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## Studies on the Traditional Drying Activities of Commercially Important Marine Fishes of Bangladesh

<sup>1</sup>M.S. Reza, <sup>2</sup>M.A.J. Bapary, <sup>3</sup>K.M. Azimuddin, <sup>3</sup>M. Nurullah and <sup>1</sup>M. Kamal

<sup>1</sup>Department of Fisheries Technology, Faculty of Fisheries,

Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

<sup>2</sup>Department of Fisheries Technology, S. F. M. Fisheries College, Melandah, Jamalpur, Bangladesh

<sup>3</sup>Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh

**Abstract:** Studies were conducted to evaluate the present status of traditional drying practices of commercially important marine fishes in the coastal region of Bangladesh. A survey was made on the source of raw materials, handling, transportation, processing and marketing aspects of fish using questionnaires through interviews among the cross section of people involved in fishing, middlemen, wholesalers, retailers and processors in the Kutubdiapara of Cox's Bazar sadar upazilla, Ghati Bhanga of Moheshkhali upazilla and Shahaparirdip of Teknaf upazilla under Cox's Bazar district. Survey was also made in the wholesale and retail dried fish markets in Chittagong and Cox's Bazar area. After harvesting, the small scale fishermen carry their catch to the landing centre in traditional bamboo baskets without using adequate ice and sell it to the pre-selected buyers or middlemen locally called 'mohajan'. Both quantitative and qualitative losses occur in raw materials due to spoilage. Considerable post harvest losses also occur in fish before and after drying due to insect attack and contamination which amounts to about 10-30% of the total catch. There is also widespread use of insecticides before and after drying to avoid insect infestation. In most cases the fishes which are not sold as fresh in the market are used as raw materials of the dried products. The overall organoleptic qualities of the dried products available in various marketing chains are very poor. There is a long marketing chain for fresh and dried products which include fishermen, purchase commission agents (fresh fish), processor, purchase commission agents (dried fish), wholesaler, retailer and finally the consumer. Due to the involvement of various middlemen in the different marketing chains, the price in each stage of marketing increases and finally the consumers buy the products with a higher price. In all the marketing chains, the dried fish products are marketed without adequate packaging. The dried products contaminated with moulds and fungus is common in the retail and wholesale markets in Chittagong and Cox's Bazar dried fish markets. Study on the marketing margin and marketing profit of traditional dried fish products reveals that the processors in primary market receive higher marketing profit followed by retailers and wholesalers in consumer market and secondary market, respectively.

**Key words:** Traditional drying, infestation, marketing, quality loss

### INTRODUCTION

Sun drying is one of the most important low cost methods of fish preservation in Bangladesh and the product plays an important role particularly in providing nutrition of the poor and economically disadvantaged people. About 20% of the artisanal catch is sun dried and consumed in the internal domestic market<sup>[1]</sup>. The physical and organoleptic qualities of most of the traditional sun dried products available in the market are not satisfactory for human consumption<sup>[2-4]</sup>. There are frequent complaints from the consumers about the quality of the products and

the major problems associated with sun drying of fish are infestation of the products by the fly and insect larvae during drying and storage, contaminants and spoilage. The quantitative losses through spoilage and insect attack on fish being dried fish have been estimated to 10-35% in the marine areas<sup>[5,6]</sup>. In tropical climates, under humid conditions, heavy infestation of unsalted dried fish by blow flies may cause up to 30% loss of the product<sup>[7]</sup>. The problem markedly evident with dried products is the contamination during different stages of handling and indiscriminate use of various types insecticide such as DDT, Nogos (Dichloroves) and Rubral

**Corresponding Author:** Md. Shaheed Reza, Lecturer, Department of Fisheries Technology,  
Bangladesh Agricultural University, Mymensingh, Bangladesh  
Tel: +88 091 55695-7 (2359) Fax: +88 091 55810

to avoid infestation<sup>[8]</sup>. However, no literature was found on the status of drying activities of marine fishes in the coastal region of Bangladesh. The present study was thereby designed to know the present status of drying activities of marine fishes and marketing margin, marketing profit of traditional dried fish products in the coastal region of Bangladesh.

