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Present status and exploitation of nile tilapia, *Oreochromis niloticus* (Linnaeus, 1758) in kaptai lake, Bangladesh

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Abstract
A study was carried out in the Kaptai Lake of Bangladesh to determine the present condition of Nile tilapia (*Oreochromis niloticus*), tilapia fishers, fishing gears, catch records and management policies. Data were collected by personal observation and other participatory methods in a year. It was found that tilapia productions were high in 1999-2000 (160.83 mt, 2.94%) and in 2000-01 (180.78 mt, 3.51%), respectively. In 2008-09, tilapia production was comparatively very low (31.85 mt, 0.86%) where lowest contribution (0.70%, 43.04 mt) in 2011-12 fiscal year. Professional, seasonal professional and subsistence fisherman were found to catch tilapia. Highest and lowest amount of catch were found in lift net (32%) and cast net (3%); and longest and shortest fishing durations were found in current net (13hrs/day) and cast net (4hrs/day), respectively. For being an exotic fish species, tilapia was being neglected for specific management practices to protection.

Keywords: tilapia, tilapia fishers, exploitation, protection, management

Introduction
Nile tilapia (*Oreochromis niloticus*) is an African native fish found versatile in the rivers and lakes, is now transplanted to many other countries including Bangladesh due to its high ability of tolerance to wide ranges of environmental conditions. The introduction of *O. niloticus* was first initiated in Bangladesh in 1974 with the hope that it would make significant contribution in fish production and insect control [1]. The Department of Fisheries (DoF) was first introduced tilapia into floating cages in Kaptai Lake under a cage culture project in 1982. Getting escaped from the cages and because of having prolific breeding ability, tilapia was first observed in 1986 and established itself successfully in this Lake. Since then it contributes a good proportion of the total catch and also provided food and nutrition.

Kaptai Lake is one of the largest man-made freshwater reservoir in South-East Asia [2], was created in 1961 by damaging the river Karnaphuli at Kaptai, mainly to provide electricity by hydropower. The reservoir covers an area of approximately 58,300 ha (68,800 ha at full surface level) and constitutes a significant component of inland water resources accounting for 46.8% of the total pond area of Bangladesh [3]. The present contribution from this fishery is around 6,000 mt. per annum, with high annual fluctuation [4].

The fish fauna of the lake was first investigated in 1966 and listed 27 sp. [5]. Compiling the information on limno-biological parameters and fisheries management of the lake, some important management options were suggested [6-11] with limited studies on socioeconomic aspects were also suggested [3, 12-13]. Hye mentioned 58 sp. of fish from Kaptai Lake [14]. A total of 66 indigenous and 5 exotic sp. of fishes were listed [15]. A few *O. niloticus* was first observed in Kaptai Lake in 1986-1987 when it contributed numbers of 0.55 mt (0.017%). Catches of this species has increased too gradually till 1989-90, then started sharp rise and reached the peak in 1992-93 (72.7 mt, 1.75%) [16].

In Kaptai Lake, most of the fishermen are involved in tilapia catching specially the subsistence and commercial fishers. Subsistence fishermen usually sell their catch in the local markets, but the commercial fishermen have to sell their catch to the commission agents or to the fish fish traders. Though there are no specific tilapia fishers but the fishermen who are engaged in fish harvesting on the lake, catch a great amount of tilapia daily.

Fishing operations in the Kaptai reservoir were first started in January 1963 by small groups of fishermen with only three types of gear, namely: seine nets, gill nets, and hooks and lines [17]. For catching tilapia, both destructive and non-destructive gears are used by the fishermen. Most of the fishermen use dharma jal (lift net), ber jal (seine net), cast net, hand lines, current net (gill net) etc. and also a fishing technique known as 'Jak fishery' (Fish aggregating devices) which is made by banned brush shelter or bush shelter. In Kaptai Lake an estimated 1,000 brush shelters were in operation [3].

