Seasonal Availability and Price Margin of Freshwater Mud Eel (Monopterus Cuchia) in Dinajpur, Bangladesh

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***Abstract*—** The main purpose of this study is to explore the seasonal availability, marketing channel and price margin of freshwater mud Eel (Monopterus cuchia). There are a number of freshwater and marine Eel species in Bangladesh, Monopterus cuchia is a freshwater species which commonly known as Gangetic mud eel, belongs to the family Synbranchidae under the order of Synbranchiformes. Data were collected through two ways like primary (questionnaire interviews with freshwater eel traders) and secondary (web articles, published reports, papers) and each stage of the survey, data were checked, edited and coded in the field. Data from various sources were coded and entered into a database system using Microsoft Excel Software and SPSS. Marketing season of this study was October to December where Kuchia is more available than other months and less available in December to February. The highest purchase of Kuchia from wholesaler was 5 mt/year and exporter was 12.4 mt/year. The highest purchase volume of Kuchia of wholesaler and exporter was 220 kg and 620 kg respectively. The highest purchase price of Kuchia of wholesaler and exporter was 165 Tk/kg and 212 Tk/kg respectively. Total purchase value of Kuchia of wholesaler and exporter was 453840 to 716800 Tk/year and 1501440 to 2733120 Tk/year respectively. The highest sell price value of wholesaler and exporter was 204 Tk/kg and 315 Tk/kg respectively. The total sell value ranged from 597312 to 897024 Tk/year in case of wholesalers and 2244800 to 4056000 Tk/year.

***Keywords*—** Fish cultivation, aquaculture, fisheries management, fresh water fish, fish trading.

I. INTRODUCTION

Inland waters of Bangladesh are rich with wild fishery resources where carps and small indigenous fishes are the most important group of fish [1] that has been successfully cultured in many countries of the world [2], particularly in the South East Asian countries [3]. Now a days, fish farmers are encouraged for inland fisheries due to increased fish production [4]. Beels are very good natural habitat of large and small indigenous fishes of different food habits [5]. Among the freshwater fish species in Bangladesh, a lot of eels are available, which have good taste, high protein contents, high market value with important production potentials. A good number of marine and freshwater eel species, available in Bangladesh like Anguilla bengalensis, Anguilla bicolor, Pisodonophis boro (Marine eels), Monopterus cuchia, Monopterus albus, Macrognathus aculeatus (Spiny eels). Among these eels, the freshwater mud eel, Monopterus cuchia, also known as Kuchia or swamp Eel [6].

Monopterus cuchia commonly known as Gangetic mud eel, belongs to the family Synbranchidae under the order of Synbranchiformes. The body of the freshwater mud eel, is a slender shaped streamline with a tapering tail. They do not have pectoral, pelvic and dorsal fin rather the dorsal and anal fins are fused with caudal or tail fins forming a single ribbon along the whole length of the fish [1]. Ventral fins are also reduced, sometimes skin folds are seen. A pair of supra branchial chambers are present and each contain a complicated labyrinthine organ. The pharyngeal pouches starts developing at an early stage but become functional quite late in its life history [7]. The main feature of the body is slimy with snake like appearance. The color of fresh specimen is light brown becoming light green on abdomen with numerous black spot. Body color is deep brown whereas abdominal part is comparatively opaque; eyes are small, head not conspicuous [8]. Anus is posteriorly situated than normal position. Barbie is absent but rib and one row of palatine teeth are present. Very small, round and indistinct scales longitudinally arranged. Gill-opening crescentic of which gills greatly reduces. Gill openings are situated antero-lateral part of the body [9]. Gill filaments are distributed up to isthmus. The gills of this species are reduced but they have an air breathing organ in the form a pair of sacs on two sides of the head [10]. For this reason fish has a bimodal gaseous exchange and aquatic respiration is supplemented by aerial respiration through pharyngeal diverticula, although water remains the primary medium for normal metabolism [11]. It has

also remarkable ability to distend respiratory air sac for gas exchange in both water and air [12]. Arterioles penetrate deep into the epithelial region of air sacs and buccopharynx in spiral-like fashion to form the characteristic vascular papillae of the respiratory islets.

