

Present Status of Fish Biodiversity: Two Types Rain-Fed Waterlogged Paddy Lands in Bangladesh

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Abstract: Investigation was carried to find out the abundance and present status of local ichthyo-diversity and production status of managed and unmanaged rain-fed waterlogged paddy lands (rain-fed waterlogged paddy lands i.e *Dogis*) in 2012. Total area of the managed and unmanaged *Dogis* was 30.76 ha and 29.15 ha respectively. Soil and water quality parameters of the managed *Dogis* were more or less similar to acceptable limits but varied in the unmanaged *Dogis*. In six managed *Dogis*, 35 species under 27 genera were found whereas 22 species of SIS and SRS were naturally recruited. In the unmanaged *Dogis*, only 20 species of SIS under 14 genera were found and all of them are in near extinct condition in the area. A total of 25 SIS and SRS species were recorded in two study areas where 11 species are threatened. Average fish production in the managed *Dogis* and unmanaged *Dogis* was 648.8 kg ha⁻¹ and 47.29 kg ha⁻¹ respectively. Fish production in unmanaged *Dogis* was 13 times lower than the managed *Dogis*. The most significant message of this investigation is that due to lack of management vast *Dogis* can't contribute in the country's total fish production and current ichthyo-diversity is decreasing. It is important to take management steps for the unmanaged *Dogis* through community engagement to convert an unproductive area into a productive one. These will provide the SIS and SRS suitable habitat for their sustainability.

Key words: *Dogi* • Environmental Parameters • Biodiversity • Fish Production

INTRODUCTION

The rain-fed waterlogged paddy land is locally known as *Dogi* comprising an area more than 8 acre [1]. Bangladesh has the third largest aquatic fish biodiversity in Asia, after China and India, with about 800 species in fresh, brackish and marine waters [2]. The rivers, tributaries, *beels* (permanent and seasonal lakes and wetlands), *baors* (oxbow lakes), *haors* (large deeply flooded depressions) and floodplains support some 289 fish species [3]. There are more than 150 Small Indigenous Species (SIS) and Self Recruiting Species (SRS) of fish in the floodplains of Bangladesh [4]. These provide and

meet the demand of nutrition to local people especially to the poor [5]. Traditionally in the rainy season, *Dogis* have been utilized as a community fishery and a source of aquatic plants by poorer, landless people in the community. Generally, the fishery comprised mainly SIS and SRS of fish. Complete drying during winter season, no natural recruitment during rainy season and no recruitment by the community is the feature of *Dogi*. As a result, local ichthyo-diversity is becoming extinct in the *Dogi* year after year. Besides, the large water body is remaining as unutilized. The SIS of fish occupies an important position in the popular food items of Bangladesh [6]. Through community engagement, in

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addition with increasing production by stocking carps in the *Dogis*, they should be conserved for their common availability and sustenance throughout the country.

MATERIALS AND METHODS

Study Area and Period: Present study was conducted on two types of *Dogi* such as managed and unmanaged. Six managed *Dogis* (Fig.1) were selected at Ramganj in Lakshmipur District, namely Amirpur, Devnagar, Dudrajpur, Miribari, Nandiara and Nolchera. Another six unmanaged *Dogis* (Fig. 2) were selected at Chatkhil in Noakhali, namely Bepari Bari, Kobiraj Bari, Adam Market, Janata Bazar, Poranpur and Badalkot. The duration of the research work was from July 2012 to December 2012.

In Chatkhil, primary data was collected through personal communication by using a semi-structured questionnaire with community people of the area. Ichthyo-diversity and production status data was collected through focus group discussion (FGD) in the month of November to December 2012. At the beginning of the interview a brief introduction about the objectives of the study was given to the audience and assured them that all information would be kept confidential. The collected data from the community information were checked to justify. In Ramganj, secondary data was collected from an NGO namely ERDA (Environmental Resources and Development Alternatives). The NGO is responsible to involve community in the *Dogis* in Ramganj for the conservation of ichthyo-diversity and increasing production.