## MATERIALS AND METHODS

**Survey on handling, transportation and processing of fish:** A survey was conducted over a period of nine months from March 2002 to November 2002, on the source of raw material, handling, transportation and processing of fish using questionnaires through interviews among the cross section of people including fishermen, middlemen, wholesalers, retailers and processors in the in the Kutubdiapara of Cox's Bazar sadar upazilla, Ghati Bhangra of Moheshkhali upazilla and Shahaparirdip of Teknaf upazilla under Cox's Bazar district. The processing steps for the production of dried fish products were studied. Information were collected from 30 households and different actors involved in this sector from each locations.

**Marketing system of dried fishery products:** A survey was also conducted on the marketing system including cost-benefit of the of dried fishery products in the wholesale market/araf market and in retail market of Cox's Bazar and Chittagong, using prescribed questionnaire. Data were also collected from producers in Kutubdiapara, Sonadia and Shaparirdip areas of Cox's Bazar and 20 shops of retail markets of Kazirdewry (Chittagong), Reyazuddin market (Chittagong), Boro Bazar (Cox's Bazar) and Teknaf Bazar (Teknaf).

## RESULTS AND DISCUSSION

**Status of raw material collection system:** Figure 1 and 2 shows the raw material collection system at different landing centres. As soon as the fish reach the landing centre, the local fish traders and agents take care of landing, handling, sorting and auctioning by species and size-groups. Although auctioning is a common practice, there are other types of price-fixation systems that have been followed by some traders' associations in some selected markets. The small scale fishermen carry their catch to the landing centre in traditional bamboo baskets or pulling carts and sell it to the pre-selected buyer or middlemen locally called 'mohajan'. The 'mohajan' gives loan to the poor marginal fishermen with certain condition that the fishermen must sell their catch to the 'mohajan'



Fig. 1: Landing of fresh fish at DFCD landing center, Cox's Bazar



Fig. 2: Landing of fresh fish at landing center near Kutubdiapara, Cox's Bazar



Fig. 3: Transportation of raw material in pulling cart under heavy pressure

as per market price. It was observed that during the peak season, when large volumes of fishes are harvested, the processors collect the raw material at cheaper price for production of dried products. The study reveals that the processors use poor quality raw materials for production of dried fish products. This is due to the use of inadequate ice, handling under heavy pressure (Fig. 3), longer exposure of the raw materials at higher temperature (Fig. 4) at different stages of handling (Fig. 5) and transportation, rough handling (Fig. 6), contamination and



Table 1: Fish species used for processing of traditional dried products

English name	Scientific name	Local name
Silver jew fish	<i>Johnius argentatus</i>	Lal poa
Silver jew fish	<i>Otolithes argentatus</i>	Rupa poa
Chinese pomfret	<i>Stromateus chinensis</i>	Rup chanda
Silver pomfret	<i>Stromateus cinereus</i>	Foli chanda
Black jew fish	<i>Johnius diacanthus</i>	Kala datina
Red snapper	<i>Lutinaus johnii</i>	Ranga choukya
Indian salmon	<i>Polynemus indicus</i>	Lakhua
Ribbon fish	<i>Trichiurus haumela</i>	Churi
Bombay duck	<i>Harpodon nehereus</i>	Loitya
Silver grunter	<i>Pomadasy hasta</i>	Shada datina
Brown pomfret	<i>Parastromateus niger</i>	Halichanda
Long jew Fish	<i>Otolithes brunneus</i>	Lambu
Indian mackerel	<i>Rastrelliger kanagurta</i>	Champa
Indian pike-conger	<i>Congresox talabonodius</i>	Carniga
Cat fish	<i>Arius sp.</i>	Kata
Hard tail	<i>Megalaspis cordyla</i>	Kauua
Bullet tuna	<i>Auxis rochii</i>	Bom maitya
Striped bonito	<i>Sarda orientalis</i>	Bom maitya
Bird shrimp	<i>Metapenaeus lysianassa</i>	Catchu chingri
Jinga shrimp	<i>M. affinis</i>	Kharkharia chingri
Coral shrimp	<i>Parapenaeus cornuta</i>	Shukana chingri

