Bangladesh J. Zool. **39**(2): 157-171, 2011

COMPARATIVE STUDY OF THE PRODUCTION OF CLOSED WATER FISHERY RESOURCES INSIDE AND OUTSIDE THE EMBANKMENT OF MEGHNA DHONAGODA IRRIGATION PROJECT

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Abstract: A comparative carried out was done on the closed water fishery resources between inside and outside the embankment of Meghna Dhonagoda Irrigation Project (MDIP). This research explores that the culture fishery has been developed inside the MDIP project area after the construction of Flood Control, Drainage and Irrigation (FCDI) Project. The average production of fishes in closed water (ponds and borrow pits) was higher inside (2374.39 kg/ha and 2436.37 kg/ha) than outside (1984.32 kg/ha and 2075.01 kg/ha) in 2003-2004 and 2004-2005. The significant difference ($p<0.001$) was found between the production of two zones. The overall production of closed water increased inside the embankment in all cases except culturable ponds. Production of culturable ponds was higher in outside due to the entrance of natural fish in inundated ponds during monsoon.

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Key words: ponds, borrow pits, MDIP, fish, production, irrigation, embankment.

INTRODUCTION

Inland closed water fisheries resources are very rich in Bangladesh. Culture based fishery is the most suitable in closed water bodies mainly ponds and borrow pits in our country. After the construction of Flood Control, Drainage and Irrigation Projects, the culture fishery has been developed in the project areas. Fish production increased to 21.02 lakhs mt in 2003-2004, which was 17.81 lakhs mt in 2000-2001 (DOF 2005). In Bangladesh, fish provides up to 63% of animal proteins consumed (BBS 2001 and DOF 2005).

Fish as a staple article of food, must have found favourable to man at a very early stage of his history. The muscular tissue of flesh or a fish is made up of 60

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to 82 percent water, about 13 to 20 percent proteins and a greater or lesser amount of fat (Qureshi 1951). So, like other rice eating people of the world, the Bangladeshi is very fond of fish. Every time they prefer fish to meat. Fish was literally available on the very doorstep of the people, fresh and often alive (Ahmad 1952).

At national level, 46% of the ponds are under aquaculture. The remaining ponds either culturable or derelicts (BFRSS 1986). SPARRSO (1984) estimated the area of derelict, cultured and culturable ponds to be about 43, 27 and 30%, respectively but according to BFRSS (2004) these are 12, 65 and 23%, respectively. In the year 1987-88, total inland culture production was 1.76 tones, but in 2004-2005, the total inland culture production was 8.82 mt. out of which only pond production was 7.57 mt (BFRSS 2005). Before the flood control and irrigation projects were implemented, the production of fishponds in flood-prone areas was very low. Aquaculture was risky because there was the possibility of inundation. Once flood control infrastructure was built, this risk greatly diminished. According to recent statistics, 2482 kg/ha is produced on an average in the ponds of Bangladesh (DOF 2005).

More than 80% of the animal protein in the diet comes from fisheries products alone (Rubbi *et al.* 1978). Most of the people in developing world are still dependent almost entirely on fish as a source of animal protein. Fish protein is 85 - 95% digestible and all dietary essential amino acids are present in fish (Nilson 1946).

In 1987, Bangladesh became third in world inland fish and shrimp production after China and India, and produced 581,827mt of fish and shrimp (FAO 1987). So, fisheries sector plays an important role regarding employment generation, animal protein supply, and foreign currency earning and poverty alleviation.

Although after the construction of embankment inland open water fisheries decreased, but pond production increased. Bangladesh has 1,288,222 man-made ponds which provide a total area of 146,890 ha (BFRSS 1986). At present, some borrow pits and ditches have been developed. According to Centre for Integrated Rural Development in Asia and the Pacific (CIRDAP), study in 1987 on the impact of flood control in three Flood Control Drainage and Irrigation (FCDI) projects it was found that flood protection improved conditions for expanding and intensifying pond fish culture.

OBJECTIVE

The objective of this study was to conduct a comparative study on the closed water fishery resources between inside and outside the embankment of Meghna Dhonagoda Irrigation Project (MDIP).