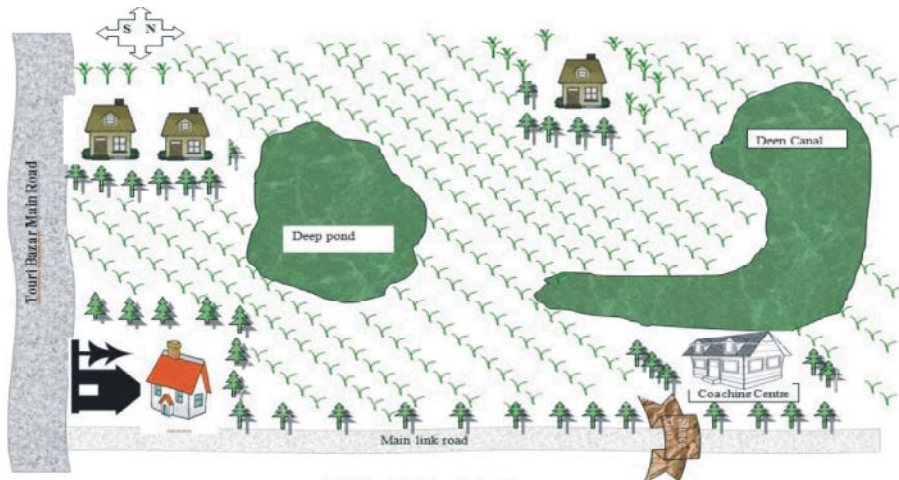


Fig. 1: Structural map of managed dogi (Amirpur Dogi) in Ramganj (Source: Environmental Research and Development Alternatives (ERDA) Office, Noakhali, Bangladesh).

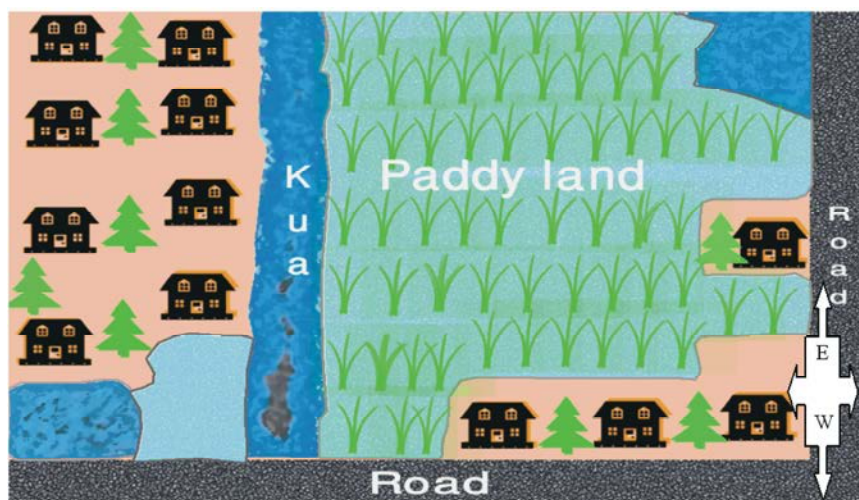


Fig. 2: Structural map of unmanaged *dogi* (Bepari bari *Dogi*) in Chatkhil.

Determination of Soil Quality: Soil sample was collected from *Dogi* and *Kua* (Deep pond in the *Dogi*). Random sampling was followed. The sample was collected from three places and then mixed. Finally, a final sample was taken which was dried in under indirect sunlight. After drying it was powdered and quality was measured.

Soil pH measurement was done with HANNA HI 9210N ATC pH Meter. The potassium (K) content in the soil was determined by measuring the contents of directly in the soil extract using a flame photometer (JENWAY PFP-7). The phosphorus (P) and sulphur (S) content in the soil was determined by reading the absorbance using a Spectrophotometer (T80).

Determination of Water Quality: Suitable water quality parameters play an important role on adaptability, growth, reproduction and so on. Geography of the area is responsible for the betterment of water quality parameters such as physical factors, chemical factors etc. Water quality parameters such as Temperature, Dissolved oxygen (DO), Hydrogen ion concentration (pH) were recorded monthly, generally during the middle of each month.

