

*Article*

**Fish fermentation in Lalpur, Brahmanbaria district: ecological implication and value chain analysis**

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**Abstract:** The study was conducted to evaluate the present status of the production of traditional fermented fish product - shidal (Chapa shutki or shidol) in Lalpur, Ashuganj Union, Brahmanbaria district and its ecological implication and value chain during June to November, 2016. Shidal is produced by natural fermentation process of fresh water punti and marine phaisha and poa fish during winter (October to January). It was found that the Shidal production from freshwater fish in Lalpur has been shrinking gradually due to a decline in fish production from the Meghna River Basin and low supply of raw fishes from others areas. The fishers noted the local extinction of large numbers of once common fish with a gradually low supply of punti and a declining average size among the fishes that are still captured. It was found that not only the total volume of catch decreased but there have been a marked decline in catch per unit effort (CPUE) over the last ten years. During the fermentation season, every day 2-4 ton of raw punti are sold in Lalpur Fish Landing Center and the price of punti varies with grade, season and quality. On an average 4 kg of fresh punti produces 1.2 kg of dry punti and 1.2 kg of dry punti produces 1.44 kg of shidal. It was observed that there were two types of punti used for making shidal in Lalpur - with scales and without scales. The prices of shidal were Tk 800/kg, Tk 500/kg, and Tk 500/kg produced from punti, poa and phaisha, respectively. There are nearly 250 dangaries (fish processing place) for Shidal production and each of the dangaries produce 100-150 motkas (each motka contains 36-40 kg of shidal) of shidal in a season. One motka is sold in Tk. 20,000-24,000 when there is no salt used but Tk. 16,000 per motka when salt is used. It was found that around 2000 people were employed in Shidal production and another 200 people worked in filling in the motka in Lalpur. No chemical are used to make Shidal but some salt is applied during Shidal processing. It was observed that there was no fixed marketing channel for Shidalshutki. Seventy percent (70%) of the Shidal are produced for the domestic market. Shidal produced from small sized punti are exported to India but Shidal produced from marine fishes has never been exported. Although people prefer Shidal made from punti, but due to its gradual disappearance from the natural water bodies, they are forced to consume Shidal prepared from marine poa or phaisha.

**Keywords:** fish fermentation; ecological implication; value chain analysis; fish drying

**1. Introduction**

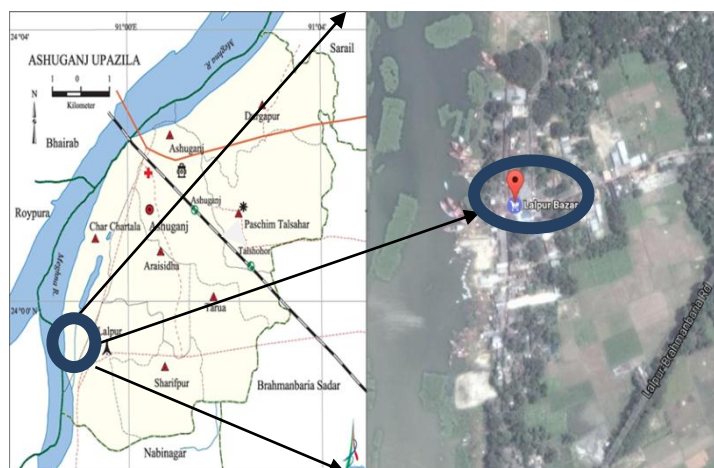
Fish and Fisheries are integral parts of lives and livelihoods of Bangladesh. Fisheries is one of the most important subsectors of Bangladesh agriculture and is considered to be the thrust sector for sustainable

