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OPEN WATER JALMAHALS OF KALAPARA UPAZILLA UNDER THE DISTRICT OF PATUAKHALI

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Abstract: The study was conducted to determine the present status of open water *Jalmahals* at Kalapara upazilla of Patuakhali district and their potentiality. The study identified a total of 296 *Jalmahals* (excluding major rivers) having a total area of 4754.14 acres and covering about 3.90% of the Upazilla area. Among the 296 *Jalmahals*, 246 *Jalmahals* were smaller in size (<21 acre), 32 were moderately medium (21-50 acre), 11 were medium (51-100 acre) and the rest 7 were larger in size (>100 acre). According to category, 173 were canals, 114 were khas ponds and only 9 were dighis. Based on functional type, 41 were found to be open, 83 were semi-closed and 172 were closed. Of the 296 *Jalmahals*, 88 were found to be leased out of which 90 were under fish culture activities. Some legal aspects and water quality parameters of 15 *Jalmahals* selected randomly based on the functional type (i.e. Open, Semi-closed, Closed) and categories (i.e. Canal, Dighi, Ponds) were also investigated. Water quality parameters studied were water depth, secchi depth, water colour, water temperature, pH, dissolved oxygen, salinity, types and density of submerged plants and density of water hyacinth. The variation in water quality parameters was found to be significant. The study has also identified the local crafts and gears used at the study area. Many of the *Jalmahals* were found to be fully covered with water hyacinth and neither culture program nor major fishing activity, were found there. It is suggested that those *Jalmahals*, which are not leased out for management, should immediately be taken up by the Government and be given to the genuine fishermen through lease for proper management.

Key words: Open water; Jalmahal; Fisheries management

Introduction

Open water in Bangladesh has great ecological, economic, commercial and socioeconomic importance. The inland capture fishery is based on the vast fresh water resources comprising of some 270 species of fin fish and shell fish. It also supports a significant range of other activities such as extraction of reed, harvesting of edible aquatic vegetation and their products, medicinal herbs, shells, etc. During the monsoon season, large scale migration of fish and prawn takes place through the open waters. For example, sexually mature individuals of river breeding fish like the local major carps (Rui, Catla, Mrigal, Kalibaush) migrate from the beels to their breeding grounds in the rivers to breed through canals and flood plains (DOF, 1995).

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Considering the status and potential, a large number of water bodies are traditionally called haors, baors, beels, rivers, canals, khas ponds, and dighis. They are the potential fisheries resources, which are also called the *Jalmahals*. These *Jalmahals* may be either open or closed water bodies. These are the common water resources used by the people living around the *Jalmahal* for a variety of purposes. These *Jalmahals* are leased out to the people through auction or through invitation of tenders by the Ministry of Land (MoL) whose main interest is to obtain the revenue. As a result, the leaseholder tries to catch even the last fish before expiry of his lease period. This leads to threaten the open water fisheries resources. The coastal region of Bangladesh especially Patuakhali is very rich as open water fisheries, but they are not giving desired production due to lack of proper management system.

In view of the above, the present study is aimed at finding out the present status of the *Jalmahals*, assessment of the state of their fish resources, their management systems and also to identify the future potential of the *Jalmahals* belonging to Kalapara upazilla.

Materials and Methods

This study was carried out from January to July, 1999. A format was first developed to collect information about the present status of the *Jalmahal* resources and their management policy. The data and relevant information were collected from various sources such as Upazilla Fisheries Office, AC Land Office, Union and Zilla Parishad Offices, ADC (Rev.) Office of Patuakhali District and Water Development Board.

Length and width of the *Jalmahals* were recorded to the nearest m to estimate their area. Area of the rivers could not be estimated as it was difficult to measure their length and breadth. The *Jalmahals* were categorized after FAP 17 (1994) as river, baor, canal, dighi and pond. They were further categorized arbitrarily as (1) Open: having no sluice gate but some sort of tidal fluctuation, (2) Semi-closed: having a sluice gate or a very narrow inlet/outlet device and (3) Closed: stagnant water bodies having neither sluice gate nor inlet/outlet devices.

