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Coastal set bagnet fishery in the Payra river, Bangladesh and its impact on fisheries and biodiversity

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PEER REVIEW

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Comments

This study gives useful information on the use of set bagnet in the Payra river and its effects on fisheries and biodiversity of the area. The data showed that some species were found as critical endangered species. Therefore, the authority must take strict action against the use of set bagnet in Payra river to save the fish biomass and biodiversity.

Details on Page 300

ABSTRACT

Objective: To assess the catch composition and seasonal variation in catch of set bagnet fishery from the coastal Payra river, to understand the importance and impact of set bagnet fishery on biodiversity and fisheries, and to find out feasible strategies to reduce the negative impact of set bagnet fishery.

Methods: The research was conducted with selection of research area, preparation of gear survey and catch assessment form, sample collection, laboratory analysis and selection of analytical methods to achieve the objectives of the study.

Results: A total of 52 species belonging to 23 families were recorded from set bagnet in the Payra river. Most important commercial fishes and their annual catch by set bagnet in the study area were 51.03 MT Ilish (*Tenualosa ilisha*), 8.83 MT Rita (*Rita rita*), 6.92 MT Air (*Sperata aor*), 4.72 MT Chital (*Chitala chitala*), 2.03 MT Boal (*Wallago attu*), 1.84 MT Baghair (*Bagarius bagarius*), 3.35 MT Foli (*Notopterus notopterus*) and 13.46 MT Golda chingri (*Macrobrachium rosenbergii*). All these species were mostly caught at initial stages of their life cycle, which usually move with the tidal current.

Conclusions: Study suggested that set bagnet should be restricted to allowable limit with strong monitoring system for the protection and conservation of valuable fish species in the coastal areas of Bangladesh.

KEYWORDS

Species composition, Threatened species, Commercial species, Conservation

1. Introduction

Bangladesh is a land of rivers and acts as a drainage outlet for a vast river basin complex made up of the Ganges-Brahmaputra-Meghna river system, and rich in various fisheries resources[1]. Open water fishery

resources play an important role in the economy and food habits of the people of Bangladesh[2-4]. Coastal rivers of the country are valuable natural ecosystem of Bangladesh and the Payra river is one of them which provides natural spawning grounds and nursery grounds for many commercially important species of aquatic biota and a significant

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portion of the country's fisheries production is dependent on this coastal river[5,6].

Payra river is a body of running water moving to a lower level in a channel on land in the country of Bangladesh and the river finally falls into the Bay of Bengal by the name of Burishwar river. Its center lies at a latitude of 22°28' and longitude of 90°20' and it has an elevation of 1 m above sea level. Payra river is also known as the Rajganj river. This river is an exclusive aquatic ecosystem with diversified species of plants, fish and other organisms. Of all these living organisms, fish is the most important element which has an important and potential contribution in the economic development, poverty alleviation, employment, animal protein supply and foreign currency earnings for the national sector. Most of the catch of this river is landed by small-scale local fishermen and it is believed that about one fourth of it is harvested by set bagnet. The large number of species caught by set bagnet has many negative impacts on biodiversity and fisheries, when compared with other fisheries. Set bagnet is a traditional fishing gear in the coastal area, still being operated by small-scale fisher folk in Bangladesh. Set bagnet makes an efficient gear for capturing a wide range of finfish and shellfish species including juveniles. The net is operated with some regional variations in design and mode of operation. This gear is widely used in the Payra river for collecting small fish mostly juvenile of commercially valuable species.

In riverine set bagnet fisheries, contribution of this net in national production is very minor but the destructive effects on biodiversity and fisheries are very high. It is used to catch fishes like Chital (*Chitala chitala*), Ilish (*Tenualosa ilisha*), Bele (*Glossogobius giuris*), Taposi (*Polynemus paradiseus*), Air (*Sperata aor*), Poa (*Otolithoides pama*), Golda chingri (*Macrobrachium rosenbergii*) etc. and all these species are caught at juvenile stage. These undersized fishes are locally known as *guramas*. Per kg of this *guramas* contains thousands of fry of commercially valuable fishes. Major portion of these commercially valuable species are unable to grow in a mature stage due to set bagnet fishery and the result is failure in recruitment and decline in total production.