development and socioeconomic advancement of rural fishermen and fish producers/processors (Alam, 1999). Fish are also supply 60% of the total animal protein of human. It contributes 3.65% of the Gross Domestic Product (GDP). In the year of 2014-2015, the total fish production was 36.84 lakh metric tons and Bangladesh is ranked 5<sup>th</sup> as aquaculture producing country in the world. Bangladesh earned 4660 crore taka by exporting fish and fishery product in the year of 2014-2015 (DoF, 2015). Dried fish is fish which is dried, fermented, salted, or other methods of preservation by using simple technologies resulting in dehydration, weight reduction and concentration of nutrients. Dried fish usually come from two sources and these are marine dried fish and fresh water dried fish. Production of Shidal is done by traditional sun dried method of small sized punti. Fermentation takes place in large earthen jars called (motka). The product of dried fish (Shidal) is easily transportable, marketable and storable (Nowsad, 2007). A large number of people of our country especially Brahmanbaria, Mymensingh, Netrokona, kishoreganj, Jamalpur and Tangail region are involved with this fermented product production and marketing. Shidal is a home processed food, prepared from a small sized fish (Punti). In Bangladesh Shidal is produced in winter season because of availability of the raw material supply and fish oil, favorable weather condition, less humidity, rate of moisture evaporation during drying is homogenous in this season. Fog in winter season keeps the dried fish suitable for fermentation. Fermentation takes place in the motka that are filled with punti which is tamped down by foot to make it jam-packed. Then the filled motka are generally half-buried and kept in a dark room to allow fermentation for 4-6 months until the characteristic flavor and colour appear in the product. The fermentation motka are prepared by polishing them with punti oil extracted by boiling punti guts extracted during the drying process. Semi-solid appearance of Shidal is termed as semi-fermented products (Mansur *et al.*, 1989). Both fish muscle enzymes and bacterial enzymes are involved in the fermentation process. (Shimuda, 1996). Production of Shidal in Bangladesh especially in the Lalpur, AshuganjUpazilla at the District Brahmanbaria is engaged with this fermented product and marketing and its play a vital role to increase their socio economic condition. There are about 200 owners/investors in Shidal processing in Lalpur. The fermented fish business in Lalpur is worth >100 crore taka if the value of imports and exports are considered. The inland aquatic habitats of Bangladesh are rich in faunal diversity containing at least 293 species and 63 species of prawn, several species of turtles, tortoises, fresh water mussels and other living organisms (Hossain *et al.*, 2012). Inland capture fisheries, a large number of different types of fishing gears are used, some of which catch large numbers of undersized fish, some catch a few illegal size fish and others catch only legal size fish (Kibria and Ahmed, 2005). Generally in dried fish marketing involve producer, wholesaler, *aratdar*, middleman, retailer and finally consumers. However the number of actors varies depending on the extent of market. Therefore in a standard common marketing chain that generally exists in country's domestic marketing pattern, four stakeholders are observed - dry fish traders, wholesaler, medium operator and retailer between producer and consumer. The marketing system operates through a set of intermediaries performing useful commercial functions in a chain formation from the producers to the final consumers (Nayeem *et al.*, 2010a). The objectives of the present study was to investigate the present status of Shidal processing activities in the study areas; to study the ecological impact fish fermenting in the study area; to evaluate the existing Shidal fish marketing system and to know the problems associated with Shidal processing and marketing activities.

## 2. Materials and Methods

### 2.1. Study area

The village Lalpur is located in the Union Lalpur, Upazilla Ashuganj at the District Brahmanbaria (Figure 1). This area is famous for producing and supplying Shidalshutki all over the country mainly Dhaka, Comilla, Mymensingh, Sylhet, Rangpur and Tripura, Asham, West Bengal of India.



**Figure 1. Map of Lalpuri Union showing the studied area.**

## 2.2. Period of study

The study was conducted for a period of six months from June to November, 2016. The researcher paid monthly once or sometimes twice extensive visits throughout the period.

## 2.3. Sample size and sampling procedure

The sample of 16 dried fish farmer and 20 Shidal producers was selected from Lalpur village, Brahmanbaria district by using random sampling. To achieve the objective of the study a comprehensive interview schedule of structured questionnaire was used to collect data.

## 2.4. Data collection methods

In the present study data were collected through focus group discussion (FGD) and stakeholder's interview. All the interviews were mostly unstructured and free flowing, lasting from a few minutes to several hours in length, depending on the circumstances in which they were conducted and were conducted with both individuals and groups of respondents. Women and children either individually or in a group were given priority and special care was taken to interview them wherever possible. Different types of actor associated with dried fish value chains were identified during the course of fieldwork and efforts were made to interview as many as possible of each, based on limitations of time and their availability.