Monopterus cuchia generally distributed in the freshwaters of Bangladesh, India (Northern and North Eastern), Pakistan and Mayanmar etc. The habitat of this fish is freshwater and brackish water and has been found in the altitudinal range 76-1350 m above sea level. It also found in shallow, well vegetated water and mud. It is available in mud holes in shallow beels and boro paddy field throughout the Bangladesh especially Sylhet, Mymensingh, and Tangail regions. This fish live in ponds, canal, rivers, beels, baor, shallow water comparatively rich with aquatic plants and flooded rice fields [13]. However, recently this fish was also recorded from Chalan beel, Bangladesh. They often spend their daytime hiding under stones and mud or having burrowing habit. This fish resides in the mud holes in the shallow beels along the dykes of paddy field, pits and swamps during the winter season [14]. They can live in holes without water by the help of respiratory organs. Some fishery scientists says that they pass entire summer in hole, but sometimes coming out from the hole to take oxygen. Most of the time in hole of water their mouth position is kept straight upper position and return into the hole completely when found any enemy [15].

The freshwater eel, Monopterus cuchia as a voracious general predator that feed during the night on small fish, amphibians, crustaceans, echinoderms, insect larvae, aquatic invertebrates etc. They also feed on natural foods such as fish fingerlings, earthworms, tubifex, snails, aquatic insects, insects pupae, slaughter house waste (liver, intestine, viscera, skin of livestock animals) etc. In the absence of water and food, this eel is able to survive long periods of drought by burrowing in moist earth [16]. The fish showed highest growth rate in terms of increase in weight with receiving dead small fish as feed and lowest growth was recorded in fed with pellet feed.

In Bangladesh, Kuchia is an export earning commodity that plays an important role in both national and international markets [17]. Considering the increasing demand in the international markets, eel fishery has been gaining popularity among the coastal community of greater Khulna and Chittagong regions as well as grater Mymensing, Sylhet and Comilla region. Globally eel production was expected to grow by thrice between 1985 and 1992, representing an increase of about 58% [18]. On the other hand, world aquaculture production of freshwater eels has increased over the past decade and is currently around 2,33,000 mt/year valued at over US$ 975 million [19]. A significant commercial fishery for eels exists in various developed countries like Australia, Thailand, Malaysia, Japan, Korea, USA, China, Italy, Greece, Egypt, Singapore, Cambodia and Taiwan consisting a great available export market.

It can generate employment opportunity directly and indirectly in terms of people employed in the production, marketing and other associated business [20]. This species has fishery value especially in West Bengal and Assam where it is valued as a foodfish (Talwar and Jhingran 1991). People often rear Monopterus cuchia in cage and sell in local market. In Assam it is cultured for food and has medicinal value for anaemia. The average protein content per lOOg of Kuchia flesh is 14g and the caloric value of Kuchia flesh is as high as 303 Kcal/lOOg compared to 110 Kcal/lOOg in other average fishes. Four species of eel, Monopterus cuchia, Anguilla bengalensis, Pisodonophis boro and Pisodonophis cancrivorus available in Bangladesh. Bangladeshi Kuchia has a huge demand in China and other East-Asian and Asia Pacific countries. Expert Promotion Bureau (EPB) data showed that earning from Kuchia and export jumped to Tk 56 crore in the last fiscal from Tk 22.2 crore in the fiscal year (2010-11). The EPB data also showed that the export volume of eels has doubled between the last two fiscals [21].

Kuchia is such an important fish that many people depend on it for their livelihood. The most marginalized population especially adivasi people, poor people and children collect Kuchia from the wild and sell these to the market or wholesalers. But now-a-days this fish is hardly found in the open water system. Kuchia is one of the species among 25 vulnerable species. Habitat destruction is occurred through blockage of water flow, shallow water depth, encroachment by agriculture and aquaculture purposes [22]. Disease is another factor for the reduction of Kuchia in recently. In most cases hemorrhages, septicemia, different kinds of lesions etc. are the common symptoms of the affected fish. The freshwater eels are recorded as rare species from flood plains and beels due to disease outbreak.

Several works regarding Kuchia have already been conducted such as growth, survival and production, DNA fingerprinting of the freshwater mud eel, growth and survival rate, socio-economic condition of people involved in Kuchia catching. However, there is a lack of information about marketing channel and price margin of Kuchia in Dinajpur region. Therefore, this scientific approach will help to represent the actual situation and price margin of Kuchia by considering the objectives like to know the seasonal availability of freshwater mud Eel, Monopterus cuchia and to analyze the marketing

channel and price margin of freshwater mud Eel, *Monopterus cuchia*.

