Impact of Island on Fish Diversity and
Fisherman Community in Palordi River, Bangladesh

¹Diba Kar, ²Shaharior Hossen, ²Md. Rajib Sharker,
³Md. Foysul Hossain, ⁴Md. Abdul Hannan, ⁵Layla Khasrun Zannat,
⁶Mir Mohammad Ali, ⁷Prosun Roy and ⁸Md. Ashik Al Faisal

¹Department of Fisheries Management,
Bangladesh Agricultural University, Mymensingh 2202, Bangladesh
²Department of Fisheries Biology and Genetics,
Patuakhali Science and Technology University, Patuakhali 8602, Bangladesh
³Department of Aquatic Environment and Resource Management,
Sher-e-Bangla Agricultural University, Dhaka 1207, Bangladesh
⁴Department of Aquatic Animal Health Management,
Sher-e-Bangla Agricultural University, Dhaka 1207, Bangladesh
⁵Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi 6205, Bangladesh
⁶Department of Aquaculture, Sher-e-Bangla Agricultural University, Dhaka 1207, Bangladesh
⁷Department of Aquaculture, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh
⁸Department of Aquaculture, Patuakhali Science and Technology University, Patuakhali 8602, Bangladesh

Abstract: The present study was conducted to denote the impact of island on the Palordi River during the period from August 2016 to July 2017. Availability of fish in present time is less than the past time, which represent the main impact of island. Study revealed 39 fish species belonging to 9 orders, 13 families and 35 genera from Palordi River. The dominant order was Cypriniformes (12 species) followed by Perciformes (8 species), Siluriformes (7 species) and Clupeiformes (5 species). Four critically endangered, 7 endangered and 5 vulnerable fish species of Bangladesh were also recorded along with 1 alien silver carp species. Eight types of nets, 4 types of traps, 2-3 types of spears and harpoons and 3 types of hooks and lines were found to be used in the river both traditionally and commercially. Island in palordi river were causes the loss of biodiversity. Large portion of fishermen (72%) were migrate in other professions due to reduced annual income (15, 000-25, 000 BDT) from fishing. Necessary steps should be taken to develop the awareness, government approaches, climate change and management policy, among the people about that impact.

Key words: Fish · Fishing gear · Island · Biodiversity loss · Fishermen · River

INTRODUCTION

Bangladesh is known as riverine country and fisheries sectors plays a significant role in socioeconomic improvement of Bangladesh [1-9]. The Inland water resources of Bangladesh are considered to be one of the richest resources in the world both in area and potential for Fisheries Development [10-15]. The richness of Bangladesh's fish diversity and high productivity comes from the geographical position of the country at the confluence of a major system of rivers in one of the world's biggest deltas [16-20]. The fisheries resource of Bangladesh consists of canals, rivers, beels, haors, oxbow lakes and flood plain [21-26]. There are 289 native fresh water species, 475 marine fish, 24 freshwater prawn, 36 shrimp and 12 exotic fish species, enhance the fisheries resource of Bangladesh [27-29]. Freshwater fish diversity is considered as the most threatened taxonomic group due to their high sensitivity to the qualitative and quantitative change of aquatic habits [30-37]. The open water bodies

Corresponding Author: Md. Rajib Sharker, Department of Fisheries Biology and Genetics, Patuakhali Science and Technology University, Patuakhali 8602, Bangladesh.

including river and estuaries 1031, 563 ha, beels 114, 161 ha, Kaptai lake 68, 800 ha, floodplains 2832 792 ha and polder/enclosures 873, 000 ha [15, 38].

Islands and bars are very common features among them all. In Bangladesh, both islands and bars are known as chars, but in this article only the vegetated islands within the riverbanks are referred to as chars. The island of Palordi River in gournadi is such a one type of island. The majority of the affected people perceive island as a natural degree of economic loss and vulnerability of population due to island has dramatically increased in recent years. The present study was aimed to assess the impact of island on fish biodiversity and socioeconomic condition of fishermen in Palordi River.