Thermometer is used to measure water temperature of *Dogis*. DO was measured by HANNA Instruments HI 9146 Portable Water proof Microprocessor Dissolve Oxygen Meter with the range 0.00 to 45mg/L O₂. pH was calculated by direct method by using HANNA Instruments pHep HI 96107 Pocket sized pH meter.

Data Processing and Analysis: The collected data were summarized, scrutinized and recorded carefully by the standard methods. Finally relevant tables were prepared in accordance with the objectives of the study. Microsoft office 2007 was used for data analysis.

RESULTS AND DISCUSSION

Total area of six managed *Dogis* was 76 acre (30.78 hectare). Vegetation was low in four *Dogis* and moderate vegetation was in two *Dogis*. Water color was light greenish to greenish. There are at least two sanctuaries in each *Dogi* where no fishing activity takes place during the dry season. Total area of six unmanaged *Dogis* was 72 acre (29.15 hectare). Vegetation was higher in four *Dogis* and moderate vegetation was found in two *Dogis*. Water color was dark to pale. No sanctuaries were in the *Dogis*. Aquatic weeds and plants are dried and utilized

as fuel in Ramgonj. But in Chatkhil small amount of vegetation is utilized as fuel and the remaining is decomposed in the lands as community believes that it will act as fertilizer. Decomposition may cause higher S content in the soil.

In the managed *Dogis* average soil pH, K, P and S was 6.90, 0.025 Meq/100 g soil, 13.67 µg/g soil and 24.67 µg/g soil respectively. Average soil pH, K, P and S in the unmanaged *Dogis* was 5.40, 0.047 Meq/100 g soil, 7.67 µg/g soil and 36.67 µg/g soil respectively. According to BARC [7] pH near 7 is optimum for adequate availability of nutrients in the bottom soil. Adhikari [8] observed that the best way to counter water pH problem is to lime the pond to increase the soil pH to greater than pH 6-8. Soil pH of the managed *Dogis* is within the recommended level. The community use lime to increase the soil pH. Jhingran [9] recorded that sediments less than 30 ppm available P are poor, 30-60 ppm is average and above 60 ppm is optimal. The P, K and S level of managed *Dogis* was found within the limits as described by BARC [10] but varied in the unmanaged *Dogis*. According to Swann [11] all the body functions of fish are performed in water. Thus it is important to maintain suitable water quality parameters. Water quality parameters were varied in both study area during the study period (July-September) except salinity. Salinity was 0 ppm in two study area. Average temperature, DO and pH in the managed *Dogis* were 29.91°C, 4.38 ppm and 8.20 respectively. On the other hand, average temperature, DO and pH in the unmanaged *Dogis* were 29.77°C, 3.59 ppm and 6.30 respectively. Asadujjaman *et al.* [6] recorded temperature 25.20°C to 29.76°C and pH 7.89 to 9.13 in Fisheries Field Laboratory complex Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh which is similar to managed *Dogi*. The temperature, DO and pH content of pond waters should be in the range of 24-32°C, 5 ppm and 6-9 respectively for good growth of fish [12 and 13]). Bhatnagar *et al.* [14] also recommended that DO concentration of 1-3 ppm has sub-lethal effect on growth and feed utilization; 0.3-0.8 ppm is lethal to fishes. The water quality of managed *Dogi* was within the recommended value but was not satisfactory in the unmanaged *Dogi* except temperature. In the managed *Dogis* suitable water quality parameters is the result of managing the *Dogis* through community engagement. Water and soil quality deterioration in the unmanaged *Dogis* is higher and increasing due to decomposition of vegetation, low light penetration, lack of management and so on.