The lake fishery is being managed by the BFDC (Bangladesh Fisheries Development Corporation). The corporation issues fishing licenses and establish fishing regulation. During spawning season (March-June), fishing is banned by the authority and as a result fishing of tilapia does not occur. For this, the production and the population number also increases. Problems encountered in the culture of *O. niloticus* is that it is extremely difficult to keep the population down due to its quick breeding habits resulting in overcrowding and stunting of the stock. So, the present study was undertaken to know the present status of tilapia, tilapia fishers, fishing gears, catch records, marketing systems and the existing management practices of tilapia to protection.

2. Materials and Methods

In order to collect relevant information survey method was followed. By this technique the information were collected by the memory of the adjacent people specially the fisherman as per interview and from the fish culturist and the fish marketing officer of BFDC. For this study a combination of questionnaire interview, Participatory Rural Appraisal (PRA) tool such as Focus Group Discussion (FGD) and cross-check interviews with key informants were used for fishermen.

2.1 Study area and duration

Based on the concentration of tilapia fish production, Kaptai Lake of Rangamati district was considered for this study (Fig. 1). The data were collected in respect of tilapia fishery in the Kaptai reservoir for one year from July 2014, to June 2015 to fulfill the requirement of the research objectives. The study was based on field survey where primary data were collected from the Kaptai Lake.