II. MATERIALS AND METHOD

A. Site Selection

The The study was conducted in Dinajpur district under Rangpur Division which is bounded by Thakurgaon and Panchagarh districts in the north, Gaibandha and Joypurhat districts in the south, Nilphamari and Rangpur districts in the east, and the state of West Bengal, India in the west. The total area of the district is 3,437.98 km. There are 13 Upazilas in Dinajpur where 4 Upazila such as Nawabganj, Ghoraghat, Biral and Birganj were selected (Fig. 3.1). These Upazilas have diversifying small ditches, canal and marshland as well as smaller size derelict pomds where freshwater eel is available and collected by eel collectors. Therefore, supply and marketing point of view these Upazilas were selected for the study.

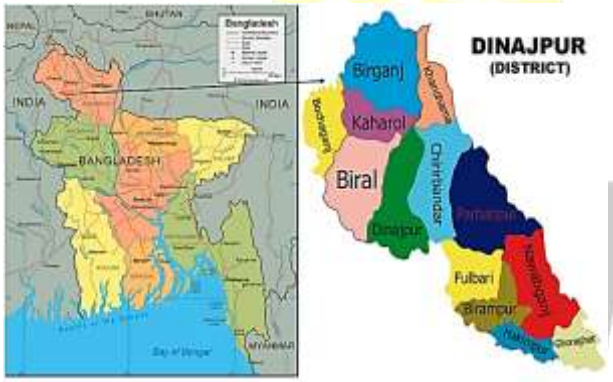

Figure 1. Map of the study area (Nawabganj, Ghoraghat, Biral and Birganj)

B. Data Collection

Data collection as well as field survey was concluded from July, 2016 to June, 2017. The data were collected through stakeholder based separate semi-structured questionnaire prepared by a pre investigation. Data collection methods were followed by following two steps: Primary data was collected by questionnaire interviews with freshwater eel traders, focus group discussion with exporters and wholesalers and cross-check interviews with key informants. Secondary data were collected from web articles, published reports, papers and reviews the existing information on the different aspects of the Kuchia fishery and marketing in Bangladesh.

C. Data Processing and Analysis

At each stage of the survey, data was checked, edited and coded in the field. Data from various sources was coded and entered into a database system using Microsoft Excel software and SPSS. Preliminary data sheets was compared with the original coding sheets to ensure the accuracy of the data entered. Descriptive method of analysis was used to describe the survey results using means and percentage. Some diagrams was also used for describing the findings.

D. Sample Number of the Study

A total of 40 interviewee of Kuchia wholesaler and 10 of exporter under four upazila in Dinajpur district was selected for questionnaire interviews as stakeholder.

E. Variables of the Study

A characteristic, number, or quantity that increases or decreases over time, or takes different values in different situations. Two basic types are (1) Independent variable: that can take different values and can cause corresponding changes in other variables and (2) Dependent variable: that can take different values only in response to an independent variable. In this study, the following characteristics of sampled wholesalers were considered as the independent variables. These are: marketing season and marketing time whereas dependent variables are average volume purchase, average volume sold, purchase price and sell price.

1. Measurement of Independent Variable

A marketing season is a period of one year or sometimes less, designated for reporting and analysis of production, marketing and disposition of commodity. It was measured by no. of months. For example, September to November marketing time was scored by one (1) while October to December was measured by two (2) and December to February was scored by three (3). Marketing is the activity, set of institutions, and process for creating, communicating, delivering, and exchanging offerings that have value for customers, partners, and society at large. For example, the marketing time is 7 am to 11 am in case of Kuchia.

2. Measurement of Dependent Variable

Average vol. purchase means what amount of commodity bought by one respondent. It was measured by no. of Kg. For example, in case of wholesaler average volume was measured as 188 kg, 204 kg, 220 kg, 236 kg, or 252 kg. The score number was assigned as 1, 2, 3, 4 or 5 respectively. Average vol. sold means what amount of product sold by one respondents. It was measured by no. of Kg. For example, in case of Wholesaler average volume was measured as 188 kg, 204 kg, 220 kg, 236 kg, or 252 kg. The score number was assigned as 1, 2, 3, 4 or 5 respectively. A purchase price is the price an investor pays for an investment, and the price becomes the investors cost basis for the calculation of a gain or loss when the investment is sold. It was measured by no. of Tk/kg. For example, purchase price was measured as 155 Tk, 165 Tk or 175 Tk. The score number was assigned as 1, 2, or 3 respectively. The sell price of goods or commodities is the price at which a particular product or commodity is sold across

channels or markets [23]. It was measured by no. of Tk/kg. For example, in case of wholesalers sell price was measured as 204 Tk, 212 Tk or 219 Tk. The score number was assigned as 1, 2, or 3 respectively.