MATERIAL AND METHODS

Closed water (ponds and borrow pits) survey was carried out in both inside and outside of the embankment. At first 10%, out of 241 villages, was selected randomly from inside the embankment. Then, all the ponds and borrow pits of the selected villages were surveyed. The selected villages (24) covered nine unions inside the project area. Thus, 378 ponds and 22 borrow pits were surveyed by using the pre-tested questionnaires which include questions like fish production, types of fish species, types of culture, ownership, position of pond owners, methods of fish culture, problems of fish culture, etc. Similarly, the same methods were applied in outside the embankment and five villages out of 46 were selected randomly. So, the selected 10% villages include 43 ponds and six borrow pits, which were surveyed, and the data as in inside were collected. The surveys were conducted for the period of two years (2003-2004 and 2004-2005).

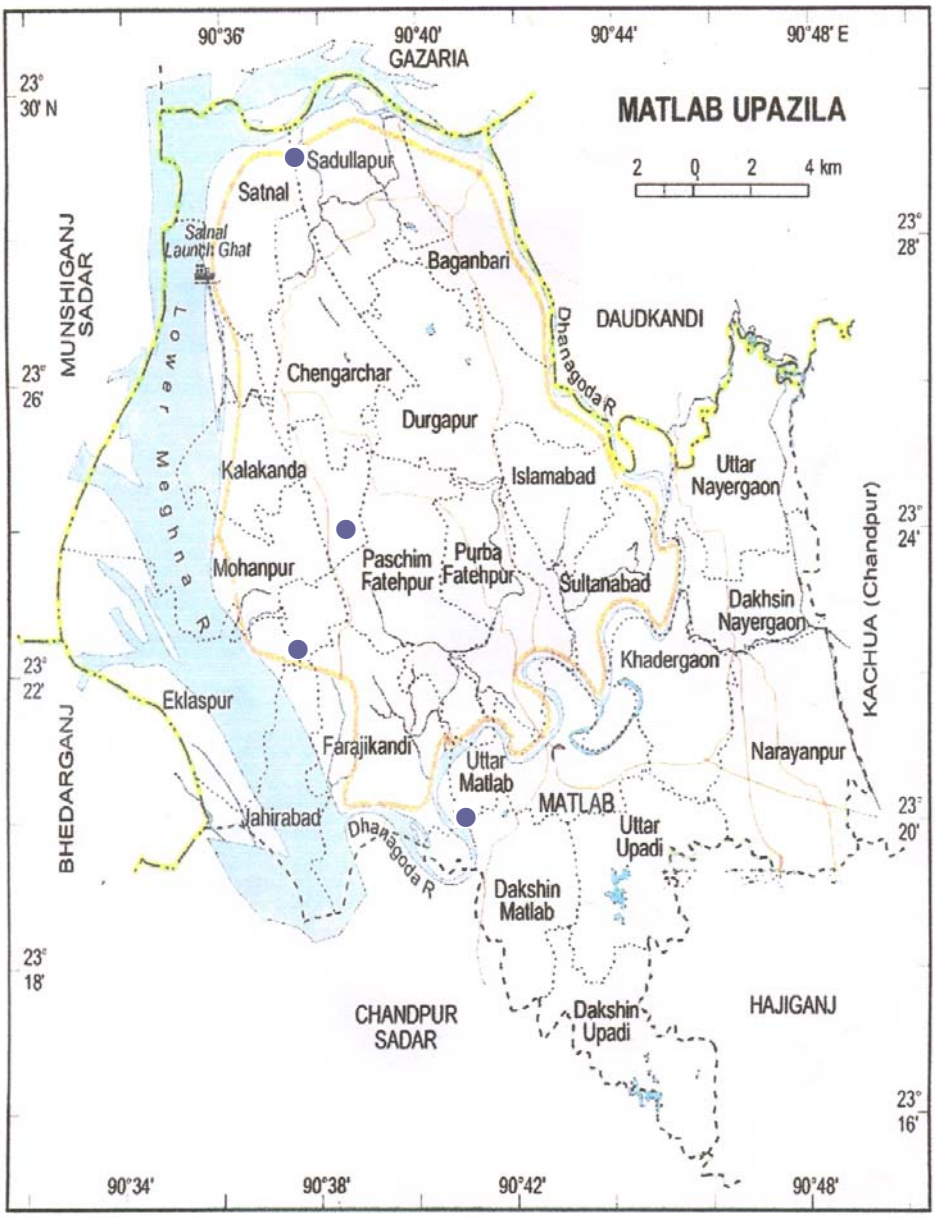
RESULTS AND DISCUSSION

In Meghna Dhonagoda Irrigation Project (MDIP) area, closed water fisheries based on culture fisheries in the ponds and borrow-pits have been developed after construction of embankment. Particularly, the development of culture fisheries was noticed in the ponds and borrow-pits. The people of MDIP area started fish culture in ponds and borrow pits in both inside and outside the embankment. The findings were recorded in terms of flooding, type of water body, ownership, type of culture, method of culture, problems of fish culture regarding the production of culture fishery resources both inside and outside of MDIP in Matlab North area.