Table 1: Ichthyo-diversity in six managed *Dogis* in Ramganj

Order	Family	Genus	Species	Local Name	
Beloniformes	Belontiidae	<i>Xenentodon</i>	<i>Xenentodon cancila</i>	Kakila	
Channiformes	Channidae	<i>Channa</i>	<i>Channa striatus</i>	Shol	
			<i>Channa punctatus</i>	Taki	
			<i>Channa marulius</i>	Gajar	
Cypriniformes	Cyprinidae	<i>Amblypharyngodon</i> <i>Aristichthys</i> <i>Barbonemus</i> <i>Catla</i> <i>Cirrhinus</i> <i>Ctenopharyngodon</i> <i>Cyprinus</i> <i>Esomus</i> <i>Hypophthalmichthys</i> <i>Labeo</i>	<i>Amblypharyngodon mola</i>	Mola	
			<i>Aristichthys nobilis</i>	Bighead Carp	
			<i>Barbonemus gonionotus</i>	Thai Sarputi	
			<i>Catla catla</i>	Catla	
			<i>Cirrhinus mrigala</i>	Mrigal	
			<i>Ctenopharyngodon idella</i>	Grass Carp	
			<i>Cyprinus carpio</i>	Common Carp	
			<i>Esomus danricus</i>	Darkina	
			<i>Hypophthalmichthys molitrix</i>	Silver Carp	
			<i>Labeo rohita</i>	Rui	
			<i>Labeo gonius</i>	Gonia	
			<i>Labeo calbasu</i>	Kalibaus	
			<i>Labeo bata</i>	Bata	
			<i>Puntius ticto</i>	Tit Puntii	
			<i>Puntius sophore</i>	Jat Puntii	
			<i>Salmostoma phulo</i>	Fulchela	
			Cobitidae	<i>Lepidocephalus</i>	<i>Lepidocephalus guntea</i>
<i>Clarias</i>	Magur				
Claridae	<i>Clarias</i>	<i>Clarias batrachus</i>	Magur		
		<i>Heteropneustes</i>	Shing		
Heteropneustidae	<i>Heteropneustes</i>	<i>Heteropneustes fossilis</i>	Shing		
		<i>Pangasius</i>	Thai Pangas		
Schilbeidae	<i>Pangasius</i>	<i>Pangasius hypophthalmus</i>	Thai Pangas		
		<i>Mystus</i>	Bajuri Tangra		
Bagridae	<i>Mystus</i>	<i>Mystus tengara</i>	Bajuri Tangra		
		<i>Mystus cavasius</i>	Kabasi Tangra		
Clupeiformes	Notopteridae	<i>Notopterus</i>	<i>Notopterus notopterus</i>	Foli	
Perciformes	Mastacembelidae	<i>Mastacembelus</i>	<i>Mastacembelus pancalus</i>	Guchi Baim	
			<i>Oreochromis</i>	Tilapia	
	Anabantidae	<i>Anabus</i> <i>Colisa</i>	<i>Anabus testudinus</i>	Koi	
			<i>Colisa fasciatus</i>	Khailsha	
			<i>Colisa lalia</i>	Boicha	
	Nandidae	<i>Nandus</i>	<i>Nandus nandus</i>	Bheda	
			<i>Chanda</i>	Nama Chanda	
	Ambassidae	<i>Chanda</i>	<i>Chanda nama</i>	Nama Chanda	
			<i>Pseudambassis</i>	<i>Pseudambassis beculis</i>	Chanda