Set bagnet is being used along the entire Payra river with heavy concentration in some areas. Although set bagnet is harmful for overall fisheries, the fishermen usually set the nets in the river closer to their home. This reduced the travelling time and greatly increased the security of gear and catch. This net is far less labour intensive than alternative fishing methods; often the net is operated by only one person. This has advantages of keeping operation costs down. This type of fishery provides fisherfolk income and most importantly food throughout the year. Due to the advantages, major portion of fishermen are involved with set bagnet fishery. Nevertheless, set bagnet is a tool of undesirable and destructive fishing method. It is very essential to identify the negative impact of set bagnet on fish biodiversity and fisheries, and to develop management strategies for conservation measures.

2. Materials and methods

2.1. Study area and period

The present study was carried out in the Payra river of Patuakhali District, Bangladesh. The total length of the river is approximately 45 km and width is 1-1.5 km. The river originated from the Tetulia river via the Karkhana river and finally fall into the Bay of Bengal by the name of Burishwar river. The study area was 15 km (length-wise) of the Payra river adjacent to the Dumki Upazila (Figure 1). The study was conducted for a period of 1 year from April 2013 to March 2014.

2.2. Collection and transportation of fish samples

A large number of fishermen were involved for fishing in the Payra river. Most of the fishermen in the river depended on fishing activities by adopting numerous fishing methods and using different fishing gears. The gear survey and catch assessment for set bagnet were made monthly. A boat was hired in the survey day and fish samples were collected from the set bagnet catch on the river. Fishes were caught in the river during both day and night by using set bagnet. Freshly caught unsorted samples of set bagnet catches were collected once a month for over an entire year from April 2013 to March 2014. All samples were preserved with crushed ice in fish box and brought to the laboratory as soon as possible.

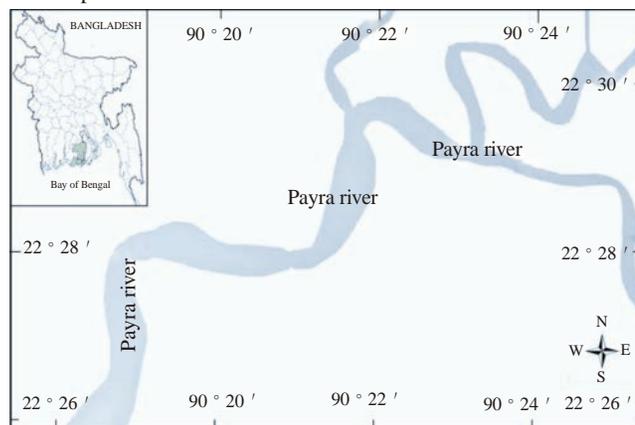


Figure 1. Map showing location of the study area (Payra river) in Bangladesh.

2.3. Laboratory analysis

In the laboratory, ice preserved samples were washed with running tap water for removing dirt and then adhered water on the fish skin was absorbed by the tissue paper. For complete drying, fishes were finally placed in the room temperature for half an hour. Fish samples were sorted out and identified up to the species level following different books[7,8]. For set bagnet catch, number of species, total weight of each specimen, and individual length of collected samples were measured. Total length of individual fish was taken in centimeter and weight was taken in gram.

2.4. Estimation of catch rate and annual catch of set bagnet

Catch rate (kg/haul) and catch composition of set bagnet were analyzed separately for each month. For selected species-wise annual production estimation, monthly mean catch rates for each species were multiplied by the number of fishing days for each month, the average number of hauls per fishing day and the estimated number of fishing gears in the study area for respective month. For estimation of annual catch, from 18 to 24 March "Jatka Conservation Week 2014" was excluded from the calculation due to absence of set bagnet fishing during this period in the Payra river.

2.5. Data processing, analysis and presentation

The collected data were summarized and processed for analysis. Tabular technique was applied for the analysis of data by using simple statistical tools like sums, averages and percentages etc. Finally, the processed data were transferred to a spreadsheet of Microsoft Excel, from which tables and figures were prepared for revealing the objectives

of the study.

2.6. Limitations of the study

No related study was previously conducted in the Payra river regarding to the present status of fisheries with the impact of several fishing gears, so that the present comparative study became difficult.