III. RESULTS OF THE STUDY

The results of this study and their logical interpretations have been systematically presented in this section allowing to the objectives of the study. The first section deals with the information of marketing time and the second section deals with the trade information as well as the marketing margins deals in third section.

A. Marketing Days

The wholesaler collected Kuchia every day from various places, stored and sold to Dhaka in 2 days/week which is ultimately 8 days/month which is similar to exporter's depot. This reason wholesaler recruits 3 or 4 labors to collect Kuchia.

B. Marketing Season

The seasonal score of the wholesaler ranged from September to January. Data presented in Table 1 indicate that the highest percentage (50%) of wholesaler had October to December marketing time whereas 27.5% and 22.5% wholesaler had September to November and December to February respectively. The wholesalers also collect Kuchia in other months but in fewer amounts than the peak season [9]. On the contrary, the highest percentage (70%) of exporters had October to December and others had January to March. They also continue crab business side by side Kuchia because Kuchia is less available in other months. Monthly availability of Kuchia is presented in Table 1.

Table 1. Marketing season

Respondents	Characteristics	Scoring Method	Range (Obs)	Categories	Respondents	
					No.	%
Wholesaler	Season	Months	Sept- Feb	Sept- Nov	11	27.5
Wholesaler	Same	Months	Sept- Feb	Oct- Dec	20	50.0
Wholesaler	Same	Months	Sept- Feb	Decr- Feb	09	22.5
Exporter	Same	Months	Oct - March	Oct- Dec	07	70
Exporter	Same	Months	Oct- March	Jan- March	03	30

C. Species Size

There are various sizes of Kuchia found in Dinajpur region like 200-250 gm, 300-350 gm, 400-500 gm and above 500 gm. Among them 200 to 250 gm Kuchia has very high demand in foreign countries due to their availability.

D. Average Volume Purchase

The volume purchase score of the wholesaler ranged from 180 to 260 kg (Table 2). In that table, the highest percentage was purchased 220 kg (213-228). It also indicates that 17.5%, 17.5%, 15% and 12.5% wholesaler purchased 188, 204, 236 and 252 kg respectively. On the contrary, the highest percentage (50%) was purchased 620 kg (560-680) by exporter whereas 30% and 20% purchased 460 and 780 kg respectively (Table 2).

E. Purchase Price

The purchase price value score of the wholesaler ranged from 150 to 180 Tk/kg. Data presented in Table 2 indicate that the highest (42.5%) percentage of wholesaler purchased Kuchia on 165 Tk/kg (160-169) while the other 30% and 27.5% wholesaler purchased Kuchia on average 175 (170-179) and 155 (150-159) Tk/kg respectively. In case of exporter, the highest (50%) percentage of exporter purchased Kuchia in 212 (208-215) Tk/kg while others purchased 204 (30%) and 219 (20%) Tk/kg respectively (Table 2).

Table 2. Trade information

Respondents	Characteristics	Scoring	Range (Obser	Categories	Respon		Mean±SD
					No.	%	
Wholesaler	Avg. Vol. Purchase	No. of Kg	180-260	181-	07	17.	210.833± 24.884
				197-	07	17.	
				213-	15	37.	
				229-	06	15.	
				245-	05	12.	
	Avg. Vol. Sold	No. of Kg	180-260	181-	07	17.	210.833± 24.884
				197-	07	17.	
				213-	15	37.	
				229-	06	15.	
				245-	05	12.	
	Purchase Price	Tk\ Kg	150-180	150-	11	27.	165.25±7.675
				160-	17	42.	
				170 -	12	30.	
	Sell Price	Tk\ Kg	200 - 220	200 -	23	57.	209.5± 6.812
				208 -	05	12.	
				216-	12	30.	
Exporter	Avg. Vol. Purchase	No. of	400 - 840	400-	03	30	-
				560-	05	50	
				720-	02	20	
	Avg. Vol.	No. of	400 - 840	400-	03	30	-
				560-	05	50	
				720-	02	20	
	Purchase Price	Tk/kg	200 - 220	200 -	03	30	211±5.578
				208 -	05	50	
				216-	02	20	
	Sell Price	Tk/kg	300-330	301-	03	30	314±7.379
				311-	05	50	
				321-	02	20	

F. Total Purchase Value

In Table 3, the cost value of wholesaler is range from 226920 to 358400 Tk/Month and 453840 to 716800

Tk/year. On the contrary, the purchase value of exporters was range from 750720 to 1366560 Tk/Month and from 1501440 to 2733120 Tk/year (Table 3).