Table 2: Ichthyo-diversity in six unmanaged *Dogis* in Chatkhil

Order	Family	Genus	Species	Local Name		
Cypriniformes	Cyprinidae	<i>Amblypharyngodon</i> <i>Esomus</i> <i>Puntius</i>	<i>Amblypharyngodon mola</i>	Mola		
			<i>Esomus danricus</i>	Darkina		
			<i>Puntius ticto</i>	Tit Puntii		
			<i>Puntius sophore</i>	JatPuntii		
			Cobitidae	<i>Lepidocephalus</i>	<i>Lepidocephalus guntea</i>	Gutum
					<i>Clarias</i>	Magur
			Heteropneustidae	<i>Heteropneustes</i>	<i>Heteropneustes fossilis</i>	Shing
<i>Mystus</i>	Bajuri Tangra					
Channiformes	Channidae	<i>Channa</i>	<i>Channa striatus</i>	Shol		
			<i>Channa punctata</i>	Taki		
			<i>Channa marulius</i>	Gajar		
			<i>Channa gachua</i>	Cheng		
Perciformes	Mastacembelidae	<i>Mastacembelus</i>	<i>Mastacembelus pancalus</i>	Guchi Baim		
			<i>Macrogathus aculeatus</i>	Tara Baim		
	Anabantidae	<i>Anabus</i> <i>Colisa</i>	<i>Anabus testudineus</i>	Koi		
			<i>Colisa fasciatus</i>	Khailsha		
			<i>Colisa lalia</i>	Boicha		
	Nandidae	<i>Nandus</i>	<i>Nandus nandus</i>	Bheda		
			<i>Chanda</i>	Nama Chanda		
Ambassidae	<i>Chanda</i>	<i>Chanda nama</i>	Nama Chanda			
Beloniformes	Belontiidae	<i>Xenentodon</i>	<i>Xenentodon cancila</i>	Kakila		

Table 3: List of threatened fish in the managed and unmanaged *Dogi*

Sl. No.	Scientific name	Local name	National status
01	<i>Channa marulius</i>	Gozar	E
02	<i>Labeo bata</i>	Bata	E
03	<i>Mastacembelus pancalus</i>	Guchi Baim	E
04	<i>Nandus nandus</i>	Bheda	V
05	<i>Chanda nama</i>	Nama Chanda	V
06	<i>Pseudambassis beculis</i>	Lal Chanda	V
07	<i>Macrornathus aculeatus</i>	Tara Baim	V
08	<i>Channa gachua</i>	Cheng	V
09	<i>Puntius ticto</i>	Tit Punt	V
10	<i>Mystus cavasius</i>	Kabasi Tangra	V
11	<i>Notopterus notopterus</i>	Foli	V

*(E=Endangered and V= Vulnerable)

In the six managed *Dogis* in Ramganj, 35 species under 27 genera, 14 Family, 5 Order were found (Table 1). Within 35 recorded species, 22 species were naturally recruited and 13 species were introduced (4 indigenous major carps and 9 exotic fishes) by the farmers community. In the six unmanaged *Dogis* in Chatkhil, 20 species under 14 genera, 11 Family, 4 Order were recorded (Table 2). A total of 37 species were found in both study area (managed and unmanaged). 24 species were naturally recruited SIS and SRS and 11 species were carps, 1 cichilid and 1 catfish. Fulchela (*Salmostoma phulo*) and Chanda (*Pseudambassis beculis*) were only found in managed *Dogis*. Cheng (*Channa gachua*) and Tara Baim (*Macrornathus aculeatus*) were only found in unmanaged *Dogis*. Local community is not willing to introduce carps in the unmanaged *Dogis* due to knowledge gap and social instability. Shamim Ahmed *et al.* [15] studied nutrient values of 35 fishes collected from *Dogi* at Ramganj in Lakshmipur which is similar to present findings of managed *Dogi*. Amin *et al.*, [4] identified a total of 61 SIS of fish and 16 threatened SIS and SRS of fish were locally common available in the Northwest part of Bangladesh. Hossain and Ahmed [16] recorded a total of 32 species from different treatments *viz.* 30 from *Matshyarani* fish sanctuary and 25 and 24 species from 1 km upstream and downstream of the sanctuary in the river Old Brahmaputra. Hoq [17] recorded in Chalan Beel a total of 121 species of SIS including 41 riverine species, 29 migratory species and 51 flood plain species. In the present study number of of SIS and SRS is lower in managed and unmanaged *Dogi* than the other study.