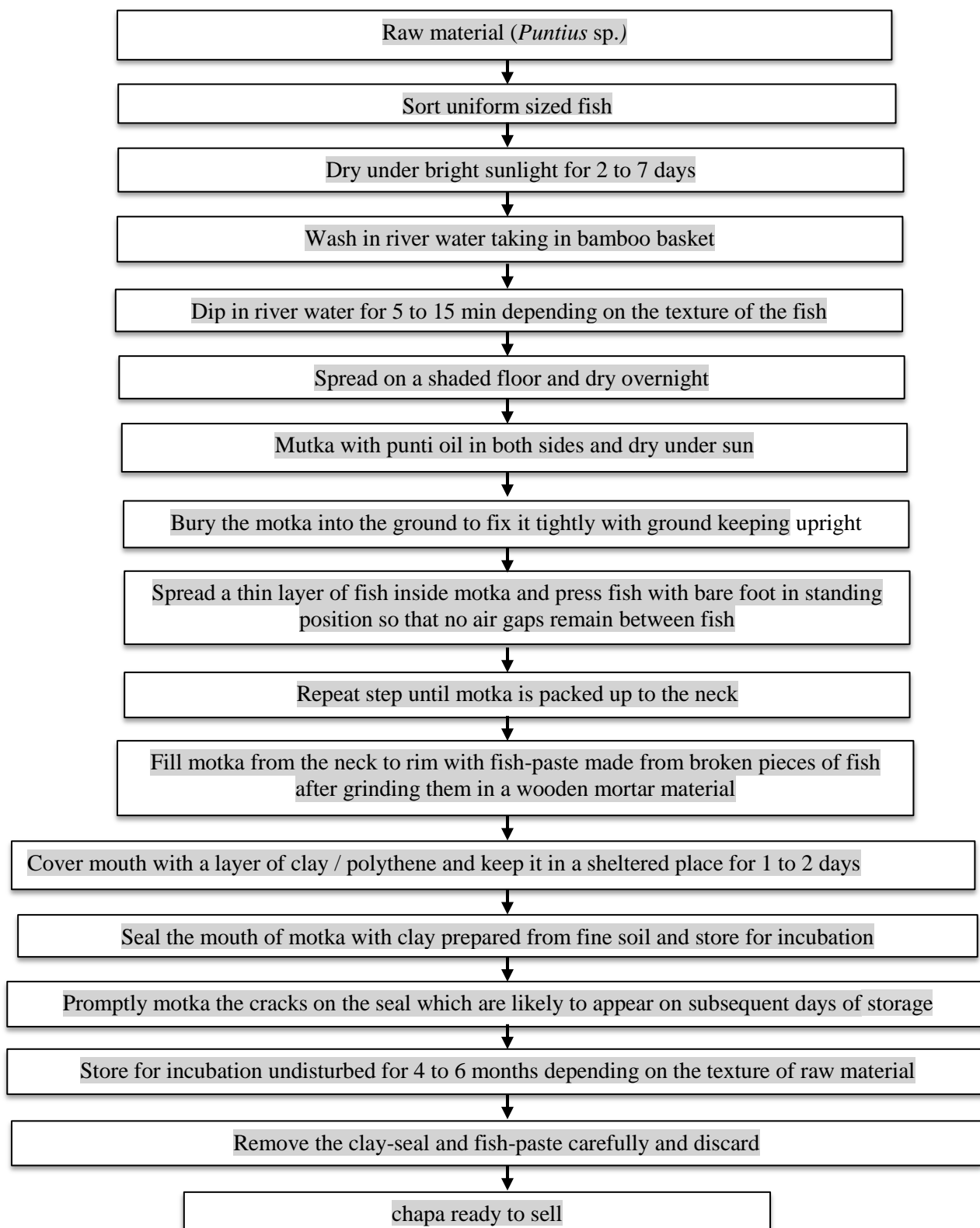
## 2.5. Data processing and analysis

After data collection the data were edited for analysis. In order to minimize error, data were collected in local units and later local units were converted into standard units and the data were transferred to the tabulation sheet. Later tabulated sheet transferred to computer. Cost and margin were calculated and presented in the form of tables and pie chart. Data were processed and finally analyzed using Microsoft Excel.

## 3. Results

### 3.1. Fermentation process of Shidal

Shidal were prepared by the traditional method of fermentation in anaerobic condition of dried punti. Punti were dried for 2 to 7 days on bamboo dangary with netting over the top. Dried punti which were washed in river water for 10 minutes and then placed in motka after 8-10 hours which were tamped down by foot to make it jam-packed. After filling the motka with a layer of crushed dry fish were placed on the top motka and the mouth of motka were covered with the layer of clay and a sheet of polythene. Then the filled motka were generally half-buried and kept in a dark room to allow fermentation for 4-6 months until the characteristic flavor and colour appear in the product. The fermentation motka were prepared by polishing them with punti oil extracted by boiling punti guts extracted during the drying process. The more water and the less pressure applied for the shorter of fermentation. On an average 4 kg of fresh punti produces 1.2 kg of dry punti, on average 1.2 kg of dry punti produces 1.44 kg of *shidal* (because of water absorption). The best quality punti comes from Habiganj and Best qualities Shidal are found in December to January (Figures 1 and 2).



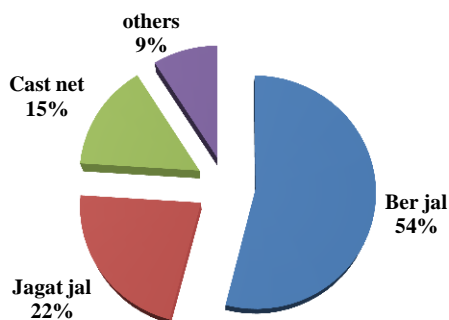
**Figure 2. Shidal production methods.**



Figure 3. Shidal production process (A-N).

### 3.1.1. Collection of raw fish

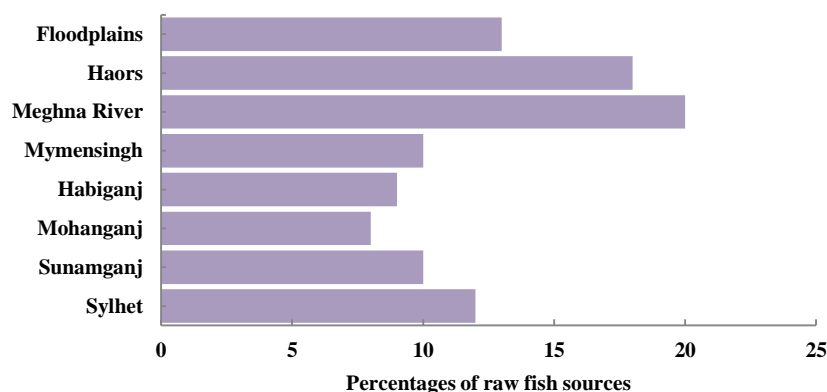
Usually landings occur in the morning and in the afternoon and fish were sold through auction. Different types of fishing trap and net were used to catch to fish. Nets including *berjal* (54%), *jagatjal* (22%), cast net (15%) and others (9%) were used to catch punti species (Figure 4).