G. Sell Price

The sell price value score of the wholesaler ranged from 200 to 220 Tk/kg. Data presented in Table 3 indicate that the highest (57.5%) percentage of sell price of wholesalers was 204 (200-207) Tk/kg while the other 30% and 12.5% wholesaler sold Kuchia on average 219 and 212 Tk/kg respectively. In case of exporters, the highest percentage (50%) of exporters sold in 315 (311-320) Tk/kg where as 30% and 20% exporters sold 305 and 325 Tk/kg respectively [22].

H. Total Sell Value

The total sell value ranged from 298656 to 448512 Tk/Month and 597312 to 897024 Tk/year which is shown in Table 3 in case of wholesaler. But the total sell values for the exporters were from 1122400 to 2028000 Tk/Month and from 2244800 to 4056000 Tk/year.

Table 3. Cost - profit value of exporters

Respondent No.	Average Vol. (Kg)	Purchase Price Value (Tk/kg)	Total Purchase Value (Tk/Day)	Total Cost (Tk/Month)	Sell Price value (Tk/kg)	Total Sell Value (Tk/year)	Profit Value (Tk/year)	Net Profit Value (Tk/year)
1	460	204	93840	750720	305	2244800	743360	643360
2	460	204	93840	750720	305	2244800	743360	643360
3	460	204	93840	750720	305	2244800	743360	643360
4	620	212	131440	1051520	315	3124800	1021760	921760
5	620	212	131440	1051520	315	3124800	1021760	921760
6	620	212	131440	1051520	315	3124800	1021760	921760
7	620	212	131440	1051520	315	3124800	1021760	921760
8	620	212	131440	1051520	315	3124800	1021760	921760
9	780	219	170820	1366560	325	4056000	1322880	1222880
10	780	219	170820	1366560	325	4056000	1322880	1222880

I. Price Variation of Freshwater Eel in Marketing Channel

Kuchia price is not fix due to its fully depend on wild sources. As a result the price of Kuchia vary from wholesaler to exporter. The last selling price depends on several factors like transport system, packaging cost and the labor involvement [24]. Sometimes exporters have the greatest influence over the price paid. Wholesaler bought Kuchia 165 Tk/kg and sold it to exporter 204 Tk/kg. In their transmission their transport cost was 2.5 Tk/kg which makes profit 37 Tk/kg. After receiving Kuchia exporter sold it to buyer 315 Tk/kg and made their profit 78 Tk/kg. Their transport cost from depot to airport was 25 Tk/kg [8].

J. Profit

The total profit of the wholesaler were ranged from 58896 to 84112 tk/month with the Mean ± SD is 71124.6 ± 7897.749 and from 116792 to 167224 Tk/year being Mean ± SD is 141249.2 ± 15795.498 which is presented in Figure 4.2 whereas the total profit for exporters were ranged from 321680 to 611440 tk/month and from 643360 to 1222880 Tk/year with the Mean ± SD was 449232 ± 106515.407 tk/month and 898464 ± 213030.8 Tk/year [11].

K. Total volume of Monopterus Cuchia Purchased

In the study area, total volume of Monopterus cuchia purchased from each wholesaler which was ranged from 3 to 5 mt/year and from each exporter was ranged from 7.5 to 12.4 mt/year.

L. Freshwater Eel Marketing Channel

In any kind of fish market farmers can never directly communicate with consumers rather they can contact through supplier or local agent. In Eel marketing systems, there were a number of people involved in the study areas. Wholesalers collect Kuchia from different sources by collectors and sell to the exporters by using plastic drum in the mode of transportation. Sometimes retailers also collect Kuchia from collectors and sell to the consumers like Adivasi people [25]. There is an informal agreement between wholesalers and exporters

to supply certain quantities in spite of the lower profit margins. The exporters use foam box during exporting to foreign countries by cargo plane [26].

