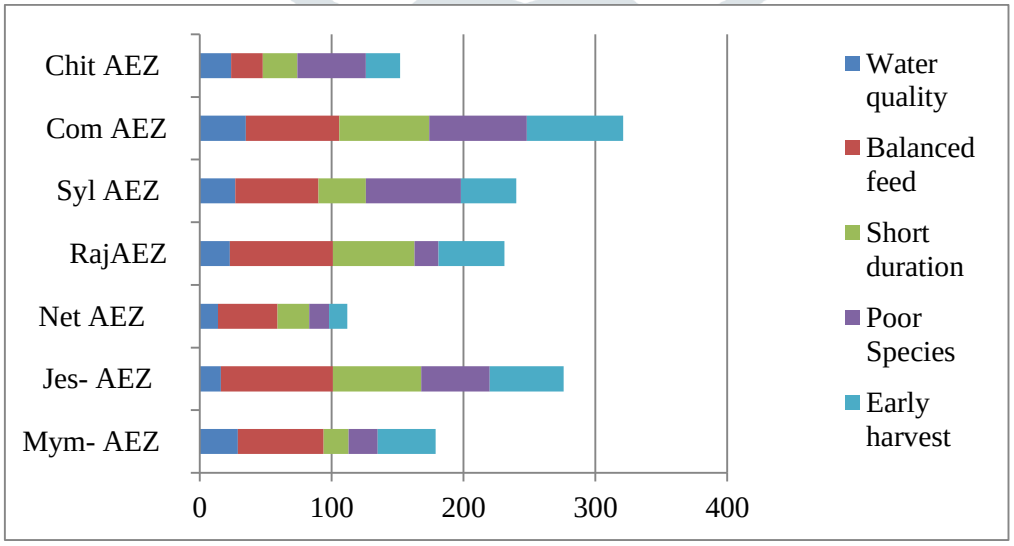

Figure 4: Bar chart showing priority action for increasing exo-carp fish growth as a function of AEZ

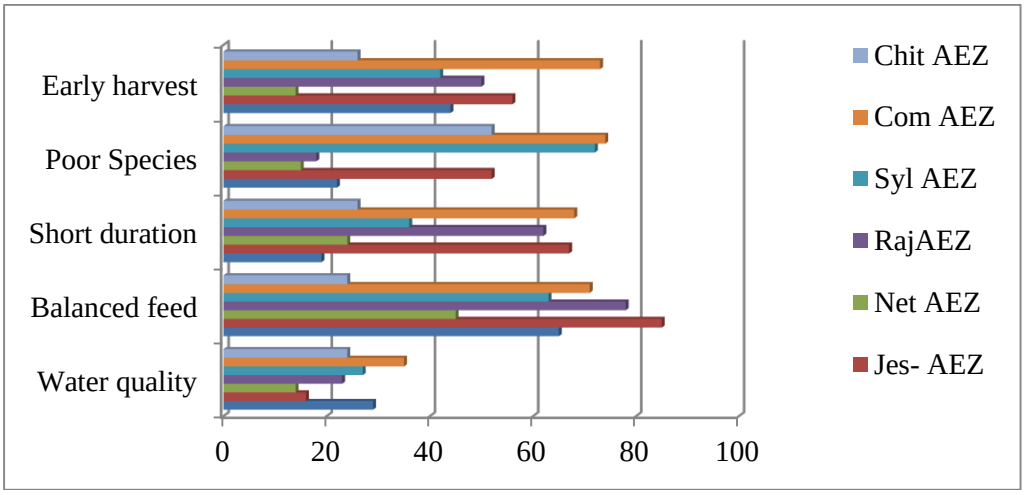

Figure 5: Bar chart showing priority action for increasing exo-carp fish growth as a function of Causes