**Figure 4. Percentages of raw fish used in Shidal production harvested by different gears.**

### 3.1.2. Source of raw fish

Punti were sourced from haors (18%) and floodplains (13%) and adjacent area of Meghna River (20%). Quality punti were came from Sylhet (10%), Sunamganj (12%), Mohanganj (8%), Habiganj (9%), Mymensingh (10%) district. Phaisa and Poa were from marine sources. The Shidal processors of Lalpur bring fish from all over the country and phaisha and poma [poa] from India although not that much. The qualities of dry punti were highest from Katik to Poush (Figure 5). Marine fish (phaisha and poa) were sourced from India originate from Kolkata, Madras, Assam and Andhra Pradesh. The majority were from Andhra Pradesh. People there were vegetarian so they don't eat much. The Shidal processors of Lalpur buy this fish through clearing and forwarding agents mainly through Argatala land port in Tripura. Lalpur is close to the railway line. Fresh fish were delivered by train and truck and dried fish were distributed by train truck and boat.



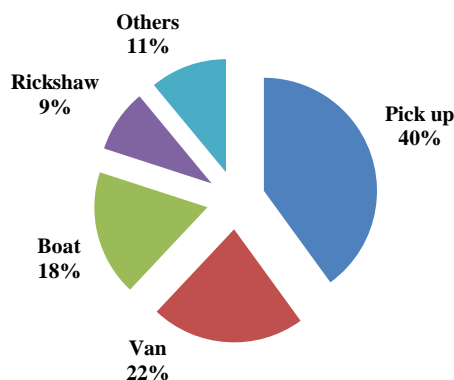
**Figure 5. Source of raw fish collection.**

### 3.1.3. Price of raw fish

There were many different grades of punti based on quality and size. Both size and quality of punti depends in the season. Price of raw fish were varies the grade size and month of harvest. Usually price varies 50-150 taka and sizes of punti were 1-3 inch. Fisherman stars to harvest fish at early November.

### 3.1.4. Transportation of raw fish and Shidal

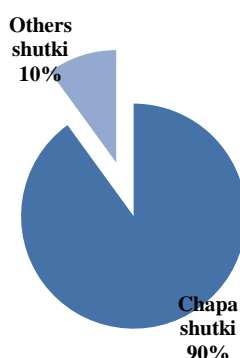
Pick up (40%), van (22%), boat (18%), rickshaw (9%) and others (11%) etc. were mainly used for transportation of raw fish and finished product (Shidal) (Figure 6). Steel made ice box, bamboo basket and plastic drum were mainly used for carry fish during transportation. 90% people did not have sufficient knowledge on fish quality. Some depots were present in landing center where the raw fish were received. Floors of most all the depots were cemented.



**Figure 6. Percentages of different vehicles used for raw fish and Shidal transport.**

### 3.1.5. Number of Danagaries and Godowns

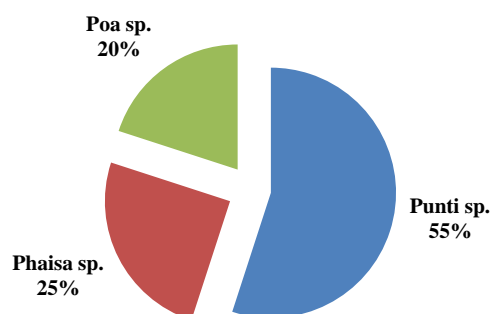
There were 50-55 godowns in Lalpur for storing dried fish prior to producing Shidal. All the dangaries (90%) (about 250) in Lalpur produce dry punti and only 8-10 dangary produce dried fish like gonia, boal etc. (Figure 7). All the danagaries produce 100-150 motkas of Shidal and sell the access dried punti to 50 large and small godowns here. The godowns store dried punti for short-term basis. People from all over Bangladesh buy dried punti from these godowns. Almost all godown owners produce Shidal as well. The godown owners produce the majority of the Shidal in Lalpur.



**Figure 7. Amount of Shidal production for all danagaries.**

### 3.1.6. Fish species used to make Shidal

Shidal cannot be produced from olive barb (*Puntius sarana*) because it contains no oil. Shidal were produced from only two small punti species (78%). Meni (*Nandus nandus*) and bhagna (*Cirrhinus reba*) were also used to produce shidal. Among the marine fish, Shidal were mainly produced from Phaisa (22%) – two species of anchovy locally known as Phaisa – *Setipinna phasa* and *S. taty* and two species of *Thryssa* locally known as Ram Phaisa – *Thryssa hamiltonii* and *Thryssa purava*. Of all the shidal produced in Lalpur 50% were punti and 50% were other species (Figure 8).