IV. DISCUSSION

A. Season

It views that the availability of Kuchia is high during October-December and less in January to March. Seasonal variation of Kuchia at Paikgacha according to the interviews was high in winter season due to happy new year, taste, winter festivals abroad, drying ditches and increasing availability of Kuchia and low in rainy season due to heavy rainfall, fewer available in beels and ponds whereas moderate in summer and autumn season [27]. This study also has similarity with the findings of Sharmin et al. [28] where they viewed that October to December is the peak season for harvesting although freshwater eels are available round the year. However, without mentioned these month Kuchia are few available in other months for that reason farmers engage to other services to continue their livelihood activities [29].

B. Average Size

The average size of Kuchia is 250 gm which has seen in this experiment. In Bangladesh, above 100 gm per individual eel are the marketable size, internationally sold in two size ranges; 120-180 gm and 300-600 gm. Exporter took eels at a common rate but sold in above mentioned two grades.

C. Volume Purchase

It shows that the highest volume of Kuchia is purchased by the wholesaler from the selected area is 256 kg and the lowest value is 183 kg where the highest percentage (37.5%) purchase is 220 kg/day. In case of exporter highest percentage was purchase 620 kg/day.

D. Purchase Price

The price of any commodity varies about the size and availability of the product [30]. The purchase price of Kuchia in this experiment also varies due to their size with seasonality which shows the highest value is 175 Tk/kg and the lowest price value is 155 Tk/kg [31].

E. Sell Price

The price of any commodity varies about the size and availability of the product [32]. The sell price of Kuchia in this experiment also varies due to their size with seasonality which shows the highest value is 219 Tk/kg and the lowest price value is 204 Tk/kg [33].

F. Profit

With seasonal variation profit varies proportionally which affect the livelihood condition of the Kuchia wholesaler. Kuchia was the main source income of the Kuchia wholesalers of the study area [17]. The annual profit of the wholesaler is 116792 Tk/year which is the lowest value and the highest value is 167224 Tk/year. In case of exporter the annual profit value ranges from 643360 to 1222880 Tk/year [34].

G. Annual Production

In this experiment the highest annual production of Kuchia by the whole seller and exporter is 5 mt and 12.5 mt respectively. The annual production by whole seller of different district in the study area were found as: Bogra: 9.39 mt, Sirajgonj: 6.50 mt, Pabna: 6.30 mt, Natore: 5.40 mt, Rajshahi: 4.30 mt and Noagaon: 7.20 mt. This study is more or less relevant to the present study. An existing annual country production was found to be more than 364.57 mt in which highest obtained from Borguna district (43.91 mt) and it is 12.05% of the total production. The highest annual production 245.11 mt/year was recorded in the freshwater districts and coastal areas produced 117.43 mt/year. They also stated that annual production of different district was as Cox's Bazar: 6.48 mt, Chittagong: 7.43 mt, Satkhira: 9.45 mt, Barisal: 10.34 mt, Khulna: 10.67, Nator: 18.06, Pabna: 18.33 mt, Mymensingh: 19.36 mt, Kishoreganj: 28.63 mt, Habigonj: 29.62 mt respectively. In the study area, annual eel production is so far below than the others district. This may be due to unavailability and decreasing of freshwater mud eel in natural water bodies as well as indiscriminate harvesting of eel year after year of the wholesaler and exporter was 116792 to 167224 Tk/year and 643360 to 1222880 Tk/year respectively

IV. CONCLUSIONS

There is a price margin gap between wholesale and export selling rate. If we take proper initiative to reduce the price gap between them, then wholesaler would collect enthusiastically more Kuchias and sell to exporter. This will be effective eventually to get more foreign currency due to high demand of exporter. On the other hand, sometimes it is found that Kuchia is only available in few months of a year and the amount of Kuchia is not enough to full fill the need for sale owing to lack of proper management of water body. Despite of these obstacles, the Kuchia production has been increased compared to previous year. Because of high export value, Government and NGOs has come to forward for increasing the emergence of Kuchia. We should raise the awareness about the importance and export value among the rural people of Dinajpur so that they can also help to increase the availability of Kuchia through proper take care of waterbody. Good relationship should be maintained among stakeholders. Price should be fixed by discussing among wholesaler and exporter. Marketing information like export market demand, price etc. should be accessible via electric media.

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