MATERIALS AND METHODS

Study Period and Locations: The study was conducted of Palordi River (Embranchment of Arial khan) in Gournadi upazila at Barisal district (Gournadi main upazila, Gainaghata and Sorikal etc.) from August 2016 to July 2017. The longitude of Gournadi is 90.212159 and latitude is 22.9619. Gournadi is located at 22°58'25" N 90°13'50" /22.9736° N 90.2306° E.

Data Collection Methods: Both primary and secondary data were used during the study. For gathering data, a combination of several survey techniques was adopted. Several PRA tools were used to collect the data from the
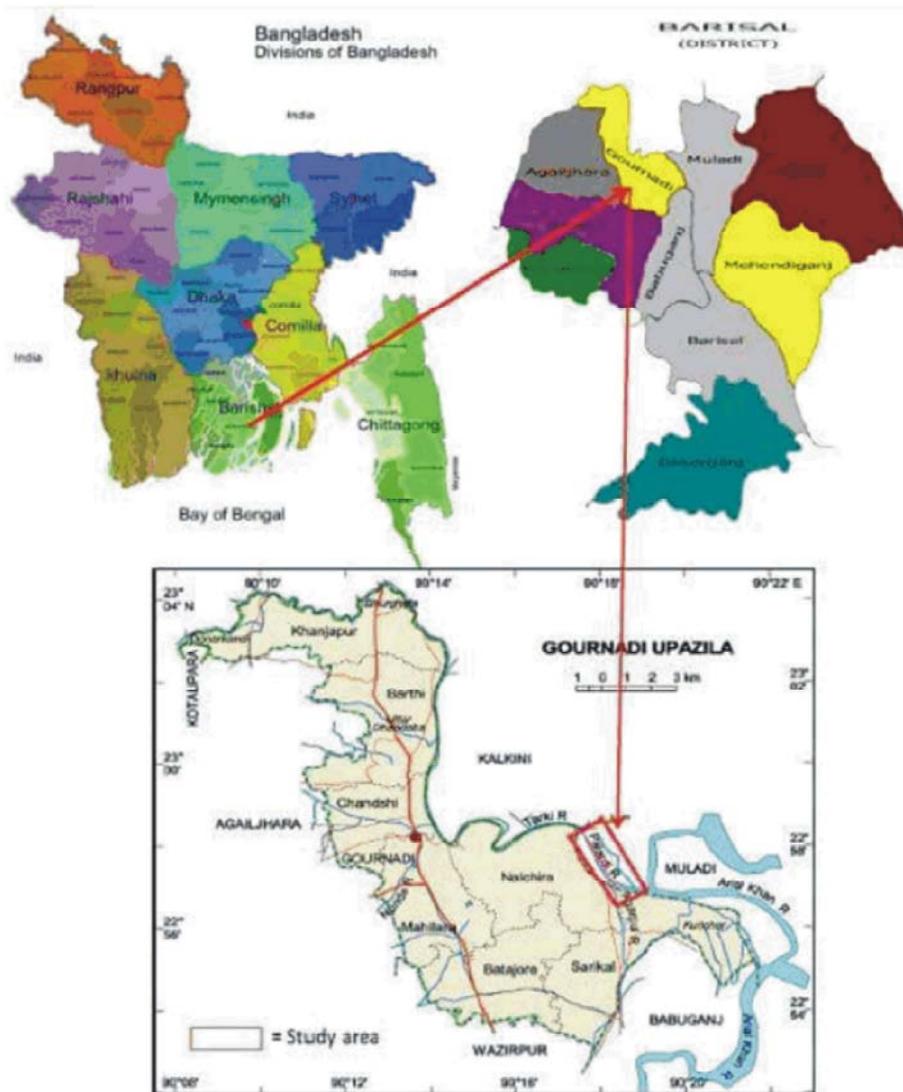

Fig. 1: Map showing the study area of Gournadi Upazila in Barisal district

fishing communities such as- personal interview, focus group discussion (FGD), crosscheck interview with extension agents and older persons, transect walk and case study. Primary data were collected from the market survey and sample collection. By using questionnaire, interviews and direct observations, primary data were gathered for this survey. Primary data were collected through structured questionnaires. The questionnaire forms were filled in by interviewing from 100 fishermen fishing in the Palordi River. Whereas, Secondary source of information consists of published material such as journals, textbooks, newspaper etc. Moreover, some important information's were collected from Upazila Fisheries Office and Local NGO's.