3. Results

3.1. The net

The set bagnet (Figure 2) was a fixed tapering net, resembling a trawl net, set in the tidal stream by anchor. It had a rectangular mouth kept open by two vertical bamboo poles and floats are used at the headline. The net was held in a fishing position against the current by linking two extended sides of the net (wing tips) with two anchors by means of cords which increased the fishing efficiency by herding the fish into the mouth-opening. The anchors were placed in some distance apart on the river bed, so that the net was parallel to the direction of the current. The set bagnet caught species of fish which drifted with the current or did not swim fast enough against current. The length of the net varied from 60-80 feet and the mouth opening length and width were 12-13 feet and 6-7 feet respectively. The mouth and wing had larger mesh size gradually decreasing to the minimum at the codend.

The net was generally made with nylon twine of count 12-18 in the mouth and of count 9 in the bag. Sometimes the bag or codend of the net was made up of mosquito net for very fine mesh size to capture fry. A synthetic monofilament net material (high density polyethelene) with knotless webbing of about 2 mm mesh size was also used. This was available in the local market, priced at 25-30 taka/m. The traditional netting also had a mixture of polyamide, polyethelene and polypropylene.

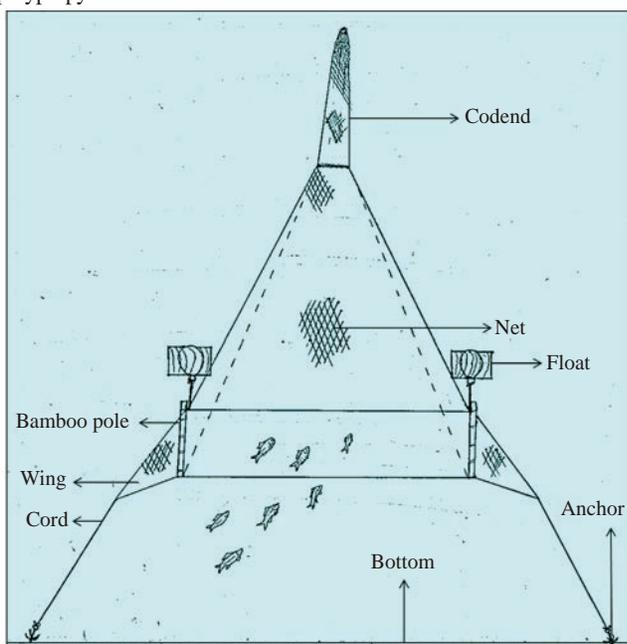


Figure 2. Sketch of a set bagnet fixed under water against current by using floats.

During the high tide, the mouth of the net faced the downstream to catch fish moving to the upstream and the fish trapped in the codend were emptied by lifting the end of the net. The net was open but always tied with ropes and when collection time came, the fishermen pulled

the codend, opened the knot and collected the harvest. This method of fishing required a small boat; two fishermen usually went to take fish trapped in the set bagnet. Use of set bagnet was a traditional origin of fishing with no scientific methods for its development. Set bagnet was the most common fishing gear in riverine, coastal and marine fisheries of Bangladesh. Set bagnet with a mesh size greater than 90 mm was not harmful to stocked fish. But most of the fishermen used mesh size less than 50 mm. In the Payra river, mouth opening mesh size of set bagnet ranged from 10 to 20 mm and in the codend, this ranged from 5 to 10 mm and even as small as 2 mm.

3.2. Species composition of set bagnet in the Payra river

During the study period, a total of 52 species (Table 1) including finfish, prawns and crabs were recorded in the catches of set bagnet in the Payra river. It was found that the highest number of species was contributed by finfish (44) followed by prawns (6 species) and crabs (2 species).

The finfish, prawns and crabs were grouped under 23 families (Table 1). The highest 9 species were found in Cyprinidae followed by 6 species each of Bagridae and Palaemonidae, 4 species each of Clupeidae and Schilbeidae, 3 species of Gobiidae, 2 species each of Notopteridae, Siluridae, and Portunidae and single species each of Engraulidae, Cobitidae, Sisoridae, Ariidae, Mastacembelidae, Ambassidae, Nandidae, Osphronemidae, Polynemidae, Sciaenidae, Sillaginidae, Belonidae, Cynoglossidae and Tetraodontidae.

3.3. Month-wise variation in the species richness

During the study period, the richness of fish species in set bagnet catches varied in different months (Figure 3).