Over flooding of closed water: During 2003-2004, it was observed that only six percent ponds and borrow-pits were over flooded inside the embankment causing rain water congestion which was seven percent in 2004-2005. On the other hand, 46.94 % and 51.02% in 2003-2004 and 2004-2005, respectively outside the embankment were subject to over-flooding during monsoon.

It was observed that 6-7% ponds and borrow pits were over flooded inside due to rain water congestion where 47-51% were over flooded outside the embankment during monsoon. Although no substantial work was done like

inside and outside areas of the embankment, but Kaiya *et al.* (1987) reported that 53.3% ponds were found to become flooded every year, which is almost similar with the present findings obtained outside the embankment.



Legend : ..... Embankment Rivers (Meghna & Dhonagoda)
● Udamdi pump house, ● Kalipur pump house, ● Eklashpur booster pump house
● Dubgi booster pump house

Fig.1. Map of the Meghna Dhonagoda Irrigation Project, Matlab North, Chandpur.

Type of water body: Among the surveyed ponds and borrow-pits 17.75% was seasonal and 82.25% was perennial inside the embankment of MDIP in both years of study. Whereas, 20.41% was seasonal and 79.59% was perennial outside the embankment [Fig.2a-b).

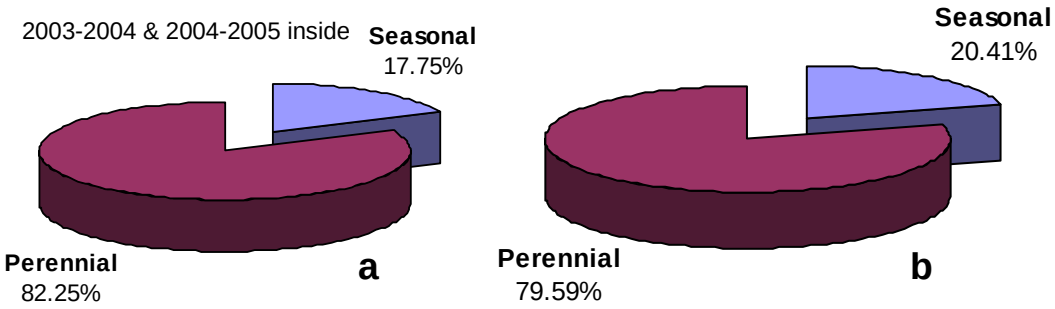


Fig. 2a-b. Contribution of ponds and borrow-pits on the basis of type of water body both inside and outside of MDIP in 2003-2004 and 2004-2005.

Ownership: On the basis of ownership it was observed that 24% was single ownership inside and 30.61% outside the embankment in two years of study. But, 47.5% was joint ownership inside and 38.78% outside in 2003-2004. Almost the same figure 46.5% inside and 36.74% outside were found in 2004-2005. In case of lease ownership, 28.5% and 29.5% inside, 30.61% and 32.65% outside in the years 2003-2004 and 2004-2005, respectively. These results are presented in Fig. 3.

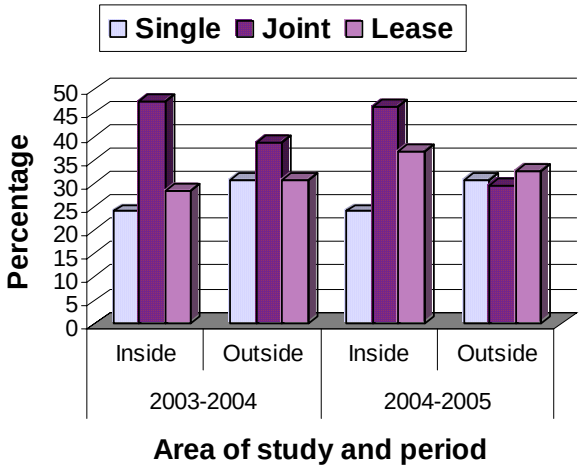


Fig. 3. Contribution of ponds and borrow-pits on the basis of ownership both inside & outside of MDIP in 2003-2004 and 2004-2005.