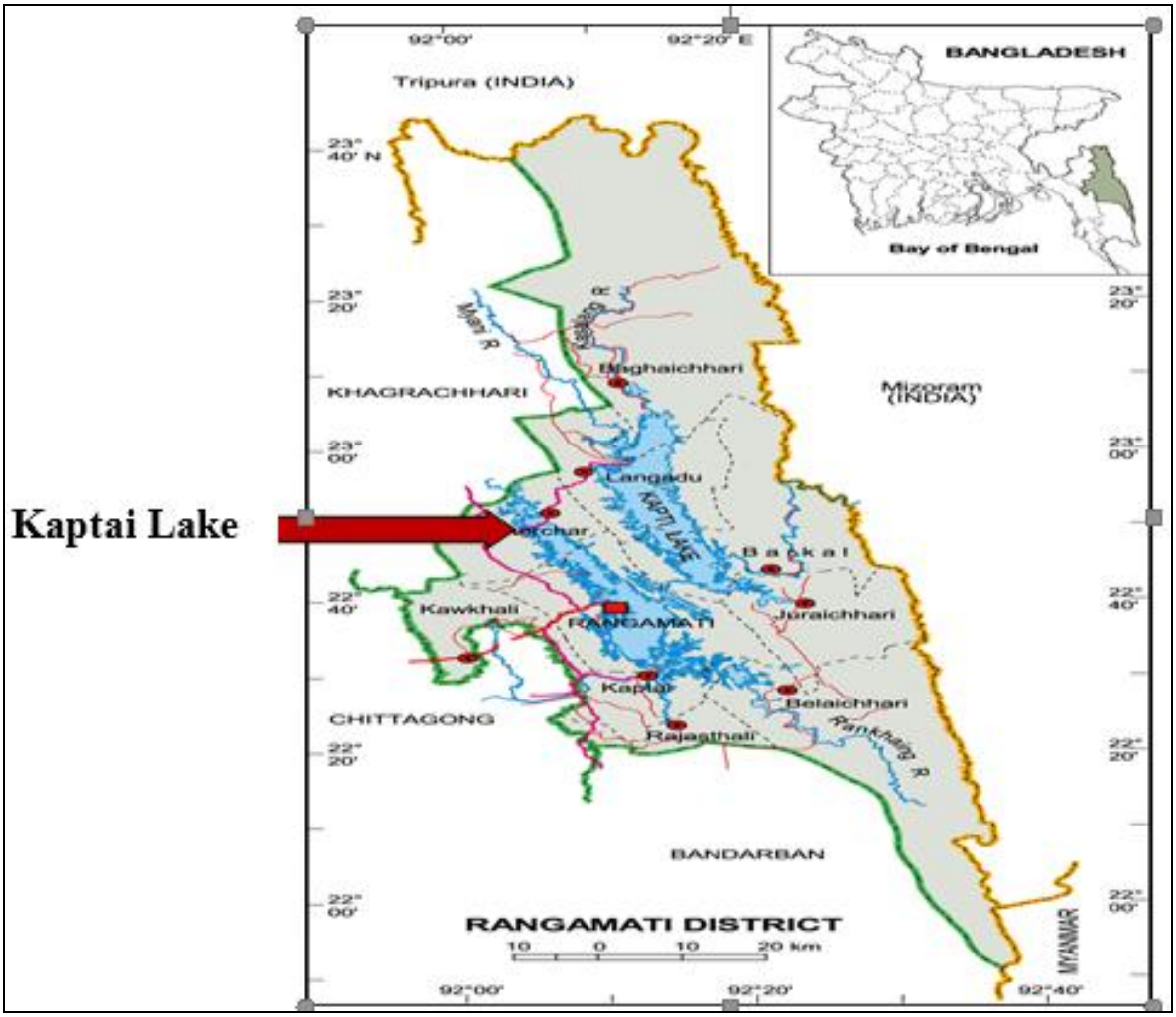

Fig 1: Map of the study area

2.2 Data source

2.2.1 Primary data source

Collection of primary data was made by field observation and fishers interview using structured questionnaire. For this study a combination of questionnaire interview, Participatory Rural Appraisal (PRA) tool such as Focus Group Discussion (FGD) and cross-check interviews with key informants were used for data collection.

2.2.2 Secondary data source

Secondary data were collected from Bangladesh Fisheries Research Institute (BFRI), Riverine sub-station, Rangamati,

Bangladesh Fisheries Development Corporation (BFDC), Rangamati, Statistical yearbook of Bangladesh, Development board Rangamati hill tracts, Department of agricultural extension, Rangamati, various government agencies, various books, journals theses, autonomous bodies and NGOs.

2.3 Questionnaire designs
For collection of information regarding gear types, fish composition, catch records of various fish species of Kaptai Reservoir specially the tilapia (*Oreochromis niloticus*), existing status of tilapia were designed keeping in mind the specific objectives of the study. Questionnaires were filled up through direct observation of gears and their catch and also interviewing the fishers' community.

2.4 Data processing and analysis
The collected data were recorded, summarized and processed for analysis. Tabular techniques were applied for the analysis of data by using Microsoft Excel.

3. Results and Discussions
3.1 Tilapia catch records
In this study, it was found that in 1986-87 the production of tilapia was 0.55 mt (0.017%), where in 1988-89 and 1989-90 the landing was 0.02% and 0.08% respectively (BFDC record). Following this, the contribution of tilapia in the total production of the Kaptai Reservoir was increasing continuously and reached the first peak in 1992-93 (72.7 mt; 1.75%). Gradually it reached the second peak in 1999-2000 (160.8 mt; 2.94%) and also reached the third pick (180.78 mt; 3.51%) in 2000-01 (Table 1). It was a great contribution for a fish species alone as an exotic species. After than the production of the tilapia seems to be consistent and contributed around 1-2% of the total fish production of the Kaptai Reservoir. But in 2013-14 the contribution became so poor (0.80%).

Table 1: Contribution of tilapia in the total fish production in Kaptai Lake

Year	Tilapia Production (mt)	Total Production (mt)	Contribution (%)
1998-99	63.97	5021.43	1.27
1999-2000	160.83	5475.36	2.94
2000-01	180.78	5155.35	3.51
2001-02	93.30	4721.78	1.98
2002-03	109.45	4566.17	2.40
2003-04	49.08	4794.19	1.02
2004-05	78.29	4770.24	1.64
2005-06	113.01	5362.49	2.11
2006-07	70.53	4439.28	1.59
2007-08	85.32	6327.16	1.35
2008-09	31.85	3697.30	0.86
2009-10	60.60	5193.12	1.17
20110-11	52.47	6669.00	0.79
2011-12	43.04	6153.16	0.70
2012-13	52.78	6424.82	0.82
2013-14	44.63	5600.43	0.80

The production of tilapia was highest in 2000-01 and lowest in 2008-09 (Fig. 2). During the third peak (2000-01), large number of tilapia was caught on April and the production was around zero on July and August. But in 2008-09, the production was highest on March and lowest on July (Fig. 3).