The highest number of fish species occurred in July (45 species) followed by August (42 species), June (39 species), September (36 species), May (29 species), and October (25 species). The lowest number of species was found in February (17 species). Species richness in the set bagnet catch was high during monsoon period (July - October). Mola (*Amblypharyngodon mola*), Jat punti (*Puntius sophore*), Golsa tengra (*Mystus bleekeri*), Tengra (*Mystus vittatus*), Kajuli (*Ailia punctata*), Chanda (*Chanda nama*), Bele (*Glossogobius giuris*), Golda chingri (*Macrobrachium rosenbergii*) and Gura chingri (*Macrobrachium tenuipes*) were the most abundant species in monsoon period. On the other hand, Chapila (*Gudusia chapra*), Ilish (*Tenualosa ilisha*), Chandana ilish (*Tenualosa toli*), Taposi (*Polynemus paradiseus*), Cheua (*Pseudapocryptes elongatus*) and Dogri (*Trypauchen vagina*) were the abundant species in winter (November - February) and Phasa (*Setipinna phasa*), Dhela (*Osteobrama cotio*) and Poa (*Otolithoides pama*) were the abundant species in summer (March - June).

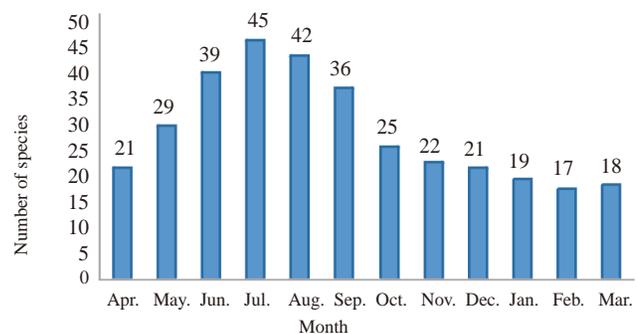


Figure 3. Monthly variations in species richness of set bagnet catch in the Payra river.

Table 1
Species composition of set bagnet in the Payra river.

Sl.	Family name	Local name	English name	Scientific name
1	Notopteridae	Chital	Clown knife fish	<i>Chitala chitala</i>
2		Foli	Bronze featherback	<i>Notopterus notopterus</i>
3	Clupeidae	Kachki	Ganges river sprat	<i>Corica soborna</i>
4		Chapila	Indian River Shad	<i>Gudusia chapra</i>
5		Ilish	Hilsa shad	<i>Tenualosa ilisha</i>
6		Chandana ilish	Toli shad	<i>Tenualosa toli</i>
7	Engraulidae	Phasa	Gangetic hairfin anchovy	<i>Setipinna phasa</i>
8	Cyprinidae	Mola	Mola carplet	<i>Amblypharyngodon mola</i>
9		Darkina	Gangetic scissortail rasbora	<i>Esomus danricus</i>
10		Bata	Minor carp	<i>Labeo bata</i>
11		Dhela	Cotio	<i>Osteobrama cotio</i>
12		Sarpunti	Olive barb	<i>Puntius sarana</i>
13		Jatpunti	Pool barb	<i>Puntius sophore</i>
14		Tit punti	Ticto barb	<i>Puntius ticto</i>
15		Chela	Large razorbelly minnow	<i>Salmostoma bacaila</i>
16		Chebli	Giant danio	<i>Devario aequipinnatus</i>
17	Cobitidae	Gutum	Guntea loach	<i>Lepidocephalichthys guntea</i>
18	Bagridae	Golsha tengra	Day's mystus	<i>Mystus bleekeri</i>
19		Tengra	Striped dwarf catfish	<i>Mystus vittatus</i>
20		Nuna tengra	Long whiskers catfish	<i>Mystus gulio</i>
21		Gura tengra	Hummingbird catfish	<i>Rama chandramara</i>
22		Rita	Whale catfish	<i>Rita rita</i>
23		Air	Long whiskered catfish	<i>Sperata aor</i>
24	Sisoridae	Baghair	Dwarf goonch	<i>Bagarius bagarius</i>
25	Ariidae	Ghagra	Engraved catfish	<i>Arius gogora</i>
26	Schilbeidae	Kajuli	Jamuna ailia	<i>Ailia punctata</i>
27		Bacha	Batchwa vacha	<i>Eutropiichthys vacha</i>
28		Batasi	Indian potasi	<i>Pseudotropius atherinoides</i>
29		Silong	Silond catfish	<i>Silonia silondia</i>
30	Siluridae	Pabda	Pabdah catfish	<i>Ompok pabda</i>
31		Boal	Freshwater shark	<i>Wallago attu</i>
32	Mastacembelidae	Guchi	Barred spiny eel	<i>Macroganathus pancalus</i>
33	Ambassidae	Chanda	Elongate glass-perchlet	<i>Chanda nama</i>
34	Gobiidae	Bele	Tank goby	<i>Glossogobius giurii</i>
35		Cheua	Pointed-tailed goby	<i>Pseudapocryptes elongatus</i>
36		Dogri	Burrowing goby	<i>Trypauchen vagina</i>
37	Nandidae	Bheda	Gangetic leaffish	<i>Nandus nandus</i>
38	Osphronemidae	Khalisa	Banded gourami	<i>Colisa fasciata</i>
39	Polynemidae	Taposi	Paradise threadfin	<i>Polynemus paradiseus</i>
40	Sciaenidae	Poa	Pama croaker	<i>Otolithoides pama</i>
41	Sillaginidae	Tulardandi	Flathead sillago	<i>Sillaginopsis panijus</i>
42	Belonidae	Kakila	Freshwater garfish	<i>Xenentodon cancila</i>
43	Cynoglossidae	Kukur jib	Bengal tongue sole	<i>Cynoglossus cynoglossus</i>
44	Tetraodontidae	Potka	Green pufferfish	<i>Tetraodon fluviatilis</i>
45	Palaemonidae	Godla chingri	Giant freshwater prawn	<i>Macrobrachium rosenbergii</i>
46		Kunchu	Kuncho river prawn	<i>Macrobrachium lamarrei</i>
47		Goda chingri	Goda river prawn	<i>Macrobrachium scabriculum</i>
48		Dimua chingri	Dimua river prawn	<i>Macrobrachium villosimanus</i>
49		Gura chingri	Spinder prawn	<i>Macrobrachium tenuipes</i>
50		Chatka chingri	Monsoon river prawn	<i>Macrobrachium malcolmsonii</i>
51	Portunidae	Sataru kakra	Swimmer crab	<i>Portunus sanguinolentus</i>
52		Zaji kakra	Blue swimmer crab	<i>Portunus pelagicus</i>