Envisaging ownership it was found that the single ownership (24%) inside was less than outside (30.61%) the embankment, where the joint ownership (47.5%) inside was higher than outside (36.74%). On the other hand, lease ownership (28.5%) inside was almost the same as outside (30.61%). Both inside and outside of the embankment, joint ownership was higher than other ownerships and it was also the problem for fish culture. Although no exact work was done like inside and outside the embankment however Kaiya *et al.* (1987) found that the ownership of ponds of Mirzapur Upazila under Tangail district was 42.1% single ownership and 40.1% joint ownership. He also noticed that multiple ownership was an important problem, which is agreed with this research. BRAC (1982) also expressed the same opinion.

Type of culture: Two types of ponds- cultured and culturable were found both inside and outside of the embankment. But, no borrow pits was found culturable. 94.25% ponds and borrow pits were cultured inside the embankment in 2003-2004 and almost the same (95%) inside in 2004-2005. On the other hand, 5.75% and 5% were culturable in 2003- 2004 and 2004-2005 respectively. In outside region, 69.39% and 73.47% were cultured, 30.61% and 26.53% were culturable in both the years of study (Fig. 4a-d).

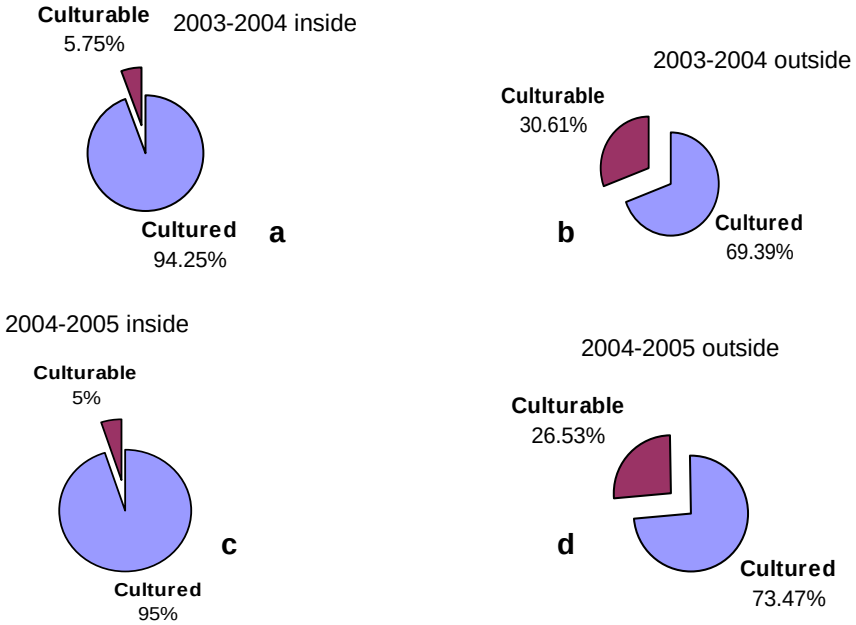


Fig. 4a-d. Contribution of ponds and borrow-pits on the basis of type of culture both inside and outside of MDIP in 2003-2004 and 2004-2005

It clearly indicates that the opportunities of fish culture in ponds and borrow pits were very high and occurred for the construction of embankment. According to SPARRSO (1984) 43% are cultured, 30% culturable and 27% derelict. But, the present findings inside the embankment indicate that the percentage of cultured ponds and borrow pits were higher than the findings of SPARRSO (1984). On the other hand, in case of the outside region of MDIP in Matlab North, although the number of cultured ponds and borrow pits were higher, but culturable ponds were the same as SPARRSO (1984). But no derelict ponds were found both inside and outside the embankment. The cultured ponds identified by ICLARM (1994) were managed in various ways with: Regular stocking with occasional feeding and fertilizing; Regular stocking without feeding and fertilizing; Irregular stocking without feeding and fertilizing. These were also followed in the cultured ponds and borrow pits in MDIP area.