Sample Collection, Identification and Preservation: Fish sample collected from the study area were identified based on meristic and morphometric feature following Rahman, 2005. Some samples were difficult to on spot identification, they are preserved with 8% formalin and transported to the laboratory of faculty of fisheries, Patuakhali Science and Technology University for further identification.

Statistical Analysis: The collected data were analyzed using Microsoft excel 2010 and presented as in textual, tabular and graphical forms to understand the fish diversity, impact of island and the socioeconomic conditions of fishermen of Palordi River.

RESULTS AND DISCUSSION

Biodiversity in Palordi River: According to IUCN, fishes Order, families, species, English name, local name and present status in Bangladesh are mentioned in Table 1. The present study recorded a total of 39 fish species belonging 9 orders, 19 families and 35 genera. The percent composition of families, genera and species under various orders are placed in Table 2. The dominant order was Cypriniformes (32.43%) comprising of all the number of species recorded. Nearest dominant orders were Siluriformes(20.91%), Perciformes(20.91%), Clupeiformes (13.51%). Hossen *et al.* [18] also reported Cypriniformies as dominant order from the Kirtankhola River. Whereas, Jahan, *et al.* [23] reported Percifomes as dominant in the Baleshwari River of Bangladesh. The study also recorded 16 threatened species belonging 7 endangered species, 4 critical endangered and 5 vulnerable, respectively.

Within the collected fish sample 18 species (46.15%) were common followed by not very common, rare and very rare (Figure 2). Present study also recorded 16 IUCN red listed species (Figure 3), whereas 26 threatened

species were reported from Baleshwari River [23] and 31 from Kirtankhola River [18].

Fishing Gears: In the present study 8 types of nets, 4 types of traps, 2-3 types of spears and harpoons and 3 types of hooks and lines were found in the Palordi river (Table 3). Both the professional and non-professional fishermen use nets to catch fishes in different fishing points of river.

Spears and harpoons are used during the rainy season but sometimes traditional fishermen used it round the year. There are some number of spears and harpoons and 3 type's hooks and lines were used in fishing purpose in this river. The fishing technique that are currently used by the fishermen of Bangladesh have been broadly categories into Netting, Angling, Trapping, De-watering and Hand picking [19, 39].

Loss of Biodiversity: Many wildlife species have been exterminated in Bangladesh and many more are threatened with extinction. In the study area it was observed that the fish species and the amount of catch as well as the total fish diversity of these rivers are gradually declining day by day. The year 2010, following species were available:

- Psudoambassia lala (Chanda)
- Ompok pabda (Pabda)
- Lepidocephalichthys gunte (Gutum)
- Dasyatis zuge (Sapla-pata)
- Macrognathus aculeatus (Tara-baim)
- Monopterus cuchia(Cuchia)
- Tetraodon fluviatilis (Potka)
- Devario devario (Banspata)

Factors Regarding Losses of Fish Biodiversity
Change the River Direction: Both natural causes and human interventions are responsible for the changes in the course of the rivers. These high sediment loads reflect the extremely high rate of erosion in their drainage basins. River courses are affected by processes of erosion and deposition which occur under natural and flood conditions. In the study area, this process has deprived the river downstream of sediment and excessive sedimentation because much of the sediment. When referring to river channel migration, it is typically in reference to meandering streams. In braided steams, channel change is driven by sediment transport. Environmentalists say the reduced flows are linked to climate change and will have a major impact as the human population grows. In low ?ows can reduced growth and recruitment of ?sh and other fauna but usually not all species in rivers and streams.

