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Fish production in baors environment of Bangladesh, present status and challenges: A review

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Abstract
Fisheries sector is one of the most productive and active sector in Bangladesh. This sector plays an important role in food security, employment opportunity and foreign exchange retributions in the economy. Bangladesh has needed 80.00 lac MT of fish within 2030 to achieve SDG (Sustainable Development Goals). Baors can keep great contribution to fulfill this target. The total fish production in baors are 7,729.00 MT and average production is 1,408.00 kg/ha. If we achieve this target baors have been utilized properly on a scientific basis. The production of fish per hectare in baors are much lower due to lack of proper scientific knowledge of fish culture and management practices. The review study has been undertaken to pinpoint or implement the sustainable baors management and fish culture technologies. The fisheries sector in baors the 21st century is facing the challenges of food security for the increasing population, habitat degradation, urbanization and industrial development. Development of responsible fisheries management and optimal use of baors water can address those challenges.

Keywords: Baor, fish production, present status and challenges

Introduction

Bangladesh is rich in water resources in the form of ponds, natural depressions (haors and beels), lakes, canals, rivers and estuaries. Considering water resources it stands third in the world after China and India (FAO, 2014) [20]. The Fisheries resources of Bangladesh are among the richest in the world and the inland fisheries production still ranks fourth in the world only after China, Indonesia and India (FAO, 2014) [20]. Bangladesh has nearly 4.5 million ha of inland water bodies which include marshes, reservoirs, *baor* (oxbow lakes), natural depressions, rivers and estuaries (Chakraborty *et al*., 2005) [2]. Baor (oxbow lake) is semi-closed water bodies. It is engaged by the dead waterways of the rivers in the declining delta of the Ganges. Locally it is called "horse-shoe" and therefore it is entitled as "Oxbow'' lake. There are approximately 600 oxbow lakes in Southwest region (greater Jessore district with highest concentration, Kushtia and Faridpur district) of Bangladesh with an estimated combined water area of 5488 ha (Hasan, 1990) [18]. By screening the inlets and outlets a *baor* can be converted into a culture based fishery (DoF, 1996) [3]. The most successful example of culture-based fisheries that has been accomplished in Bangladesh is in oxbow lakes located in south-west Bangladesh (Hasan *et al.*, 1997) [19] the average yield. Currently some baors are managed by community people under guidance of Department of Fisheries (DoF). Baors are leased to private individuals or cooperatives through open auctions. People now almost converted baors as culture fisheries; however, species like rui (*Labeo rohita*), catla (*Catla catla*), mrigal (*Cirrhinus cirrhosus*), silver carp (*Hypophthalmichthys molitrix*), kalibaus (*Labeo calbasu*), black carp (*Mylopharyngodon piceu*), tilapia (*Oreochromis spp.*) and some other fishes are now usually cultured most of the baors. In the past, baors were prominent for their natural fish all over the country due to the incomparable taste and aroma of fishes. But, now days most of the baors have already lost its fashionable characteristics as natural as well as human intervention. Due to over exploitation of fish including use of harmful fishing gears and system (fishing by dewatering), degradation and loss of fish habitats, increase agriculture production and road communication, siltation of water bodies by natural process, introduction of a number of alien invasive fish species and water pollution by industry, and agrochemical

the natural inland fish stocks have declined significantly and fish biodiversity have been affected seriously (Ali *et al*., 2009) [1]. Due to the above mentioned and other unseen backdrops, the baors are now in threatened condition and its total production is declining day by day. In view of the economic importance and culture potentials of baors the study was under taken to find out the way to enhance fish production. This study will be helpful to the fish culturists in baors, farm managers, baor managers, hatchery operators, production specialists, policy makers and extension workers etc.

Materials and Methods

The study was carried out based on the information through review of related thesis, journals, reports and books. Some practical knowledge was gained through farmers working experience, attending different seminars about baors and observing research presentation related with aquaculture and agriculture. The necessary data were collected from internet, different annual statistical yearbooks of Bangladesh, National Fish week compendiums, newspapers, visiting baors areas with different on-going researches and consulting associated consultants and researchers.

Results and Discussion

Characteristics of baor

A baor is a semicircle shaped lake that is designed at a curve/turn of a river/canal. Basically the river is departed/altered it course since several decades. But the water at the curve of the river is still noticeable. So it is just turned into a lake and having a shape of semicircle. The length of the arc can be 10% to 95% of the circle. But it is never a circle. There are more than 600 oxbow lakes in southwestern Bangladesh, covering about 5,488.00 ha, each ranging from 10 to 500 ha (FRSS, DoF, 2017) [17]. The size of an oxbow lake varies from 10 ha to 500 ha (Khan and Apu 1997) [22]. Though this covers only 0.12 % of Bangladesh's total inland waterbodies, it can ensure increased fish production through aquaculture and improved management practices (ICL 1996) [21]. The average rate of production from *baor* 1,408.00 kg/ha which can be increased manifold (FRSS, Dof, 2017) [17].