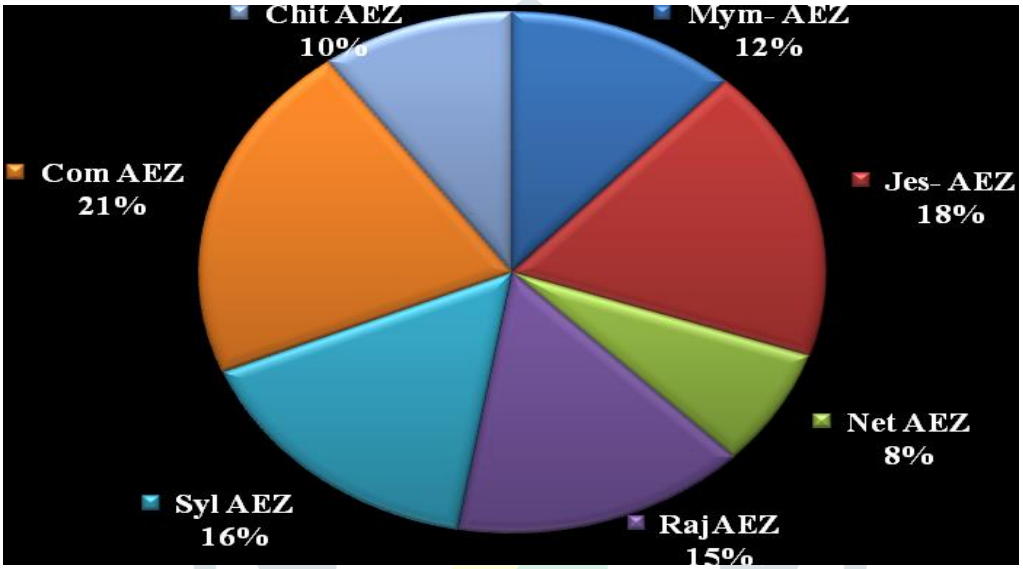

Figure 6: Pie chart showing priority action for increasing exotic carp fish growth

CONCLUSION

It is evident from results that the overall grand mean illustrate only 45% response indicating that the factor is somehow overlooked at the national level though the other variable means were found highly significant. The response was found to be highest in the Comilla Region AEZ 16.17 and 19. Being 64%, while it was lowest for Sylhet Hill Region measuring 27% response only. The results show that the response given prioritizing production action show that the grand mean response was 43%. But the individual AEZ based response was highest for Comilla Region being 64%, followed by Jessore Region being 55%. The lowest response was 22% for Netrokona.

The response in favour of factor was 63% for balanced feed, the lowest being for water quality. The main objectives of the study were to i. to identify the climatic factors aquaculture dynamics as per Agro-Ecological Zones (AEZ) parameters; ii. to know the performance of indigenous and exotic carps; and iii. to prioritize the extension and training points as to recoup climate effects on aquaculture. The response % on the factors of water-body dynamics s a function of Agro-Ecological Zones of Bangladesh was evident that the overall grand mean illustrated only 45% response indicating that the factor is somehow overlooked at the national level though the other variable means were found highly significant. The response was found to be highest in the Comilla Region AEZ 16.17 and 19. Being 64 %, while it was lowest for Sylhet Hill Region measuring 27% response only. As a factor of causes the mean response in favour of its affects was highest for higher evaporation rates being 61%, and was lowest for less rainfall being 23%.

The response given prioritizing production action show that the grand mean response was 43%. But the individual AEZ based response was highest for Comilla Region being 64%, followed by Jessore Region being 55%. The lowest response was 22% for Netrokona. The response in favour of factor was 63 % for balanced feed, the lowest being for water quality.

RECOMMENDATIONS

1. Water reduction in the water bodies mostly due to siltation for which regular dredging as per water depth requirement of the fish species is highly recommended Jessore and Netrokona AEZs.

2. Still Comilla regions AEZs shown highest suitability for carp production followed by Netrokona.

3. The depth of water bodies was found to control the climatic aquaculture dynamics as per Agro-Ecological Zones (AEZ) parameters which should be maintained as per water requirement of the species and the seasonal duration of aquaculture.
4. The performance of indigenous and exotic carps should be increased ensuring modern cultural management practices.

5. Priority should be given to aqua culturists for the extension and training points as to recoup climate effects on aquaculture.

Over all further studies on more detail points of the aquaculture farming system should be given, keeping in mind the dynamic climate changes as now dominant in Bangladesh.

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