Table 1: Order, families, species, English name, local name and present status of fishes in the Palordi River

Sl No.	Order	Family	Species (scientific name)	English name	Local name	Present status	Red list status
01.	Clupeiformes	Culpeidae	*Corica soborna*	Ganges river sprat	Kachki	Common	NO
02.	.		*Gudusia chapra*	Indian river shad	Chapila	Common	NO
03.	.		*Gonialosa manmina*	Ganges river gizzard shad	Chapila	Common	NT
04.	.		*Tenualosa ilisha*	Hilsa shad	Ilish	Rare	NO
05.	.	Engraulidae	*Setipinna phasa*	Gangetic hairfin anchovy	Phasa	Very rare	VU
06.	Cypriniformes	Cyprinidae	*Cirrhinus cirrhosus*	Mrigal	Mrigal	Not very common	NO
07.	.		*Amblypharyngodon mola*	Mola carplet	Mola	Common	NO
08.	.		*Catla catla*	Catla	Katlo	Common	NO
09.	.		*Ctenopharyngodon idella*	Grass carp	Grass crap	Not very common	NO
10.	.		*Cyprinus carpio*	Common crap	Common crap	Not very common	NO
11.	.		*Devario devario*	Sind danio	Banspata	Common	CR
12.	.		*Labeo bata*	Bata	Bata	Rare	EN
13.	.		*Labeo calbasu*	Orange fin labeo	Kalibasu	Not very common	EN
14.	.		*Labeo rohita*	Rohu	Rui	Common	DD
15.	.		*Puntius puntio*	Puntio barb	Punti	Common	EN
16.	.		*Puntius sarana*	Olive barb	Sor punti	Not very common	CR
17.	.	Cobitidae	*Lepidocephalichthys guntea*	Guntea loach	Gutum	Rare	NT
18.	Osteoglossiformes	Notopteridae	*Notopterus notopterus*	Bronze featherback	Chital	Rare	VU
19.	Perciformes	Channidae	*Channa gachua*		Gachua	Rare	VU
20.	.		*Channa punctata*	Spotted snakehead	Taki	Common	NO
21.	.		*Channa striata*	Snakehead murrel	Shol	Common	NO
22.	.	Gobiidae	*Glossogobius giuris*	Tank goby	Bele	Not very common	NO
23.	.		*Pseudapocryptes elongatus*		Chewa	Common	TH
24.	.	Anabantidae	*Anabus testudineus*	Climbing perch	Koi	Common	DD
25.	.	Nandidae	*Nandus nandus*	Mud perch	Meni	Common	VU
26.	.	Osphronemidae	*Colisa fasciata*	Banded gourami	Khailsha	Common	NT
27.	Siluriformes	Bagridae	*Mystus vittatus*	Striped dwarf	Tengra	Common	NO
28.	.		*Sperata aor*	Long whiskered	Ayre	Not very common	EN
29.	.	Siluridae	*Ompok pabda*	Pabo catfish	Pabda cafish	Not very common	EN
30.	.		*Wallago attu*	Wallago	Boal	Not very common	NO
31.	.	Clariidae	*Clarias batrachus*	Walking catfish	Magur	Not very common	NO
32.	.	Heteropneustidae	*Heteropneustes fossilis*	Stinging catfish	Shing	Common	NO
33.	.	Pangasiidae	*Pangasius pangasius*	Yellowtail catfish	Pangus	Not very common	VU
34.	Rajiformes	Dasyatidae	*Dasyatis zugei*	Stingray	Sapla-pata	Very rare	EX
35.	Synbranchiformes	Mastacembelidae	*Macrognathus aculeatus*	Lesser spiny eel	Tara-baim	Very rare	CR
36.	.		*Mastacembelus armatus*	Zig-zag eel	Baim	Not very common	CR
37.	.	Synbranchidae	*Monopterus cuchia*	Cuchia	Kuchia	Common	EN
38.	Tetraodontiformes	Tetraodontidae	*Tetraodon fluviatilis*	Green pufferfisn	Potka	Very rare	EN
39.	Osphronemiformes	Ambassidae	*Pseudoambassia lala*	High fin glassy perchlet	Lal chanda	Common	NO

Note: VU-Vulnerable, EN-Endangered, CR-Critical endangered, EX-Extinct, NT=Not threatened, DD-Data deficient. According to IUCN Bangladesh, 2013