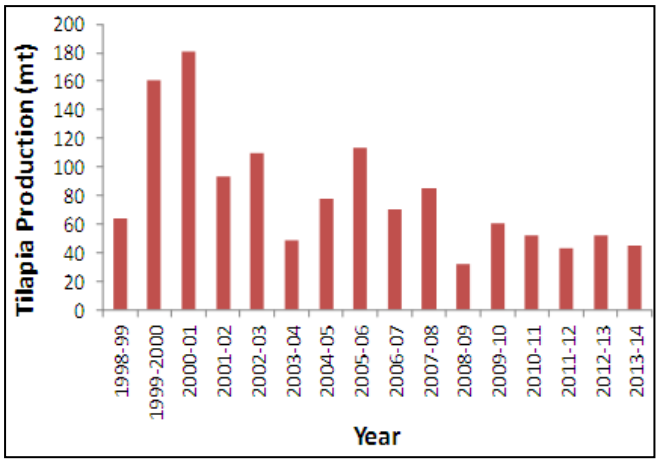

Fig 2: Tilapia production (mt) of last 16 (sixteen) years (BFDC, Rangamati)

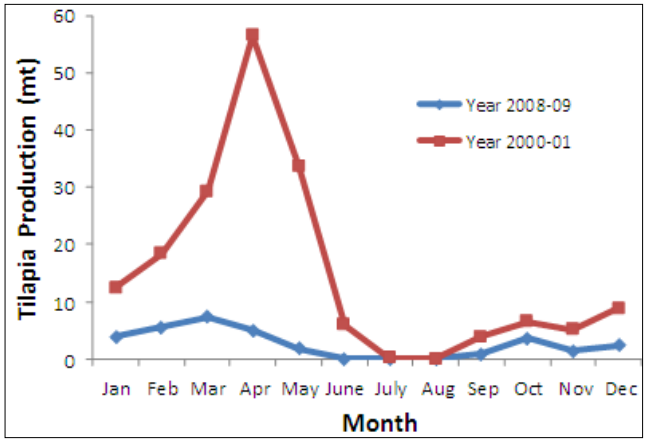

Fig 3: Monthly comparison of tilapia production (mt) between the highest (2000-01) and the lowest (2008-09) production year

3.2 Tilapia Fishers
There were no specific tilapia fishers in this reservoir but three types of fishermen were engaged in tilapia fishing in Kaptai Lake throughout the year specially the fishing season (September-April); professional fishermen, seasonal professional fishermen and subsistence fishermen. The fishers of Kaptai reservoir were local residents and migratory (Table 2). The professional fishermen catch the highest amount of tilapia (65%) than the seasonal professional fishermen (25%) and the subsistence fishermen (10%). During the closed season (May-August), the professional fishermen cannot catch fish and this time they were very helpless and did not get enough food. At this time most of them were involved in illegal fishing of tilapia. The fishermen of Kaptai reservoir were mainly Muslim (68%), followed by Hindu (23%) and Tribal (9%).

Table 2: Types of fishermen in the Kaptai reservoir for tilapia fishing

Season	Professional	Seasonal professional	Subsistence	Total
Peak 1 (September-October)	2600 (1300-Recognized)	750	1500	4850
Peak 2 (February-April)	2600 (1300-Recognized)	650	1500	4750
Off Peak (November-December)	2100 (1300-Recognized)	-	1300	3400
Closed season (May-August)	-	-	3500	3500

3.3 Fishing gears used for tilapia fishing

The fishery of Kaptai reservoir was multi-species and multi-gear in nature. The present study revealed that fishing methods of Kaptai Reservoir were traditional, and not much different from other inland waters of Bangladesh. A total of six types of nets, one type of wounding gear, four types of hook & line and one type of fish aggregating device (FAD) were used in tilapia fishing. Dharma jal (net) contributed the highest percentage (32%) of tilapia catching and Koch (wounding gear) contributed the lowest percentage (2%) of tilapia catching. The use of fishing gears and operation time depends mainly on water depth, type of fishing grounds, types of fishermen and abundance of fish. In the present study, the fishing duration of the current net was highest (13 hours/day) and cast net was lowest (4 hours/day). For tilapia catching most fishers used a common fishing technique "Jak Fishery" (fish aggregating device). By this technique fishers catch 25% of the total tilapia production.