Fifty four fish species are considered as threatened species by IUCN [18] in Bangladesh. Eleven threatened (3 endangered and 8 vulnerable) SIS and SRS of fish are found in the two study area (Table 3). The list of threatened species in the present study is lower than the findings of Amin *et al.*, [4] in the North western part of

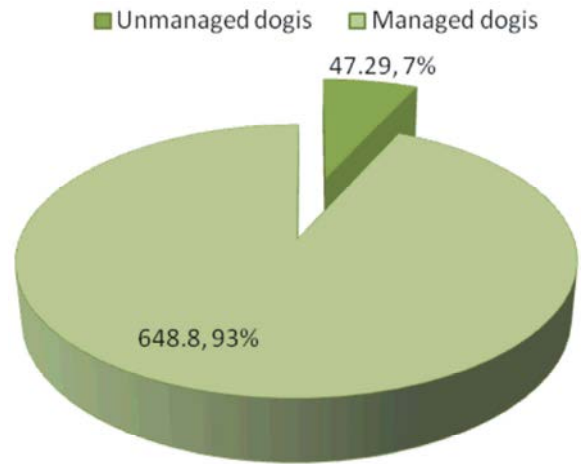


Fig. 3: Total production (Kg/ha and percentage) both managed and unmanaged *Dogis*

Bangladesh. In the managed *Dogis* SIS and SRS are not vulnerable to be extinct because of habitat management and establishing sanctuary. As a result of sanctuary establishment, SIS and SRS recruitment is not required for next year. In the unmanaged *Dogis* SIS and SRS are in the most vulnerable condition because of water and soil quality deterioration, water stagnant, no scope of entrance, no stocking, complete drying of *Kua* etc. As a result SIS and SRS species is decreasing year after year and will become extinct from the *Dogi* within short time.

Total fish production in the managed *Dogis* in Ramganj was found 648.8 kg ha⁻¹ (Fig. 3) where wild species production was 189.44 kg ha⁻¹. Total wild species production was 29.2% and introduced species production was 70.8%. Highest total production 715.56 kg ha⁻¹ was found in Nolchera *Dogi* and lowest total production 583.15 kg kg ha⁻¹ was found in Devnagar *Dogi*. Highest wild species production 209.35 kg ha⁻¹ was found in Nandiara *Dogi* and lowest wild species production 143.7 kg ha⁻¹ was found in Devnagar *Dogi*. In the unmanaged *Dogis* in Chatkhil no fish species was introduced. Only wild fish species production 49.29 kg ha⁻¹ was found in six *Dogis* (Fig. 3). Highest total production 62.45 kg ha⁻¹ was found in Poranpur *Dogi* and lowest total production 35.23kg ha⁻¹ was found in Bepari Bari *Dogi*. After comparing total production of two areas managed *Dogis* contribution was 92.4% whereas in the unmanaged *Dogis* contribution was only 7.60%. Wild species in the managed *dogis* contribution was 79.35% whereas in the unmanaged *Dogis* contribution was 20.65%. Mondol and Rahman [19] found that fish production in 2010 was 1257 kg/ha, 850 kg/ha and 845 kg/ha at Chaitali, Daxin

Sankarpur and Al-amin *Dogi* respectively in three community based fish culture management system in the rain-fed waterlogged paddy lands, Chatkhil, Noakhali. The present production of managed *Dogis* is more and less similar to the findings of Mondol and Rahman [19]. In the managed *Dogis* in Ramganj, the wild species are observed in more sustainable condition. The *Dogi* Management Committee (DMC) in Ramganj was established sanctuary and take management steps to conserve SIS and SRS of fish. Women's were also engaged in conserving ichthyo-diversity as they are half of the community.

CONCLUSION AND RECOMMENDATION

It is cleared that proper management of *Dogi* will contribute in the country's total fish production and in the economy. Due to negative environmental factors, agricultural activity, over exploitation, environmental degradation and destructive fishing practices by local resource user's diversity of SIS and SRS of fish is lower in unmanaged *Dogis* and will be decreasing year after year. Increased fish production using an equitable and inclusive community based approach has led to increased income and food security. It is significant and urgent to take all necessary steps to protect and conserve all the most and least available SIS and SRS in the *Dogi* in addition with a purpose of proper utilization of unproductive water body. It is also recommended that the CBFM approach should be extended to other *Dogi* as a key policy for the development of fisheries resources in Bangladesh.

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