Table 2: The percentage of presence of family, genera, fish species under different order

| Order	No. of family	No. of genera	No. of species	% of family	% of genera	% of species
Clupeiformes	2	5	5	10.53%	15.15%	12.82%
Cypriniformes	2	9	12	10.53%	27.27%	30.77%
Osteoglossiformes	1	1	1	5.26%	3.03%	2.56%
Perciformes	5	6	8	26.32%	18.18%	20.51%
Siluriformes	5	7	2	26.32%	21.21%	5.12%
Rajiformes	1	1	1	5.26%	3.03%	2.56%
Synbranchiformes	1	2	3	5.26%	6.06%	7.69%
Tetraodontiformes	1	1	1	5.26%	3.03%	2.56%
Osphronemiformes	1	1	1	5.26%	3.03%	2.56%
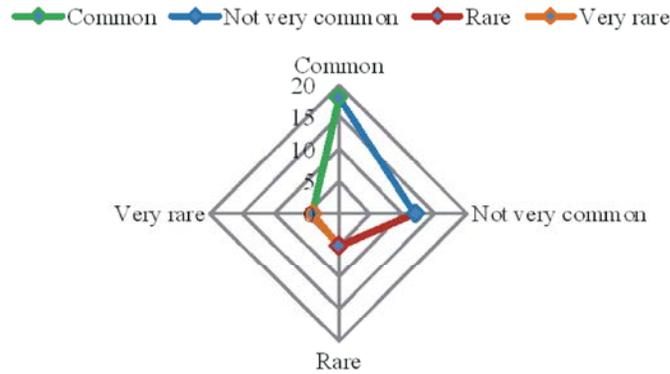
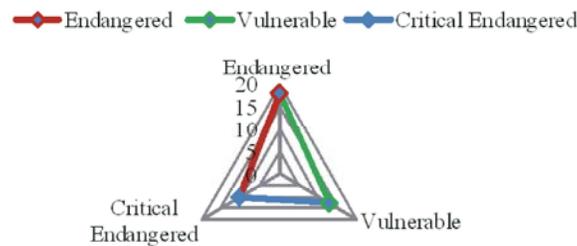Fig. 2: Value of different categories fish in the study areas

Fig. 3: Percentage of fish species under different categories of threat as per IUCN in the study areas

Table 3: The traps and wounding gears used for fishing in the Palordi River

Type of gear	Name of gear	Harvested common fish species
Traps	Chunga	Bele, Shol, Taki, Tengra, Baim, Singh, Shol, Boal, Gajar, Rui, Catal, Mrigal, Ayre etc.
	Polo	Bighead, Grass carp, Chital, Foli etc.
	Bhair	Bain, Tengra, Catal, Rui, Mrigal, Boal, Guzza, Ayre etc.
	Chupi	Bighead, Grass carp, Foli, Shol, Boal, Gajar, Rui, Catal, Mrigal, Ayre, etc.
	Gora	SIS (Puti, Mola, Kholisha, Gutum, Dhela, Tit puti, Chanda) Taki, Chigri, Crab, Koi, Lal chanda etc.
Wounding gears	Ek-ata	Boal, Carps, Singh, Magur etc.
	Tin-ata	Boal, Carps, Tengra etc.
	Konch	Carps, Boal, Ayre etc.
	Jhupi	Singh, Magur, Taki, Khorsula, Tengra etc.
Hooks and lines	Basha barsi	Shol, Jut puti, Taki, Singh, Magur etc.
	Wheel barsi	Boal, Ayre, Baila, Tengra etc.
	Dari barsi	Bele, Puti, Tengra, Singh etc.
Net	Current jal	Ilish, Rui, Catla, Silver carp, Mirror carp, Gajar, Bighead etc.
	Set bag net	All type of fish and fish related organisms.
	Jhaki jal	Bele, Shol, Taki, Tengra, Gharua, Baim, Singh, Shol, Boal, Gajar, Rui, Catla, Mrigal, Ayre etc.
	Gill net	Ilish, Rui, Bighead, Catla, Grass carp, Gajar etc.
	Beshal jal	All type of fish and fish related organisms.