Pictorial view of Baors

Species found in baor

There are many species found in baors. Some of them are rui (*Labeo rohita*), catla (*Catla catla*), mrigal (*Cirrhinus cirrhosus*), kalibaus (*Labeo calbasu*), bata (*Labeo bata*), ghonia (*Labeo gonius*), silver carp (*Hypophthalmichthys molitrix*), black carp (*Mylopharyngodon piceu*), tilapia (*Oreochromis spp.*), common carp (*Cyprinus carpio var. Specularis)* grass carp (*Ctenopharyngodon idella*), boal (*Wallago attu*), air (*Mystus aor*), taki (*Channa punctata*), shol (*Channa striata*), gazar (*Channa marulius*), koi (*Anabas spp*), shrimp (*Panaeus monodon*), prawn (*Macrobrachium rogenbergii)*, shingi (*Heteropneustes fossilis*), magur (*Clarias batrachus*), surputi (*Puntius gonionotus)* etc. (FRSS, DoF, 2017) [17].

Table 1: Species Composition of Fish Production in Baor

Species	2012		2013		2015		2016		2017 (April)		2017 (December)	
	MT	%	MT	%	MT	%	MT	%	MT	%	MT	%
Rui	679	12.93	896	17.28	864	13.26	1065	14.66	1119	14.48	1159	14.48
Catla	482	9.06	405	7.81	528	8.10	610	8.39	641	8.29	664	8.29
Mrigal	300	5.66	330	6.36	620	9.52	432	5.95	454	5.87	470	5.87
Kalibaus	65	1.33	66	1.27	98	1.50	23	0.32	25	0.32	26	0.32
Bata	0	00	0	00	144	2.21	164	2.26	178	2.30	184	2.30
Ghonia	0	00	0	00	62	0.95	8	0.11	9	0.12	9	0.12
Silver carp	909	20.08	906	17.47	1334	20.48	1470	20.23	1297	16.78	1343	16.78
Grass carp	174	4.00	210	4.05	270	4.14	411	5.65	434	5.62	449	5.62
Mirror/Common carp	625	12.70	306	5.90	283	4.34	320	4.40	338	4.37	350	4.37
Other exotic carp	0	00	64	1.24	95	1.46	35	0.48	37	0.48	38	0.48
Pangas	0	00	0	00	0	00	0	00	0	00	0	00
Boal/Air	17	0.34	85	1.64	431	6.62	97	1.33	106	1.37	110	1.37

Shol/Gazar/Taki	119	2.42	136	2.62	102	1.57	164	2.25	179	2.32	185	2.32
Koi	0	00	0	00	26	0.40	9	0.12	9	0.12	9	0.12
Shingi/Magur	53	1.06	44	0.85	44	0.68	8	0.11	9	0.12	9	0.12
Big shrimp/prawn	26	1.46	30	0.58	31	0.48	9	0.12	9	0.12	9	0.12
Small shrimp/prawn	324	5.63	344	6.63	255	3.91	304	4.18	309	4.00	320	4.00
Tilapia/Nilotica	0	00	207	3.99	171	2.63	150	2.06	298	3.86	309	3.86
Sarputi/Thai puti	0	00	74	1.43	54	0.83	110	1.52	137	1.17	142	1.77
Other Inland Fish	1010	21.82	1083	20.88	1102	16.92	1878	25.86	2141	27.70	2217	27.70
Total	4864	100	5186	100	6514	100	7267	100	7729	100	8002	100

***Source*:** FRSS, DoF, 2012-2017) [11, 12, 13, 14, 15, 16, 17]

Stocking densities of species

The total stocking density of carp species was 152 kg/ha in the year 2013-2014 and 92 kg/ha in the year 2014-2015, respectively in Bergobindapur baor. Stocking densities of carp species kg/ha are shown in Table 2.

Table 2. Stocking densities of carp species of size 5-6 inches.

Species	Stocking density (Kg/ha) in 2013-2014	Stocking density (Kg/ha)in 2014-2015
Silver Carp	48	28
Catla	15	9
Rohu	35	23
Mrigal	28	9
Grass Carp	16	9
Common Carp	10	14
Total	152	92

(**Source:** Sharif *et al.* 2016) [23]

Fish production

During the year 2016-2017 the production of fish in baorere 1,458.00kg/ha and total production was 8,002.00 MT. The district wise fish production in baors have shown (Table 3).