Method of culture: Extensive and improved extensive methods of fish culture were commonly followed in both inside and outside regions. In inside, extensive (48.27%) and improved extensive (47.75%) were observed in 2003-2004 and almost the same result was found (46.58% & 49.47%, respectively) in 2004-2005. On the other hand, in outside region, 61.76% & 58.33% were extensive method of fish culture and 38.24% & 41.67% improved extensive in 2003-2004 and 2004-2005, respectively. Only 3.98% and 3.95% were under Semi-intensive method of culture inside the embankment in both the years of study, but not found outside (Fig.5).

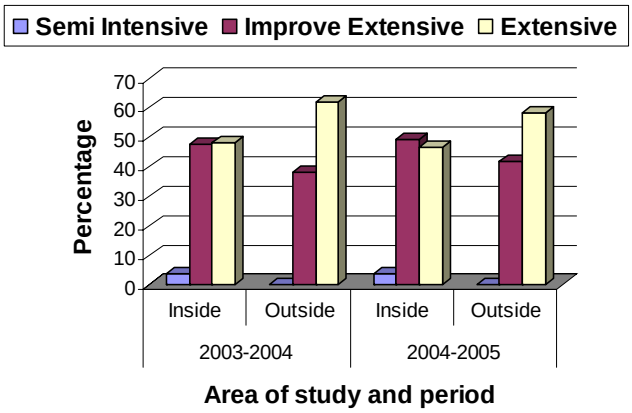


Fig 5. Contribution of ponds and borrow-pits on the basis of method of culture both inside and outside of MDIP in 2003-2004 and 2004-2005

The result showed that 48.27% was extensive, 47.75 % improved extensive and 3.98% semi-intensive in inside, whereas, 61.76% was extensive, 38.24% improved extensive and no semi-intensive method was followed in outside. It is

evident that culture technology has been developed more inside than outside the embankment.

Problems of fish culture in closed water: The views of 400 ponds and borrow-pit owners of the region inside and 49 owners of the region outside the embankment regarding the problems associated with fish culture in their ponds and borrow pits are presented in Fig.6. The major problem was lack of training (38% and 37%) in inside and also the same (40.82% and 38.78%) in outside region in both years. The second major problem was the lack of fund (33.75% and 35%) in inside, but the problem by inundation in monsoon (28.57% and 26.53%) was for outside owners in 2003-2004 and 2004-2005, respectively followed by the lack of unity (18.75% and 19.25%) inside and (12.24% and 14.29%) outside the embankment. The problem of the lack of fund (10.21% and 12.24%) in outside was almost the same as the lack of unity outside in both years. The minor problem (1.25%) was inundation in monsoon in inside in both years and the second minor was non-availability of fry (4.5% & 4%) in inside and 4.08% in outside in 2003-2004 & 2004-2005, respectively and prevention of disease (3.75% & 3.5%) in inside and 4.08% in outside region in both years which were almost the same as second minor problem for fish culture.

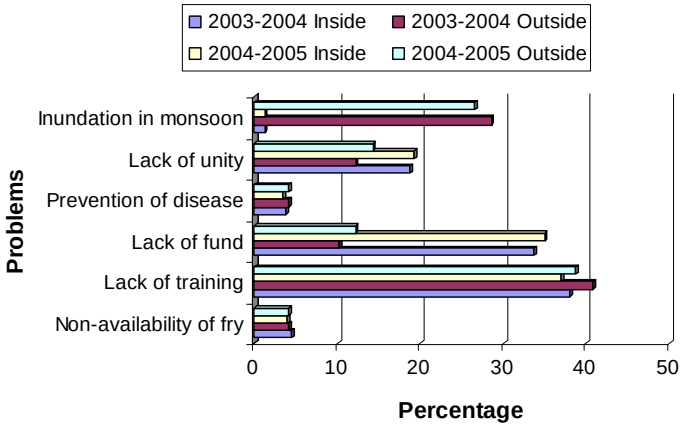


Fig. 6. Problems of fish culture in ponds and borrow-pits both inside and outside of MDIP in 2003-2004 and 2004-2005

Kaiya *et al.* (1987) noticed that multiple ownership is an important problem, which is agreed with this research. BRAC (1982) also expressed the same opinion. Karim (1978), Gill and Motahar (1982) and Ali *et al.* (1982) identified the same as a major problem for fish culture. The present study showed the major problem was the lack of training both inside and outside the embankment which is not similar to their findings.