Loss of Habitat: In the study area, landscape becomes fragmented and reduced physical structure occurring between habitat units, movement of adults, recruits and larvae between habitats becomes impeded only because of island in the river. For fish breeding, the river has not enough water but water comes into the river in May-June or rainy season when the breeding season is already over. As a result, habitat was degraded day by day and fish species were migrated into another habitat. The river remains dry throughout the fish-breeding season forcing fishermen to shift to farming but the problem is that they

don't have experience in this kind of work coupled by the lack of arable land.

Other Causes of Declining Fish Species and the Amount of Catch: In the study area it was observed that the fish species and the amount of catch as well as the total fish diversity of these rivers are gradually declining day by day. There are a number of causes for the declinations of fish diversity have been identified. Some causes are manmade and other occurrence naturally. During the study identified causes are listed in shown below:

- Reduce water level during drought period.
- There is no fish sanctuary in the whole rivers.
- River bank erosion causes reduction of water depth.
- Reduced water depth due to river bed siltation and make up island.
- Rubber dam one of the major problems.
- Use of current jal and other destructive fishing gear
- Use of illegal fishing gears
- Use of chemical fertilizer and over doses of insecticides and pesticides in agriculture land.
- Kata fishery causes reduction of mother fish etc.
- Siltation of river.
- Indiscriminate fishing throughout all period of a year.
- Fishing of brood fish and fry during breeding season.
- Environmental and water pollution.

Impact of Biodiversity Losses on the Socioeconomic Aspects of Fishermen
Migrate in Other Profession: During the study period it was observed that 72% of fishermen had lowest annual income from fishing between BDT 15, 000-25, 000, In that cases, fisherman was migrated in other profession over all the population. Such as- Business (fish food business, fertilizer business) shopkeeper, paikar businessman, Aratdar etc. The study result showed that about 35% fisher become aratder, 25% are fish feed business (Figure 4).

Annual Income Only from Fishing: During the study period it was observed that 72% of fishermen had lowest annual income from fishing between BDT 15, 000-25, 000, 18% had medium income between BDT 25, 001-35, 000 (Figure 5) Hossen et al 2020b found that the highest income of fishermen was TK. 71, 000-above and lowest income was TK 25, 000-40, 000 which is better than present study.

Savings: Savings play an important role for future planning of fishermen. In the study area, it was found that only 35% fishermen had savings and 65% had no savings (Figure 6). Present study reported better results than the fishermen of Tetulia River [24].

Housing Condition: The nature of house indicates the social status and their financial status of the people. In the study area, there are many kacha house made on the island of the Palordi River. They are very poor and live in under the poverty line. On the other hand, the housing condition of fishermen or people of this area were divided into three categories: (1) Kacha- house made of bamboo or tin with mud flooring or wall and flooring made of mud, (2) Semi paka- tin shed with tin wall and concrete flooring and (3) Paka- tin shed with brick wall and concrete flooring. The result showed that 70% fishermen had kacha house (Figure 7), which showed better results than the housing conditions of the fishermen in Sugondha River [6]. At Sundarban Estuaries, Mondal, *et al.* [2] found that 30% fishermen had kacha house.

Cultivate of Crops: The soil of the island is extremely fertile and the climate is tropical making excellent conditions for growing vegetables and fruits. The island has a total 6-7 acres for agricultural use. Agriculture is very important to the rural way of life. Vegetables are important cash crops for many island farmers. Potatoes, cabbage, rabbit, ladies' finger, tomatoes, cauliflower, sweet potatoes etc. are the main cultivated vegetables. Fruits are also cultivated on the island. Such as sugarcane, banana, papaya etc. Sugarcane, bananas, coffee, pineapple, avocados, eggplant, citrus fruit, yams, sweet potatoes and exotic flowers plants on Martinique. Jute are the common crops that are cultivated in the island. In the study area, about 20 percent of the working population is involved in subsistence agriculture.

Built up Brick Field: Bricks are made for building. In the study area, one brickfield was made-up in the bank of river (TBI brickfield) As a result, there are two impacts for made-up of brickfield. Such as- positive and negative. In positive side, brick fields constitute the major part of economic activity of the Palordi River. Total employers were jointed to the brick field. About 50% people are joint to making brick (Figure 8). Alleviated the unemployment near the river areas people.