3.4. Catch rates

The catch (in weight and in number) per haul of set bagnet fishing

varied from month to month. During the study period, the highest catch rate in weight [(5.99±0.87) kg/haul] of set bagnet operation was found in the month of January, followed by July and December. The lowest catch rate in weight [(2.25±0.36) kg/haul] of set bagnet was found in April (Figure 4).

On the other hand, the highest catch rate of set bagnet in number [(1487±189) fishes/haul] was recorded in September followed by October and August. The lowest catch rate in number [(313±81) fishes/haul] was found in March (Figure 5).

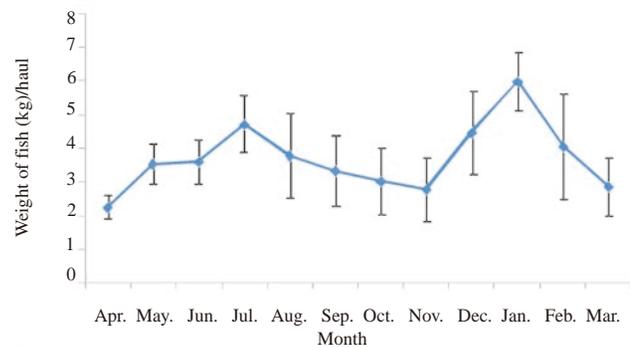


Figure 4. Monthly variation in weight (kg) of fishes caught by set bagnet per haul in the Payra river (mean±SD, n=5).

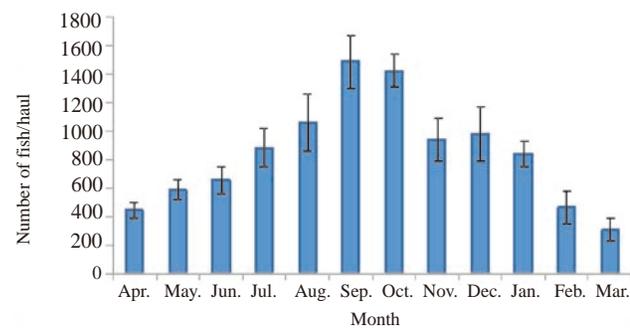


Figure 5. Monthly variation in number of fishes caught by set bagnet per haul in the Payra river (mean±SD, n=5).