**Figure 8. Fish species used to make Shidal.**

### 3.1.7. Types of Shidal produced in Lalpur

There were two types Shidal produced from punti in Lalpur - with scales and without scales. Some districts prefer puntiShidal with scales and others vice versa. With scale Shidal product were most common and popular in Bangladeshi people because of low nominal cost making them affordable to poor consumers and normally consumed with vegetables. Without scale Shidal were good quality than without scale cheap fish. Because of its taste and flavor, it fish has a good demand both in international markets among Bangladeshi living abroad. Without scale Shidal fish were high cost than with scale.

### 3.1.8. Punti oil for Shidal production

When women clean fish they keep all the scales, fins and guts. They keep the guts to extract the oil themselves. Punti oil was needed to produce Shidal from punti, phaisha, poa or other species. Oil was used both inside and outside of motka to produce Shidal. The quantity of oil produced in Lalpur was not sufficient to meet the demand in Lalpur fermentation industry, so oil was brought from haor areas – Habiganj, Sylhet, Mymensingh and Comilla. The best oil comes from Tarailupazilla of Krishoreganj. There were many suppliers/middlemen. Punti oil costs Tk 100-150/liter.

### 3.1.9. Price and weight of motka

Weight of single motka was 14-18 kg without Shidal. After filling Shidal in the motka the weight of motka was 50-60 kg. One motka carry 36 to 42 kg Shidal fish. Motka are produced in Savar (Dhaka). Shidal can be kept for about one year in motka. One motka were sold in TK 20,000-24,000 without used salt in dried fish and TK 16,000 per motka with used salt (Table 1).

**Table 1. Price and weight of motka.**

Motka Types	Cost (Tk.)	Weight (kg.)	Oil Need (litter)
New	200-250	14-16	1.5
Old	300-350	16-18	0.2-0.5

### 3.1.10. Price of different Shidal product

There were 20 different grades of punti based on quality and size. Some [dry] punti can even cost Tk 1000/kg before it were made into *shidal* [if it is large sized with high oil percentages] very dry. The price of fresh punti varies a lot. The lowest grade even costs only Tk 30-35/kg, the average were around Tk 100/kg. Shidal made with this grade of punti costs Tk 1500/kg. The minimum prices for puntiShidal were Tk 500/kg (Table 2).

**Table 2. Price of Shidal for different species.**

Species	Scientific Name	Taka
PuntiShidal	<i>Puntius chola</i> and <i>P. sophore</i>	500-800/kg
PhaishaShidal	<i>Setipinna phasa</i> and <i>S. taty</i>	500/kg
PoaShidal	<i>Macropsinosacuja</i> and <i>Panna microdon</i>	500/kg,

### 3.1.11. Manpower involved in Shidal production

About 2000 people were employed in Shidal production in Lalpur. The majority of people involved in Shidal processing come from Lalpur and occasionally their relatives or people from neighbouring areas come to work during peak season. During the fermenting season dangary owners were active at night and during the early morning. The person who prepares (conditioning) the motka (by oiling them) makes Tk 10 per jar and prepares 50-100 at a time. It was a specialized skill. The people who fill the motka are skilled. This skill is passed on from generation to generation. They were commonly known as technician. There were 200 available technicians. The people who do this work are called (*motkaboranai*) – motka fillers. The labour cost of filling a motka with fish was Tk 150 and filled 4-6 motka per day (Table 3). Sometimes Indian buyers buy dried punti directly from Lalpur for fermenting in India. When they did this they may also hire workers (*motkaborani*) from Lalpur.



**Table 3. Wages categories of labour for Shidal producing.**

Manpower	Sex	Wages
Dressing, cutting and gutting	Female	150 taka per day
Grading	Female	150 taka per day
Washing	Male	150-200 taka per day
Prepare the motka	Male	10-15 taka per motka
Input Motka	Male	150 per motka

### 3.1.12. Women in Lalpur for Shidal production

There were hundreds of women mainly involved in processing punti (cutting and gutting) in Lalpur. There were a few poor women who do work other than gutting. Most female workers were from the local area. They come from poor and also from 'solvent' families. They were 'housewives'. When the supply of fish arrives at midnight, the women were ready to work in the early morning. Most of the gutting happens before sunrise so drying can begin as soon as the mist clears. There were two types of pay for women; 1) Tk 200/day; 2) in kind (punti guts). What women receive depends on negotiation between the dangary owner and the women. However, women were mostly paid in guts. One woman can earn Tk 15,000-20,000 during a five month season. When there is not enough oil in the punti they are paid at a rate of Tk 2/kg or Tk 200/day.

### 3.1.13. Pesticide

No chemical was found to use throughout the whole process of drying punti and making Shidal in Lalpur. But some salts were used during Shidal processing it depends on sunlight. Generally 120-130 g salt was used for 1 kg fish.