The average amount of mud that is used by these brick fields is about 88.07 m^3. The average production of brickfields is 62.77 thousand bricks/year.

Collection of sand (used as a raw material for brick production) from the river bed as well as from the river bank causes different types of hydrological changes within the river system. Collecting raw material (soil) not only from the river bank but also from the agricultural land. Most of these brick fields are surrounded by agricultural land up to a greater distance [40]. It reduced of land quality. Productivity of soil declines when land becomes degraded.
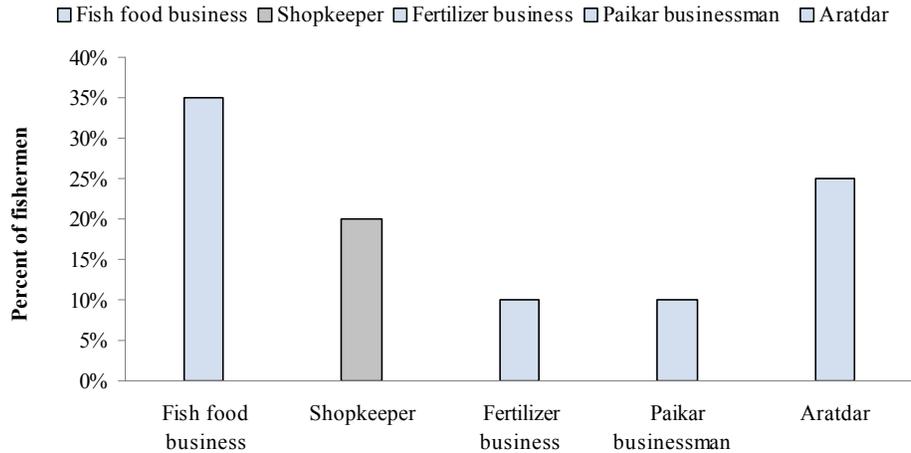
☐ Fish food business ☐ Shopkeeper ☐ Fertilizer business ☐ Paikar businessman ☐ Aratdar

Fig. 4: Migration of the fisherman to other profession
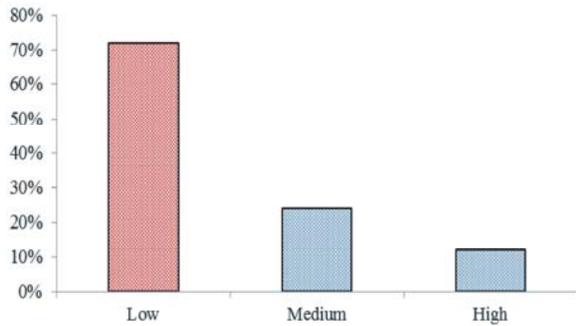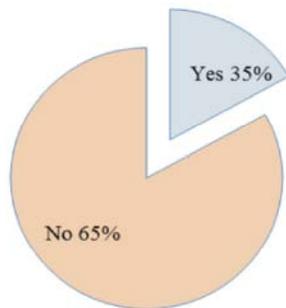

Fig. 5: Annual Income only from fishing

Fig. 6: Savings of fisherman in the Palordi River

Housing condition of fishermen

Fig. 7: Housing condition of fishermen in the Palordi River

Fig. 8: The percentage of brickfield employer in the Palordi River
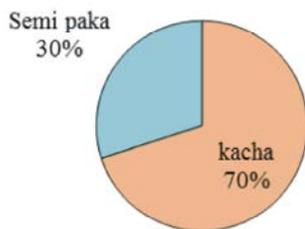
CONCLUSION

The present study focused on the impact of island in fish diversity and socioeconomic conditions of the fishermen of Palordi River. Due to formation of island, different types of fish species declining day by day. Gradually losses of fish diversity exhibited negative impact on the socioeconomic condition of the fishermen in this river. Annual income of the fishermen was not satisfactory due to lower fish diversity. Thus, fishermen were migrated into other profession. Moreover, findings of the present study would be helpful to manage and develop fish biodiversity in future.

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