Production of closed water (ponds and borrow-pits) on the basis of different categories

(a) Production on the basis of ownership: Three categories of ownerships were found among the ponds and borrow pits owners both inside and outside the embankment. These were the single, joint and lease. On the basis of ownership of closed water (both ponds and borrow pits), the highest production (2536.42 kg/ha and 2550.53 kg/ha) observed in single ownership in the inside in both the years of study. The second highest (2464.73 kg/ha and 2529.75 kg/ha) in lease ponds and borrow pits and the lowest production (2199.83 kg/ha and 2262.48 kg/ha) was in joint ownership ponds in the inside region in 2003-2004 and 2004-2005. In case of outsider ponds and borrow pits, the highest production was in lease ownership both the years of study (2110.66 kg/ha and 2167.92 kg/ha), followed by single ownership (1784.18 kg/ha and 1926.55 kg/ha) and the lowest production was in joint ownership (1599.30 kg/ha and 1703.39 kg/ha) in 2003-2004 and 2004-2005, respectively. The production data were given in Fig.7. It was clear that in all types of water bodies, on the basis of ownership, the production was slightly higher in 2004-2005 than in 2003-2004. The production was also higher in the inside region in all cases than that of the outside region of the embankment both in 2003-2004 and 2004-2005.

The result indicates that the single owner ponds and lease owner ponds are to be managed more or less scientifically than joint owner ponds.

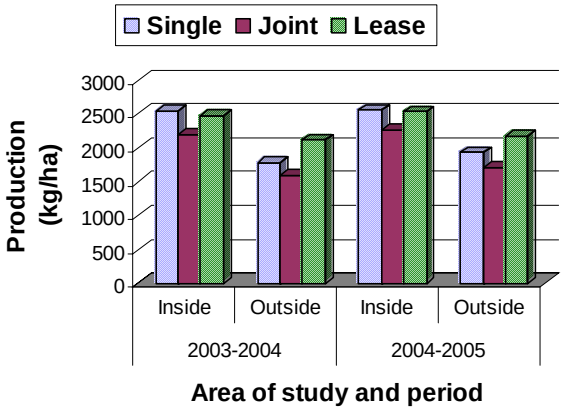


Fig. 7. Production of fishes in closed water (ponds and borrow-pits) on the basis ownership both inside and outside of MDIP in 2003-2004 and 2004-2005

(b) Production on the basis of type of water body: In two years of study, both inside and outside regions, the production was higher in perennial water body (ponds and borrow-pits) than in seasonal water body. In the inside region, the production of fishes was 2415.77 kg/ha and 2479.81 kg/ha in perennial water

body (ponds and borrow-pits) in 2003-2004 and 2004-2005, whereas 1638.98 kg/ha and 1664.50 kg/ha in seasonal water body. On the other hand, in the outside region, the production was 2011.67 kg/ha and 2098.67kg/ha in perennial water body but 1409.76 kg/ha and 1578.05 kg/ha in seasonal water body, in two years of study. It was evident that both the inside and outside of the embankment of MDIP, the production of fishes was higher in the perennial water body than the seasonal water body. The results are shown in Fig.8. In both the inside and outside regions, it was observed that the production was a little bit increased chronologically in 2004-2005 in both types of water body than the previous year of the study.

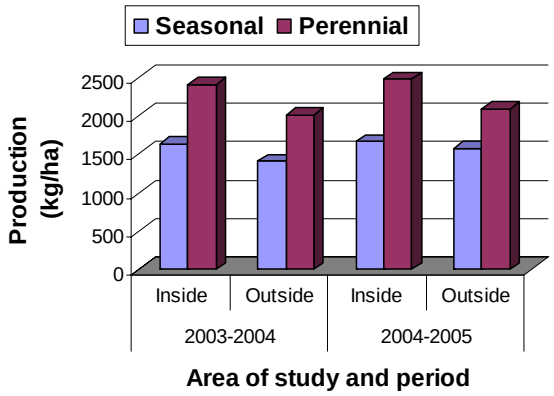


Fig. 8. Production of fishes in closed water (ponds and borrow-pits) on the basis of type of water body both inside and outside of MDIP in 2003-2004 and 2004-2005

(c) Production on the basis of type of culture: The production of fishes was higher in cultured ponds and borrow-pits in both inside and outside regions than that of culturable. In 2003-2004 and 2004-2005, the production in cultured ponds and borrow pits was 2440.65 kg/ha and 2494.70 kg/ha in the inside and 2076.93 kg/ha and 2140.22 kg/ha in the outside region. But, in case of culturable ponds, the production was lower (641.95 kg/ha and 561.07 kg/ha) in the inside region than in the outside region (1274.89 kg/ha and 1244.05 kg/ha) in 2003-2004 and 2004-2005, respectively (Fig.9). It was evident that the production of culturable ponds in the outside of the embankment was almost double than that of the inside of the embankment of MDIP. In case of culturable ponds, there was an exceptional; the production was higher in 2003-2004 than in 2004-2005 both the inside and outside regions. It may be noted that no borrow pits were found as culturable in both the inside and outside the embankment of MDIP.