### Seasonal calendar of Shidal production

The season of peak production is from November to January (Table 4).

**Table 4. The Seasonal calendar of Shidal production.**

Calendar	Months											
Gregorian	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bangla	Mag	Fal	Cho	Boi	Jou	Asa	Shi	Bha	Ash	Kar	Agh	Pou
Lalpur												
<b>Month</b>	<b>Activity</b>											
<b>Sep</b>	Preparation of dhangary and start harvest of punti at mid of September											
<b>Oct</b>	Fully starts harvest of punti and start Shidal production											
<b>Nov</b>	Fully start Shidal production											
<b>Dec</b>	Shidal production											
<b>Jan</b>	Shidal production and selling											
<b>Feb</b>	Shidal production and selling and punti harvest reduced											
<b>Mar</b>	Gradually reduced Shidal production											

### 3.1.14. Health of workers

The people involved in processing, trading and buying fish, they have black skin because they work all hours. They say that 'people who work with dry fish also become dry'.

### 3.1.15. Local consumption

People in Lalpur all eat Shidal, but it is a particular delicacy for women, and pregnant women especially like it. Good quality mutton costs Tk 450/kg, but good quality Shidal costs TK 1300/kg. Normally when people from Lalpur visit relatives they bring Shidal with them as a gift. These were well accepted and preferable to offering mutton and other valuable items.

### 3.1.16. Infrastructure condition

Characteristics of dried puntiprocessing center and Shidalprocessing center are listed below (Table 5).

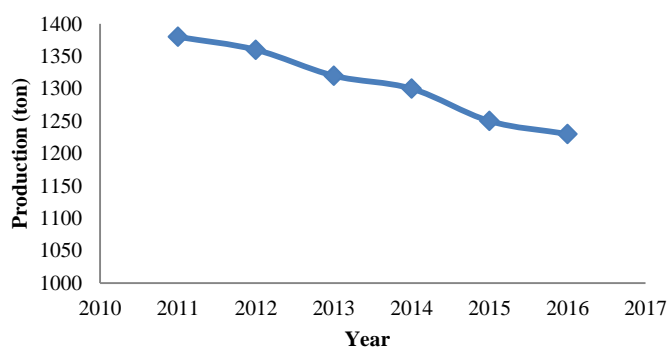
**Table 5. Characteristics of dried puntiprocessing center and Shidalprocessing center.**

Infrastructure	Dried puntiprocessing center	Shidalprocessing center
Construction	Made with Bamboo, net, polythene, rope,	Made with tin shed wall and rope used bamboo
Floor condition	Bamboo, net and rope	Cemented floor
Water supply	River and underground water	River and underground water
Electricity	Available	Available
Storage facility	Available	Available

### 3.2. Ecological impact of fish drying on fish diversity

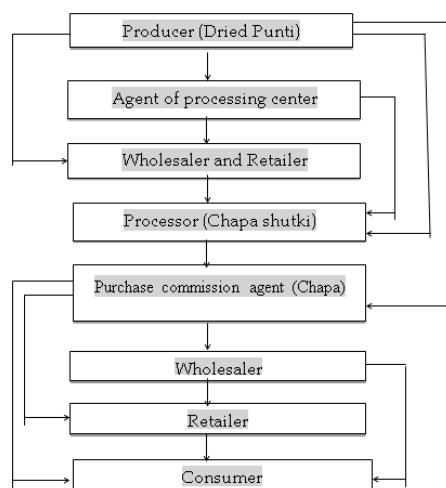
In Lalpur village Shidal business was start with punti species and 1990s year Poaorphaisa were included in this business, when reduced the availability of punti. However, the traditional dried fish production in Lalpur was shrinking gradually due to a decline in fresh water fish production from the Meghna River in the adjacent area of Lalpur and supply of raw fishes from the others areas. With an increasing population, the demand for Shidal is rising in the domestic and international markets every year. Over-fishing in the main fishing zones by low income of the fishermen have led to a reduced punti production which brings down the volume of Shidal fish. As a result recruitment of new fishes is reduced every year due to over-fishing. Fishers are used destructive fishing methods and gears and the growing tendency to fish indiscriminately, irrespective of size and species (e.g. by the use of seine nets with extremely low diameter mesh sizes, and catching hatched juveniles shortly after spawning has taken place). At the same time, the number of entrants into the fishery is increasing, due in part to population growth and the breaking down of traditional social norms governing participation in fisheries. In tandem, these pressures are resulting in increasing on fisheries resources in the Meghna River. Consequently, catch per unit effort (CPUE) is generally falling, and stocks of several species of fish like punti were in decline.