3.5. Threatened species in set bagnet catch

Payra river is one of the important coastal rivers in Bangladesh. Fish diversity is quite high in the river. It serves as a nursery, breeding and feeding grounds for many threatened species. In the total catch of set bagnet, 16 threatened species were recorded; there were 6 vulnerable, 6 endangered and 4 critically endangered species (Table 2) out of 54 threatened species of Bangladesh[8].

3.6. Impact of set bagnet fishery on valuable fish stocks

Set bagnet was widely used in the Payra river during the study period and 52 species were caught. Species composition of set bagnet contained many valuable fish stocks which were caught at juvenile stage. Among the total species, considering mature size, ecological importance and commercial values, 8 species were

selected as more vulnerable due to set bagnet at the initial stage of their life cycle. A list of these fishes is shown in Table 3.

Table 2

List of threatened species in set bagnet catch.

Local name	English name	Scientific name
Vulnerable species		
Foli	Bronze featherback	<i>Notopterus notopterus</i>
Tit punti	Ticto barb	<i>Puntius ticto</i>
Air	Long whiskered catfish	<i>Sperata aor</i>
Kajuli	Jamuna ailia	<i>Ailia punctata</i>
Chanda	Elongate glass-perchlet	<i>Chanda nama</i>
Bheda	Gangetic leaffish	<i>Nandus nandus</i>
Endangered species		
Chital	Clown knife fish	<i>Chitala chitala</i>
Darkina	Gangetic scissortail rasbora	<i>Esomus danricus</i>
Bata	Bata	<i>Labeo bata</i>
Dhela	Cotio	<i>Osteobrama cotio</i>
Silong	Silond catfish	<i>Silonia silondia</i>
Pabda	Pabdah catfish	<i>Ompok pabda</i>
Critically endangered species		
Sarpunti	Olive barb	<i>Puntius sarana</i>
Rita	Whale catfish	<i>Rita rita</i>
Baghair	Dwarf goonch	<i>Bagarius bagarius</i>
Bacha	Batchwa vacha	<i>Eutropiichthys vacha</i>

Table 3

Valuable fish stocks caught by set bagnet at juvenile stage in the Payra river

Sl.	Local name	Common name	Scientific name
1	Chital	Clown knife fish	<i>Chitala chitala</i>
2	Foli	Bronze featherback	<i>Notopterus notopterus</i>
3	Ilish	Hilsa shad	<i>Tenualosa ilisha</i>
4	Rita	Whale catfish	<i>Rita rita</i>
5	Air	Long whiskered catfish	<i>Sperata aor</i>
6	Baghair	Dwarf goonch	<i>Bagarius bagarius</i>
7	Boal	Freshwater shark	<i>Wallago attu</i>
8	Golda chingri	Giant freshwater prawn	<i>Macrobrachium rosenbergii</i>

The average length of Ilish, Rita, Air, Chital, Boal, Baghair, Foli and Golda chingri in set bagnet catch were 7.1 cm, 10.3 cm, 11.5 cm, 13.1 cm, 10.6 cm, 12.4 cm, 10.2 cm and 4.3 cm respectively. But in nature, considering fishing mortality, Ilish can grow up to 60 cm[9], Rita- 150 cm[8], Air- 180 cm[8], Chital- 120 cm[10], Boal- 186 cm[10], Baghair- 200 cm[8], Foli- 60 cm[10] and Golda chingri- 25 cm[11].

Annual catch (in number) of seven large commercially important finfish species and one species of prawn in 15 km study area of the Payra river was calculated to demonstrate the annual impact of set bagnet on biodiversity and fisheries. Estimated annual catch (in number) of the important species in the surveyed 15 km area by set bagnet were: 11.341 million of Ilish, 0.747 million of Rita, 0.49 million of Air, 0.302 million of Chital, 0.177 million of Boal, 0.114 million of Baghair, 0.286 million of Foli and 6.819 million of Golda chingri.

Among the selected important species, estimated annual catch (in weight) by set bagnet were: Ilish-51.03 MT, Rita-8.83 MT, Air-6.92 MT, Chital-4.72 MT, Boal-2.03 MT, Baghair-1.84 MT, Foli-3.35 MT and Golda chingri-13.46 MT. All these species in set bagnet catches were immature fauna. If these species were not caught by set bagnet,

they would produce 8505.411 MT Ilish, 1866.710 MT Rita, 1740.295 MT Air, 1222.549 MT Chital, 795.042 MT Boal, 517.299 MT Baghair, 60.156 MT Foli and 1227.453 MT Golda chingri from only 15 km (length-wise) of the Payra river. On the other hand, if we consider 30% natural and other fishing mortality, these species would produce 5953.788 MT Ilish, 1306.697 MT Rita, 1218.207 MT Air, 855.784 MT Chital, 556.529 MT Boal, 362.109 MT Baghair, 42.109 MT Foli and 859.217 MT Golda chingri. A list of annual catch of valuable species by set bagnet in the study area with their expected production is shown in Table 4.