In culturable ponds in the inside, the production was 641.95 kg/ha and 561.07 kg/ha in 2003-2004 and 2004-2005, respectively which is inconformity

with the findings of MPO (1984). According to MPO (1984), the production in this type of ponds usually does not exceed 500 kg ha/yr. But, the production of the same type of ponds in the outside region of MDIP was at least 1274.89 kg/ha, which is more than double of the findings of MPO (1984).

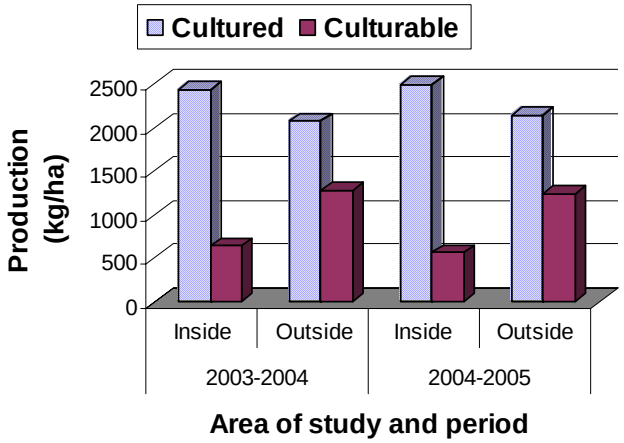


Fig. 9. Production of fishes in closed water (ponds and borrow-pits) on the basis type of culture both the inside and outside of MDIP in 2003-2004 and 2004-2005.

(d) Production based on the method of culture: It was observed that three types of methods of fish culture were practiced to produce fish in the ponds and borrow-pits during two years of study, such as extensive, improved-extensive and semi-intensive cultures. Generally in the borrow-pits, semi-intensive culture was not found. The semi-intensive culture was practiced in the ponds of the inside region only and showed the highest production (4574.42 kg/ha and 4646.51 kg/ha), followed by 2870.30 kg/ha and 2847.87 kg/ha by the improved-extensive culture and the lowest 1886.65 kg/ha and 1919.53 kg/ha by the extensive culture in 2003-2004 and 2004-2005, respectively. Similarly, the same tendency was observed in the ponds and borrow pits of the outside region by the improved–extensive and extensive cultures in both the years of study (2430.03 kg/ha and 2385.16 kg/ha) and (1754.89 kg/ha and 1888.24 kg/ha). In all types of culture methods, the production was higher in the inside region than that of the outside in both the years of study (Fig. 10).

The highest production (4574.42 kg/ha and 4646.51 kg/ha) was observed by the semi-intensive method and the lowest production (1886.65 kg/ha and 1919.53 kg/ha) was observed by the extensive method in two years of study in the inside, respectively, which is very high and not in conformity with the findings of Islam and Dewan (1986), who reported that the production of fish by the extensive culture was 500 kg/ha/yr and by the semi-intensive was 2725

kg/ha/yr. From the present findings, it may be mentioned that the fish culture practice has been developed scientifically and production increased gradually in MDIP area. Furthermore, Quddus *et al.* (2000) found that per hectare yield of the extensive, improved extensive and semi-intensive categories of culture were 1.3, 2.12 and 4.0 metric tons, respectively which support the present findings of yield in the extensive culture ponds (1.89 mt/ha), improved extensive culture ponds (2.87 mt/ha) and semi-intensive culture ponds (4.57 mt/ha) in 2003-2004 in inside of MDIP. According to Tripathi (1990), the yield rates of 2000 kg/ha/yr under the extensive and 5000-7000 kg/ha/yr under the semi-intensive systems are now easily possible which strongly supports the present findings.