In fermentation season, there have great demand of punti which are used for fermentation. This demand increased fishing pressure of fish in Meghna River. Fishing may result in changes in productivity of resources and affects associated species. Fishing may also affect ecological processes at very large scale. During the fermentation season, every day 2-4 ton of punti were sold in the Lalpur fish landing center (Ferry Ghat) and that amount punti comes from Meghna river and other regions like Sylhet, Sunamganj, Mohanganj, Habiganj, Mymensingh district. In season year nearly 1200-1300 ton of Shidal were produced in Lalpur village and these production were reduced day by day due to decline of raw fish. In the year of 2011 and 2012 the total Shidal production were 1380 ton and 1360 (Figure 9). However, the most commonly held view among most categories of interviewee was that fish supply has decreased over the years. A number of interviewees in the study areas stated that not only the total volume of catch decreased but there have been a marked decline in catch per unit effort over the last ten years.

**Figure 9. Year wise production curve.**

### 3.3. Marketing channel of Shidal

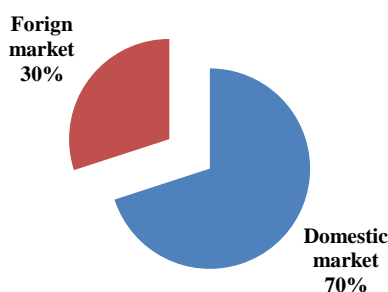
Generally in Shidal marketing, the stakeholders involved are producer, wholesaler, *aratdar*, middlemen, retailer and finally consumers. Therefore in a standard common marketing chain that generally exists in country's domestic marketing pattern, four stakeholders were observed - dry fish traders; wholesaler, medium operator and retailer between producer and consumer. It addition there were a number of backward stakeholders e.g. fisher, *Paiker*, and wholesaler were identified (Figure 10). Two types of *Pikers* were observed – land based *paiker* and *pannyapaiker* dealing with the marketing of raw fish at the very initial stages of fish harvesting. The majority of Shidalshutki producers were from low income group.



**Figure 10. Marketing system of traditional Shidal in Lalpur.**

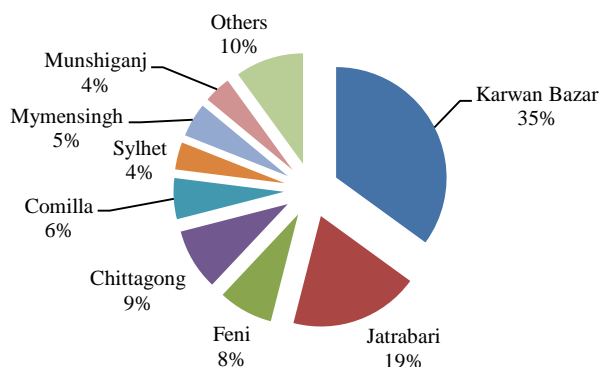
**3.3.1. National and transboundary trade of Shidal**

Lalpur supplies fermented fish to all the main divisional towns in Bangladesh. 70% of the Shidal produced in Lalpur was for the domestic market. The Shidal processing facility of Lalpur were very close to Indian border only 2-3 km. Tk 50 million worth of fermented product were exported to India (Tripura) from Lalpur every year. Shidal made with small sized punti (least price among all the punti) were exported to India. Poma and phaisha Shidal were not exported (Figure 11).



**Figure 11. Marketing channel of Shidal.**

Most of these were sent to Karwan Bazar (44%) and Jatrabari (20%). Small amount of punti were also sent in Feni (8%), Comilla (6%), Chittagong (9%), Sylhet (4%), Mymensingh (5%) and Munshiganj (4%) (Figure 12). Sometimes dry punti were purchased from Syedpur but Shidal were not sent to Syedpur. During the peak drying season some large dried fish were sent from Lalpur to Massimpur.



**Figure 12. National marketing channel of Shidal.**

### 3.3.2. Economic aspects

Cost of Shidal depended on the species, quality, size and weight, season, volume of fish, market distance, market infrastructure, mode of transportation, form of marketed fish (i.e. dried, fermented, salted), supply and demand, and consumption behavior of consumers and labor required. When supplies were scarce dried fish prices increased. Demand behavior may also contribute to inter seasonal price fluctuations. There were many factors affecting the price of Shidal through demand and supply. On the supply side, the prices were affected by the seasonality of production and weather conditions which cause the seasonality of the market supply, i.e. the quantity of the product available on the market. Prices also vary from market to market. Moreover, market prices differ according to species and size. For the same species, price depends closely on the size of the fish with larger fish fetching significantly higher prices per kilogram.

### 3.3.3. Main activities of Shidal stakeholder

The main activities of shidal stakeholders are shown in Table 6.