Fifteen of the surveyed *Jalmahals* (three each from open, semi-closed, closed, dighi and pond type) had been selected randomly for studying some water quality parameters such as water depth, secchi depth, water colour, water temperature, salinity, pH, dissolved oxygen (D.O.) and area covered by water hyacinth and submerged plants. The selected open *Jalmahals* were, Dhulashar-Mithagonj canal (J_1), Arpangachia canal (J_2), and Masuakhali canal (J_3), situated in Mithagonj, Chakamuia and Dhankhali unions respectively. The selected semi-closed *Jalmahals* were Badurtali canal (J_4), Pakhimara canal (J_5), and Amtali canal (J_6), situated in Tiakhali, Nilgonj and Mithagonj unions respectively. The selected closed *Jalmahals* were Khaprabhanga canal (J_7), Tulatoli canal (J_8) and Chinguria canal (J_9) which were situated in Khaprabhanga, Latachapli and Lalia unions respectively. The three dighis selected were Kashem Mollah dighi (J_{10}), Wazut Ali Khan dighi (J_{11}) and Nasnapara dighi (J_{12}). The first two were situated in Dhulashar union and the last one was in Tiakhali union while the three ponds selected were Kuakata

Mouza Sarkary pond (J₁₃), Faridgonj Jame-Mosque Khas pond (J₁₄) and Red Crescent Killa pond (J₁₅), situated in Latachapli, Nilgonj and Dhulashar unions respectively.

Results and Discussion

A total of 296 *Jalmahals* (excluding major rivers) having a total area of 4754.14 acres were recorded. Variation in number and area of *Jalmahals* were found in different unions of Kalapara upazilla (Table 1).

Table 1: Union-wise distribution and extent of the *Jalmahals* in Kalapara upazilla

Name of Union	Area of Union (acre)	Area Covered by <i>Jalmahals</i>	Number of <i>Jalmahals</i>	Area of <i>Jalmahals</i> (acre)	Average Size (acre)
Kalapara Sadar	1868.29	1.23	11	22.98	2.09
Tiakhali	7082.32	2.88	20	204.25	10.21
Chakamuia	9388.50	10.67	17	1002.00	58.94
Dhankhali	15111.77	2.41	29	363.94	12.55
Lalua	12870.02	1.94	35	250.00	7.14
Mithagonj	18981.64	5.58	31	1059.62	34.18
Nilgonj	16704.86	3.42	69	571.29	8.28
Dhulashar	10972.00	1.75	27	191.69	7.10
Khaprabhanga	14121.87	3.10	24	437.33	18.22
Latachapli	14906.18	3.74	33	557.99	16.91
Total	122007.6	3.90	296	4754.14	16.06

Kalapara upazilla covered an area of 1,22,007.6 acres of which the *Jalmahals* was 3.90%. But the scenario is different in different unions of the Kalapara upazilla (Table 1). The maximum number of (69) *Jalmahals* were recorded from Nilgonj union but they covered only 3.4% of the union area as they were comparatively smaller (average area was 8.28 acres) in size. The minimum number (only 11) was recorded from Kalapara sadar union which was followed by Chakamuia union which harbors 17 *Jalmahals* but they covered 10.67% of the union area as they were bigger (average size 58.94 acres) in size. The area covered by *Jalmahals* in different unions of the Kalapara upazilla is shown in Fig.1.

Most of the *Jalmahals* (173) were canals, followed by ponds (114) and dighis (9). The number of closed *Jalmahals* was 172, followed by semi-closed (83) and open (41). The size of *Jalmahals* was found to vary from 0.1 to 494 acre (Table 2).

It was noticed that the smaller *Jalmahals* (<21 acre) were more in comparison to the larger ones. An inverse relationship has been found to exist between size of the *Jalmahals* and the number of *Jalmahals* leased out as well as between size of the *Jalmahals* and the number of *Jalmahals* under fish cultivation (Table 2). Water quality parameters as recorded from the fifteen selected *Jalmahals* have been presented in Table 3. Parameter wise they are presented as follows:

Water Depth: Water depth of the open *Jalmahals* was higher than that of the other two functional types (Table 3). Variation is found to be statistically highly significant both in case of functional types and categories (Table 4). Water invades the *Jalmahals* in the

Table 2. Relationship between size, category and status of the surveyed *Jalmahals*.

Size class (acre)	Freq	Size (acre)		Mean	Category			Functional type			Leased out	Under fish cultivation
		Min.	Max.		Canal	Dighi	Pond	Open	Semi cl.	Closed		
<21	246	0.1	20	30	123	9	114	25	56	165	83	82
21-50	32	21	48	16	32	0	0	9	18	5	4	5
51-100	11	54	89	11	11	0	0	2	8	1	1	3
>100	7	197	494	7	7	0	0	5	1	1	0	0
Total	296	0.1	494	64	173	9	114	41	83	172	88	90

Table 3. Mean water quality parameters as recorded from the 15 selected *Jalmahals* during the period from June to July, 1999.