Table 4

Annual catch (in number) of valuable fish stocks by set bagnet in the Payra river (in 15 km) with their expected production at adult size.

Local name	Annual catch in set bagnet (MT)	Average weight in set bagnet catch (g)	Average adult size in weight (kg)**	Expected production at adult size (MT)	If we consider 30% mortality, then the expected production (MT)
Ilish	51.03	4.51	0.75	8505.411	5953.788
Rita	8.83	12.51	2.5	1866.710	1306.697
Air	6.92	14.92	3.55	1740.295	1218.207
Chital	4.72	16.77	4.05	1222.549	855.784
Boal	2.03	12.65	4.5	795.042	556.529
Baghair	1.84	18.41	4.55	517.299	362.109
Foli	3.35	10.43	0.21	60.156	42.109
Golda chingri	13.46	2.23	0.18	1227.453	859.217

*Estimated annual catch in number of commercially important species in the surveyed 15 km area by the set bagnet; **Average adult weight of commercially important species collected from present field surveyed on the basis of fishermen's opinion.

4. Discussion

In the Payra river, 52 species of finfish, prawns and crabs under 23 families were recorded in the set bagnet catches. Hasan conducted a survey on set bagnet fishery in Ramnabad river. He recorded a total of about twelve species of finfish and prawns under 11 families in set bagnet catch during his study period[12]. Islam *et al.* reported that about 12560 set bagnet were estimated to be operated in the estuarine areas of Bangladesh. A total of about 185 species or groups of species of finfish and shellfish were identified in the estuarine set bag net catches. These included 15 penaeid shrimps, 9 freshwater prawns, 3 crabs, 3 mollusks, 90 pelagic and 62 demersal finfish[13], whereas current study was conducted on set bagnet fishery in a coastal river and recorded 44 species of finfish, 6 species prawns and 2 species crabs in the gear. Heavy freshwater runoff from the Meghna river greatly reduced salinity in the Payra river leading to less availability of brackish and marine water species. From the study, it was found that most of the species were freshwater fish except some migratory fish.

Seasonal variations in the species diversity were found throughout the study period in the Payra river. During monsoon period (June to September) when water level is high, maximum number of species was recorded in set bagnet catch. Islam *et al.* conducted a survey on set bagnet fishery and they also reported that the highest species diversity

was found in the monsoon season^[13]. Maximum species were found in set bagnet catch during monsoon period because of the abundance of diversified species at their initial stage in the coastal river.

The monthly mean catch rates of set bagnet exhibited different values in different months. This could probably be due to the presence of numerous species which had different peak month of abundance. During the study period, highest catch rate in weight [(5.99±0.87) kg/haul] was found in January and highest catch rate in number [(1487±189) fishes/haul] was found in September. On the other hand, lowest catch rate in weight [(2.25±0.36) kg/haul] was found in April and lowest catch rate in number [(313±81) fishes/haul] was found in March. In September, highest catch rate in number was observed whereas highest catch rate in weight was observed in January. These unrelated catch rates (in weight and in number) were due to the presence of large number of Kachki (small fish) in September, which increased the number of species rather than weight of catch.

The Payra river is the major spawning ground and habitat for many important fish species. This river also serves as natural habitat for many threatened species. The International Union for Conservation of Nature revealed 54 threatened species of fishes in Bangladesh^[14]. Among them, Foli (*Notopterus notopterus*), Tit punti (*Puntius ticto*), Air (*Sperata aor*), Kajuli (*Ailia punctata*), Chanda (*Chanda nama*) and Bheda (*Nandus nandus*) under vulnerable groups, Chital (*Chitala chitala*), Darkina (*Esomus danricus*), Bata (*Labeo bata*), Dhela (*Osteobrama cotio*), Silong (*Silonia silondia*) and Pabda (*Ompok pabda*) under endangered groups and Sarpunti (*Puntius sarana*), Rita (*Rita rita*), Baghair (*Bagarius bagarius*) and Bacha (*Eutropiichthys vacha*) under critically endangered groups were found in set bagnet catch in the Payra river. Abundance of Foli, Air, Chital, Pabda, Sarpunti, Rita and Baghair were extremely reduced by the set bagnet through indiscriminate fishing.