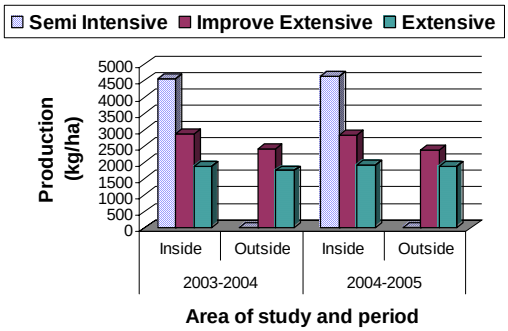


Fig. 10. Production of fishes in closed water (ponds and borrow-pits) on the basis method of culture both inside and outside of MDIP in 2003-2004 and 2004-2005

(e) Average production of fishes in closed water (ponds and borrow-pits): The average production of fishes in closed water (ponds and borrow pits) in the inside and outside of the regions of the embankment of MDIP was slightly higher in 2004-2005 than 2003-2004 (Fig.11). The average production was 2374.39 kg/ha in inside, whereas, 1984.32 kg/ha in the outside in 2003-2004. On the other hand, the average production was 2436.37 kg/ha in the inside and 2075.01 kg/ha in the outside region in 2004-2005.

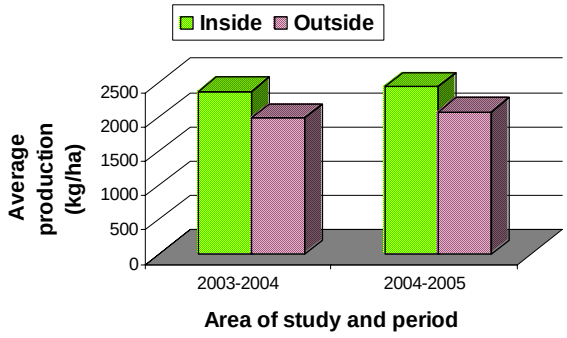


Fig. 11. Average production of fishes in ponds and borrow-pits both inside and outside of MDIP in 2003-2004 and 2004-2005

The average production was found 2374.39 kg/ha in 2003-2004 in the inside was slightly lower than the national average production of ponds (2609 kg/ha) in 2003-2004 and the average production found 2436.37 kg/ha in 2004-2005 in the inside region is almost similar to the national average production of ponds (2482 kg/ha) in 2004-2005. In contrast, the average production was found 1984.32 kg/ha and 2075.01 kg/ha in 2003-2004 and 2004-2005, respectively in the outside region is less than that of national average production in the aforementioned years (BFRSS 2004 and 2005). ADB (2005) reported that culture fisheries was developed in the MDIP area due to the small scale fisheries and aquaculture development within the irrigation command areas through extension services, organizational and management development support, and credit inputs to initiate small scale fresh water aquaculture, primarily in small ponds, for the poor. FAP-12(1992b) and Ali (1994) reported that average pond production in the MDIP area was 1400 kg/ha and calculated that gained 400 kg/ha. So, the present average production indicates that culture fisheries production the increased in the MDIP area gradually.

The data obtained by different types of surveys from both the inside and outside of the embankment of MDIP were processed and analyzed with the help of computer software, i.e. Microsoft Excel, SPSS etc. SPSS for Windows version 10.0 was used to process the collected data. Both pair and independent t-test test were performed to know the significant difference between the data of the inside and outside regions of MDIP. It was observed that there is a difference between the average production of fish (kg/ha) of the inside and outside closed water bodies of MDIP in both the years of study. When the difference is statistically tested it is observed that the difference in the closed water body (ponds and borrow-pits) fish production between the two zones during 2003-2004 and 2004-2005 was significant at 0.001 level ($p = 0.001$).

Acknowledgements: This paper is a part of Ph.D. research work of the first author. The authors gratefully acknowledge the Ministry of Fisheries and Livestock for granting deputation for the Ph. D. research work, and DFID and British Council for funding.

CONCLUSION

The culture fishery has been developed in the inside of the MDIP project area after the construction of Flood Control, Drainage and Irrigation (FCDI) Project works. The average production of fishes in the closed water (ponds and borrow pits) was higher in the inside than the outside of the regions in both 2003-2004 and 2004-2005. The significant difference ($p<0.001$) was found between the inside and the outside of the MDIP area. Overall production of the closed water

increased in the inside region, however, the production of culturable ponds was higher in the outside region.

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(Manuscript received on February 25, 2010; revised on September 7, 2011)