Jalmahals	Open			Semi-closed			Closed			Dighis			Ponds		
Parameters	J ₁	J ₂	J ₃	J ₄	J ₅	J ₆	J ₇	J ₈	J ₉	J ₁₀	J ₁₁	J ₁₂	J ₁₃	J ₁₄	J ₁₅
W.depth (m)	72	72	73	25	26	28	29	29	3	18	19	1.1	1.6	1.3	1.6
S.depth (cm)	19	17	19	55	54	54	45	45	45	30	30	30	25	30	28
Colour	T	T	T	G	G	G	G	B	G	G	G	G	G	G	G
Temp. (°C)	21	21	20	22	22	22	22	22	22	20	20	18	22	21	21
Salinity (ppt)	11	11	12	1	1	1	0	0	0	0	0	0	0	0	0
pH	8.7	8.7	8.7	8.3	8.3	8.3	8.3	8.3	8.3	8.5	8.5	8	7.8	8.4	7.9
D.O. (mg/l)	5	5	5	4.3	4.4	4.3	4.5	4.5	4.5	4.5	5	4.4	4.6	4.5	5
% of water hyacinth	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
% of submerged plant	0	0	0	0	0	0	75	65	100	100	100	100	100	100	85

T= Turbid, G=Green and B=Brown; SD= Standard deviation; W. Depth= Water depth; S. depth= Secchi depth; Temp= Temperature; D.O.= Dissolved oxygen

rainy season (May-June), and reaches the maximum level in September and thereafter starts dropping down sharply. Similar phenomenon was observed by Ehshan *et al.* (1997) in Chanda beel at the Faridpur-Madaripur belt of Bangladesh and by Hasanat *et al.* (1996) in the river of Old Brahmaputra. The study program was conducted in the month of June-July, so, water depth of all the surveyed *Jalmahals* was higher at that time. The water depth is very important for aquaculture in case of small water bodies it should be 2m, where there is arrangement of regular water supply (Rahman, 1992). When water depth is more, it affects the fish growth, but optimum water depth is very much helpful for fish growth. The results obtained in the present study are disappointing. So, for

implementation of the fishery management activities, such as aquaculture, cage culture, pen culture or establishment of sanctuary, this area will provide a good management environment.

Secchi Depth: Secchi depth as recorded from the open *Jalmahals* was lower than that of the other categories of *Jalmahals* (Table 3). Both month to month variation as well as category to category variation were found to be highly significant (Table 4). Recording of the lower secchi depth in the rainy season agrees with the findings of Bala (1997) who found it to vary only in open *Jalmahals*, but remain unchanged in closed *Jalmahals*. In semi-closed *Jalmahal*, the standard secchi depth should be 50 to 75 cm (Pillay, 1993). So all the semi-closed *Jalmahals* which were selected for the present study were good.

Water Colour: Water colour was found to be related to secchi depth reading. The secchi reading was lower in turbid water. In open *Jalmahals*, the water colour was turbid due to mixing of the silt (Table 3). Water colour of the semi-closed and closed *Jalmahals* was found to be almost green. Green and brownish green water colour is suitable for the growth of fish species (Bala, 1997). But in some closed *Jalmahals*, water colour was not greenish due to excess growth of water hyacinth as it was in case of Tulatoli canal which was 100% covered by water hyacinth.

Table 4. ANOVA table showing significance of water quality parameters of 15 selected *Jalmahals*.

Parameter	Treatment	Sum of squares	df	Mean square	F	Significance
Water depth	Between groups	71.438	4	17.86	23.213	*** .000
	Within groups	30.776	40	0.769		
	Total	102.214	44			
Secchi depth	Between groups	8799.867	4	2199.967	155.109	*** .000
	Within groups	567.333	40	14.183		
	Total	9367.2	44			
Temperature	Between groups	41.222	4	10.306	9.867	*** .000
	Within groups	41.778	40	1.044		
	Total	83	44			
Salinity	Between groups	560.356	4	140.089	138.549	*** .000
	Within groups	40.444	40	1.011		
	Total	600.8	44			
pH	Between groups	3.901	4	0.975	4.368	*** .005
	Within groups	8.931	40	0.223		
	Total	12.832	44			
DO	Between groups	6.812	4	1.703	4.731	***.003
	Within groups	14.4	40	0.36		
	Total	21.212	44			

*** Highlt significant; ** Significant; * Not significant

Water Temperature: Water temperature of all the *Jalmahals* was found to be similar (Table 3). Water temperature is highly synergistic with the air temperature as also reported by Ismail *et al.* (1984) and Begum *et al.* (1989). Bangladesh is in the sub-tropical and tropical region, so, water temperature gradually decrease from June to December and increase from December to June within a range of 24 to 34°C (Munir and Huda, 1997).