Set bagnet was used to harvest major types of fish species, in which most of them were juveniles that move along with the current. During the study period, tremendous negative impacts were found on some valuable fish stocks. Among the total catch, 8 species, namely, Chital (*Chitala chitala*), Foli (*Notopterus notopterus*), Ilish (*Tenualosa ilisha*), Rita (*Rita rita*), Air (*Sperata aor*), Baghair (*Bagarius bagarius*), Boal (*Wallago attu*) and Golda chingri (*Macrobrachium rosenbergii*) were identified as more vulnerable to the set bagnet at initial stage of their life cycle. In comparison with the maximum length of selected species, set bagnet catches indicated that all species were caught at initial stages of their life cycle. Accordingly, this fishery can be categorized as a harmful method for valuable fish stocks.

Khan *et al.* described that set bagnet made an efficient gear for capturing a wide range of finfish and shellfish species, but it at the same time captured a wide size range of fishes including juvenile^[15]. Uddin *et al.* reported that the main problem concerning the set bagnet was its non-selectivity regarding size and species, resulting indiscriminate catches of juvenile groups^[16]. Akerman mentioned a general statement that

catches of set bagnet contained large number of juvenile species which drifted with the current^[17]. All the above findings indicated that most of the species in set bagnet catches were unable to move against current, specified that these species were mostly immature fauna. Using this type of gear (set bagnet) for fishing in the coastal rivers and the shallow waters of the sea, which are generally nursery grounds for most of the finfish and shellfish, is considered harmful to the aquatic resources.

In the overview of set bagnet catch, it was found that most of the species were juveniles of larger valuable species. An increase in mesh size may be considered as helpful measures in reducing the catch of juveniles without affecting the income from its operation. But it is not practical because set bagnet is only effective to catch juveniles of larger species and small indigenous species which are unable to move against current. On the other hand, a seasonal reduction in the fishing effort of set bagnet during selected months when juveniles of valuable species are predominant, but it is difficult to identify a specific range of months when juveniles of valuable species are available because spawning season and availability of juveniles of different species are occupied in different seasons, which may cover round the year. Fisheries research institutes and national policy planning authorities should provide thoughtful attention on this sector to identify impacts of set bagnet on overall riverine ecosystem in the country and to develop more feasible strategy as conservation measures. Considering the current findings on negative impacts of set bagnet, gradual closing of this gear might be considered by the proper authority in consultation with stakeholders that would reduce the destruction of juveniles, help in conservation and sustainable management of fisheries resources.

Conflict of interest statement

We declare that we have no conflict of interest.

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Comments

Background

Bangladesh is rich in coastal river systems which plays a

significant role in various fisheries resources of the country. The Payra river is one of them which constitutes a significant nursery grounds for aquatic biota which is important for fisheries production of the country. Therefore, the comprehensive assessment of the ecosystem of this river is in urgent need.

Research frontiers

The present research is based on coastal set bagnet fishery in the Payra river of Bangladesh. This study shows that a total of 52 species of finfish and shellfish are dominant in this river system. Among these species, some are threatened while 4 species are critically endangered species. The reason of such endangered species is due to illegal use of set bagnet by the fishermen. Therefore, the use of this net should be banned during the fishing in this river.

Related reports

Khan *et al.* described that set bagnet made an efficient gear for capturing a wide range of finfish and shellfish species, but it at the same time captured a wide size range of fishes including juvenile. Uddin *et al.* reported that the main problem concerning the set bagnet was its non-selectivity regarding size and species, resulting indiscriminate catches of juvenile groups.

Innovations and breakthroughs

In the present study, authors have demonstrated that the use of set bagnet in the fishing areas is not useful because it destroys the nursery grounds of commercially important fish and shellfish juveniles.

Applications

This research suggests that the use of set bagnet should be banned for fishing practices.

Peer review

This study gives useful information on the use of set bagnet in the Payra river and its effects on fisheries and biodiversity of the area. The data showed that some species were found as critical endangered species. Therefore, the authority must take strict action against the use of set bagnet in Payra river to save the fish biomass and biodiversity.

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