**Table 6. Stakeholder involved in Shidal sector and their main activities.**

Tier	Stakeholders	Activities
Fishing	Fisher	Work in the fishing boat, net setting, lifting fish preserving.
	Labour	Men, women, part time, day-to-day, permanent, semi-permanent work in the processing facility (khola or dangary), gutting, salting, washing, hanging, spreading and other activities during drying.
Processing	Punti oil producer	Boil the collected gut of punti and sell the punti oil to fermented fish (Shidal/shidal) producer.
	Motka conditioner	Skilled person/s who condition the motka
	<i>Motkabhorani</i>	Skilled person/s fill the conditioned motka with punti.
	Danagary/ <i>Khola</i> owner	Owner of the khola or dangary and produce dried or fermented product or both some owners produce dried fish and fish meal or only fish meal.
Marketing	Middlemen/ <i>dalal</i> <i>Pikers</i>	The first level of marketing, contract with Producer and purchase the product with cash or credit or in commission
	Transporter	Lorry owners, driver – linked with <i>paikers or dalals</i> carry the product from dangary/ <i>khola</i> to the markets.
	Commission agent, <i>Aratdar</i> , Large entrepreneur	Warehouse owners in the large wholesale markets, receive and store products and sell to large wholesalers keeping 2-3% commission
	Auctioneer	Help in auctioning, start from the lowest bid and finally sell the product to the highest bidder.
	Loader/Unloader	Load and unload product to and from lorries, boats, trucks and receive 1-2 taka per a maund (40 kg) product.
	Manager	Woke for large commission agents or for large wholesalers as a paid employee, maintain finance and collect unpaid credit from the wholesalers and retailers.
	Wholesalers	Large, medium, small – purchase product from warehouse owners/commission agents with cash and credit and supply to the next tiers by cash or credit.
	Retailers	Large, medium, small – generally buy product from the wholesalers with cash or credit. There are hawkers and street vendors in dried fish business as well and women are also involved.
	Super Market people	Owners, sales boy and girl – purchase comparatively better quality dried product and sell with high price.
	Exporters, importers	Export and import product using trade license through letter of credit (L/C).

### 3.4. Constraints in Shidal production and marketing activities

There are many constraints in Shidal production and marketing activities observed during the study. The people engaged in sun drying activities did not have enough knowledge on proper drying process and sanitation. Lack of capital was the main problem in Shidal production and market. They didn't get loan from the any Government and private bank, NGOs or any others financial organization. Involvements of middlemen were

another problem in Shidal marketing channel. There were complaints from the people living around that bad smell spreads throughout the area particularly in rough weather condition. Packaging and storage was done improperly and sometimes in an unsanitary condition which is one of the most important causes of quality losses. No involvement of government organizations was found to help the producers to produce good quality dried products in the study area.

#### 4. Discussion

Shidal is the most common processed food made by the natural fermentation of small size punti fish. There were different grades of punti based on quality and sizes. Large sized raw punti can even cost TK 1000/kg before it is made into Shidal. The lowest grade even costs only Tk 30-35/kg. The price of Shidal fish was comparatively high than the salted Shidal. The price of Shidal was found as Tk 500-850/kg for punti, poa and phaisha. This finding was more or less similar to the findings of Azam (2002).

Shidal fish marketing chain from producers/processors to consumer passes through a number of intermediaries: *beparis*, Wholesalers, *aratdars* and retailers in the study area. It might be due to geographical variation. Ara *et al.* (2010) found two marketing channel of capture fishery in Khulna district, all of which involved *aratdars*, *paiker* and retailers like intermediaries. There was no fixed marketing channel for traditional dried fish (Shidal) in Mymensingh regions and commission agents, wholesalers and retailers were involved reported by Nayeem *et al.* (2010b). Shamsuddoha (2007) also found intermediaries like wholesalers, *Aratdars*, middlemen and retailers in Coxsbazar. Bishwas (2001) found similar findings as the present study in the survey of dried fish marketing from Cox'sbazar to Dhaka. He found six marketing channel, all of which the above intermediaries were involved in dried fish marketing. Present investigation revealed that fishes were mainly dried and Shidal was made on the bank of Meghna River in the study area. In this open place sufficient sunlight and wind are available which is suitable for Shidal processing activities

Raw fishes were collected from local fish market and transportation by non-mechanized van, rickshaw, and pick up or by head load or shoulder load by the labors. Azam (2002) reported this type's transportation of raw fish for drying. Fish drying was done in few steps such as washing, sorting, dressing, salting, drying under the sunlight etc. This type traditional sun drying of fish was reported by Nowsad (2007).

#### 5. Conclusions

The present study was based on fermentation process, ecological impact, problem, value chain and socio-economic condition. The research work was mainly done on Lalpur area where traditional fish fermentation (Shidal) practices after generation (*bongshanukrome*). In Bangladesh semi fermented fish is produced in winter season because of availability of the raw material supply and fish oil, favorable weather condition, less humidity, rate of moisture evaporation during drying is homogenous in this season. Fog in winter season keeps the dried fish suitable for fermentation. Shidal processing and marketing plays an important role in the economy of Bangladesh, contributing to increased food production, diversification of the economy and increased employment opportunities. However, concerns arise about the long-term sustainability of the sector due to poor infrastructural facilities, lack of hygiene, lack of money and credit facilities, poor institutional support and inadequate extension services. However both government and NGOs have not paid enough attention to the sector. It is therefore necessary to provide institutional and organizational support, government support, extension services and more research along with knowledge of Shidal fish marketing.

#### Conflict of interest

None to declare.

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