Salinity: Saline water was found in the open and semi-closed *Jalmahals* as they had some connection with the Bay of Bengal (Table 3). A maximum of 12 ppt salinity was recorded from the open *Jalmahals* (Table 3). Variation in salinity was found to be highly significant (Table 4). Some of the fresh water fishes especially some Indian major carps such as *Labeo rohita*, *Catla catla* etc. can tolerate salinities up to 12 ppt and sometimes even grow better in salinities of about 5 ppt (Pillay, 1993). The salinity of closed *Jalmahals* was found to be zero (Table 3).

pH: pH of all the *Jalmahals* was to be found almost similar and it was in the alkaline range (Table 3). pH is considered to be an important factor in fish culture. Ruttner (1953) stated that a eutrophic lake normally maintains alkaline pH. Slightly alkaline water is good for fish species (Pillay, 1993).

Dissolved Oxygen: The amount of dissolved oxygen as recorded from the different *Jalmahals* was more or less similar and was in the desired range (Table 3). As oxygen regulates most of the processes of plants and animals, it is the most important factor in both aquatic and terrestrial environment (Rahman, 1992). DoE (1991) reported that the standard range of dissolved oxygen in any waterbody should be 4-5 ppm for fish survival.

Water Hyacinth: Water hyacinth was found in some closed *Jalmahals* only (Table 3). The water hyacinth is considered to reduce the productivity of water through uptake of nutrients, reduce amount of dissolved oxygen and pH value due to bacterial decomposition. However no water hyacinth was found in open and semi-closed *Jalmahals*, because they were nearer to saline water, probably the saline water is not suitable harmful for the growth of water hyacinth. Water hyacinth may provide shelter to the fish from excessive sunlight, assist in spawning of some species of fish. Bala (1997) reported that water hyacinth is also used for building the fish sanctuary. Water hyacinth is an excellent fertilizer as its ash contains potash and lime (Barret, 1989).

Submerged Plants: Submerged plants were found in all the surveyed closed *Jalmahals* (Table 13). The submerged plants as recorded were *Najas marina* (30%), *Ceratophyllum* (75%), *Hydrilla* (75%), *Najas indicus* (80%) and flagellum algae (15%). No submerged plant was found in the surveyed open and semi-closed *Jalmahals*. Bala (1997) reported that open and semi-closed *Jalmahals* may not contain the submerged plants. *Ceratophyllum* is good for grass carps (Pillay, 1993).

Management of the Jalmahals: Large *Jalmahals* (>20 acre) were under the administrative control of the MoL, Ministry leases them out to the local people through tender. As a result, it was found that suitable large productive *Jalmahals* were found to be controlled by the non-professional local elites and were not good management. Similar situation was reported by Talukdar (1993). A lot of *Jalmahals* was found beset with conflicts. The parties involved in conflict were village groups, local elites (influential), different communities, people from different localities etc. The root causes, of the conflicts were encroachment by the influential person(s), conflict between local and non-local people, improper leasing system etc.

Lease period appeared to be very short i.e. usually for 3 years, but for development may be extended up to 7 years. Increase of lease money by 10% per year was reported to be a great problem for the marginal fishermen. Lack of coordination was notice among the Government, Non-Government and Fisher Societies, especially in case of management of *Jalmahals*. So, following measures should be taken for development of the *Jalmahals* and for sustainability of their production:

Administrative control of all the *Jalmahals* should be transferred from the MoL to MoFL as early as possible. A new *Jalmahal* management policy should be adopted to ensure due to right of the poor fishermen in *Jalmahal* management. A good credit disbursement system should be adopted for marginal fishermen. Coordination among the Government, Non-Government and Fisher societies should be strengthened. Long term (15-20 years) leaseing policy should be adopted. Lease should be given only to the genuine fishermen. Increase in lease value should be commensurate with the increase in production and market price of fish. A conceptual framework should be developed to designate all the people, who are living in the close vicinity of the *Jalmahals*, as fisher or fisheries people.

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