Challenges

There are many challenges for increasing fish production in baors environment. Some of them are gradual decrease of inland open water, declining quality brood stock of prospective species, inadequacy of good quality seeds and production inputs, limiting fish breeding and proliferation, leaving no fish to breed next year, increasing water-logging, obstructive of migratory routes of indigenous fish species, disturbing biodiversity and creating social conflicts, obstructing the migratory routes due to increased silt deposit on the baors channels, diseases problem in baors, water pollution occurs, fishermen access to public water bodies, reduce of good aquaculture practices for confirming food safety in baors, impacts of climate change on fisheries and aquaculture, increasing fish feed price, mugging by the local leaders members, using high dosages of pesticides and insecticides, floods occur irregularly, continuous drying of baors, lack of proper developed management system and controlled harvesting, stealing is a common problem in baors fishery, negligence of the fisheries officer, lack of adequate market facilities for fish marketing, agro chemicals used for rice cultivation, water hyacinths pressure etc.

There are some ways to overcome these challenges, such as:

a) Stocking of fingerlings including endangered species,
b) Fingerlings should be stocked at a proper ratio.
c) Need to establish rights of the fishermen. Main conflict with this issue is to ensure the access of real fishermen into baors resource. The non-fishermen/fish businessmen need to be stopped who degrade the natural part of the baors.
d) Water pollution should be controlled.
e) Diseases should be controlled with proper treatment.
f) Restoration of habitats, establishment and maintenance of sanctuaries,
g) Fish sanctuary by the fishermen community
h) To need baor based water management planning,
i) To need baor based environmental planning
j) Expansion of cage culture and carp fattening,
k) Issuing of fishers identity card,
l) Enforcement of fish conservation acts,
m) Adoption of climate smart technologies,
n) A strong partnership has been developed among the concerned stakeholders, i.e. GO, NGO, local elites and fishers at implementation level.
o) Several socio-ecofriendly programs have been implemented to increase the fish production in baors.
p) To establish community based fisheries management,
q) To establishment of baor nurseries,
r) To conserve the aquatic biodiversity, especially fish and other aquatic species diversity in open water.
s) Alternative livelihoods support to fishers during banned fishing seasons and sanctuary maintenance,
t) Meeting should be arranged for good management practices.
u) Water hyacinths should be cleaned properly.

Table 3: Fish production in Baors

Years District		2004	2005	2006	2007	2008	2009	2011	2012	2013	2014	2015	2016	2017 (April)	2017 (December)
	Baor Area (Ha)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)	Production (MT)
Faripur	355	247	229	241	241	247	243	241	245	326	332	435	416	443	459
Gopalgonj	110	72	75	76	78	81	79	421	156	135	183	74	83	88	91
Madaripur	200	116	120	122	124	128	129	533	231	144	165	166	184	196	203
Rajbari	300	195	201	226	230	225	220	210	214	350	372	378	371	394	408
Dahka Division	965	630	625	665	673	681	671	1405	846	955	1052	1053	1054	1121	1129
Chuadanga	686	794	796	799	854	907	973	1118	1022	1045	986	976	1025	1091	1129
Jessore	1127	658	878	885	957	980	1096	2043	1089	1128	1697	1601	1930	2053	2127
Jhenaidah	807	601	545	560	591	597	591	2881	358	465	595	672	1058	1126	1164
Khulna	225	147	144	141	143	152	116	-	185	160	159	159	160	169	177
Kushtia	372	339	340	378	260	340	327	212	198	382	511	604	623	663	684
Magura	510	363	367	368	421	428	435	415	402	491	502	610	587	624	646
Meherpur	400	300	315	322	328	334	290	464	455	259	335	397	407	433	448
Narail	290	197	202	203	202	204	203	14	215	220	227	230	257	273	283
Satkhira	106	69	70	67	69	75	76	118	94	81	82	212	166	176	183
Khulna Division	4223	3468	3657	3723	3825	4017	4107	7256	4018	4231	5094	5461	6213	6608	6841
Total	5488	4098	4282	4388	4498	4698	4778	8706	4864	5186	6146	6514	7267	7727	8002
Unit Production (MT/Ha)		0.747	0.780	0.799	0.820	0.856	0.871	1.382	0.886	0.945	1.120	1.187	1.324	1.408	1.458

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Conclusion

Fish production in baors play a vital role for the support of livelihood, poverty alleviation of fishermen as well as protein supply for the people of the country. A large number of fishermen depend on the fishery activities in baors. They meet their household nutrition from the fishery activities of the baors**.** There are many problems in baors fisheries management. These problems should be solved through the application of proper scientific knowledge and modern culture technologies. As a result, the fish production will be increased in all baors.

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