Table 3: The average fishing hours of different gears used for tilapia catching in the Kaptai reservoir

Name of gears	Fishing duration (hours/day)	Tilapia catching (%)
Ber jal (mainly Kechki jal)	12	5
Current jal	13	18
Jhaki jal (Cast net)	4	3
Dharma jal	12	32
Bhasa jal	12	8
Borshi	6	7
Koch	5	2
Jak fishing (FAD)	8	25

3.4 Marketing system of tilapia

Kaptai reservoir was surrounded by high hills and there were only two (Chittagong-Rangamati and the Chittagong-Kaptai) across points to the reservoir from the plains. Hence, BFDC established two fish-landing centers, one at Rangamati and another at Kaptai for royalty collection and for the management of the lake. In the Kaptai reservoir fisheries, there were relatively complicated marketing channels. The present survey showed that now a day, not a single fisher comes either to the fish landing pontoon or of fish markets for selling their commodities. In addition, direct marketing between producer and consumer was rare and practiced only by some fishers who fished near reservoir shore. In most cases fishers hand over their daily catch either to their selected agents employed by the fish trader or commission agents. Fixing of market price was also done by the fish traders. These fish traders or commission agents come to the BFDC pontoon and sell their product to the market wholesaler or the retailer. It was found that about 72% of fishers disposed their whole catch to the specific fish dealer, about 26% fishers have no specific option for selling and only about 2% fishers sell their fish directly to the consumer. The BFDC portion was only exported.

3.5 Existing management practices

The Kaptai reservoir was managed by the Bangladesh Fisheries Development Corporation (BFDC), Rangamati. It was shown that major carps were managed by stocking every year in a few amounts (60 million fingerlings over the last four decades) and banned the fishing during in the spawning period (May-August). Being an exotic fish species, tilapia was being neglected by the management authority and no management techniques and regulations were established for protection. During spawning season due to the closed fishing tilapia fishing was also closed. As a result, tilapia exists themselves naturally. But due to the overfishing and illegal fishing tilapia stocks was decreasing continuously. This study also revealed that, the rules and regulations which were used for fishing were also for the major carps, but tilapia was out of these. As a result, management lacking of tilapia in the Kaptai reservoir will make the reservoir 'lack of tilapia'.

Table 4: Changes in the abundance of fish species in the Kaptai reservoir

Introduced	Disappeared	Dwindling	Now dominant
Cyprinus carpio	Silonia	Tor tor	Corica soborna
Hypophthalmichthys	silondia	Johniur coitor	Gudusia chapra
molitrix	Clupisoma	Setipinna phasa	Oreochromis niloticus
Ctenopharyngodon	garua	Ompok bimaculatus	Gonialosa mamminna
idella	Bagarius		Mystus aor
Puntius gonionotus	bagarius	Amblypharyngodon	Mystus cavasius
Oreochromis	Puntius	mola	Labeo gonius
niloticus	sarana	Labeo bata	Notopterus notopterus
Clarius gariepinus			Macrobrachium lamarri
			Notopterus chitala

4. Conclusion

In Bangladesh, fish products provide about 60% protein source [18]. Most of the people do not get their enough nutrition whatever they need. So, only fish can fulfill the protein demand of our people. As tilapia contributes a handsome proportion to the total fish production of the Kaptai Lake, fulfills the nutritional requirements and improves socio-economic condition of the tilapia fishers, it is necessary to ensure tilapia production in this Lake through assessing Maximum Sustainable Yield in order to suggest the highest amount of fish that could be taken from the lake each year. Sanctuaries development, fishing regulations implementation, and being familiar with spawning and egg brooding period for imposing closed season are suggested to conserve this valuable species in Kaptai Lake.

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