and nets but they maintain their livelihood from the income comes as day labourers or some sorts of labour sharing systems. The catch is being either sold directly to the agents or middlemen through auction in the wholesale market. Landing facilities and wholesale fish markets are not well developed in the coastal areas of the country. The coastal fish landing centres in many places are run by the private sector which is very poor standard in respect of hygiene and sanitation. In most cases landing centres have little or no facility of auction sheds, packing sheds and landing terminals, gangways, pontoons and proper drainage or hygienic facilities. Inadequate handling and preservation facilities make distribution systems more difficult for maintenance of raw material quality.

**Present status of fish drying activities:** A large number of fish species are used for drying in traditional and export purpose. A list of major species used for drying is given in Table 1. Traditional marine sun dried products are mainly produced in Kutubdiapara and Sonadia of Cox's Bazar, Ghati Bhanga of Moheshkhali and Shahaparirdip of Teknaf under Cox's Bazar district.

lack of knowledge of the processors about the quality aspects (Fig. 7). In rare cases processors themselves harvest raw material using their own boat and net. Generally fishermen are not owners of the fishing boats



Fig. 4: Prolonged exposure of raw material under sunlight in the open field



Fig. 6: Rough handling of raw material prior to processing



Fig. 5: Sorting of raw material in the open field prior to drying



Fig. 7: Contamination of raw material by fly in open space



**Production of traditional sun dried products**

**Steps followed in drying:** The small-scale fishermen bring their catch carrying in traditional bamboo made baskets with or without ice. The processors select the raw materials by organoleptic assessment and on the basis of time lapse between catch and purchase. Some export oriented processing plants prefer to buy raw materials from nearby landing centres and transport to their processing plant very quickly in iced condition, thus reduce the time lapse between catch and processing. Various handling steps in between the collection of raw materials and sun-drying such as grading, dressing, scaling, washing are not followed in case of traditional drying process of some small marine fishes.

Raw fishes, comparatively of larger sizes are graded before drying according to their size and species. The smaller fish are not graded at all before drying. Some are graded only on the basis of species. Mainly women (Fig. 8) and children take part in grading process of fish. Fishes of only large size are then eviscerated to remove the visceral mass using knives. Some are dressed by removing the gills and viscera by opening the ventral side. Splitting of some large size fishes are done

dorso-ventrally and the thick flesh is scored with sharp knife after splitting laterally and spreading open so as to ensure proper drying. Small size fishes, on the other hand, are not dressed at all.

The study reveals that washing facilities are very poor near traditional processing site (Fig. 9). Raw fish are washed with easily available water, though they contain wastes and filth. Fish are washed with filthy seawater very often. Small fish are not washed at all before drying. In case of large and splitted fish, they are washed just to reduce the excess blood and dirt. It was observed that the processors soak the raw fishes in various kinds of insecticides including DDT, Nogos (Dichloroves) (Fig. 10) prior to drying. They use concentration ranging from 20-80 ppm.

Small size fishes like chinese pomfret, brown pomfret, silver jew fish, anchovy etc. are sun dried spreading directly on bamboo mats (Fig. 11) or platform. But in winter, the usual practice is, large quantities of fishes are spreaded on open sandy beaches for drying due to shortage of the drying facilities. Here, the fishes get contaminated considerably with sands and microorganisms. Blowflies are very common. Their larvae



Fig. 8: Women participation in fish drying activities at kutubdiapara



Fig. 10: Soaking of raw fish in diluted insecticide prior to drying



Fig. 9: Traditional processors taking raw material for drying



Fig. 11: Traditional sun drying of small fish on bamboo made chatai





Fig. 12: Drying of insecticide treated Ribbon fish on bamboo poles

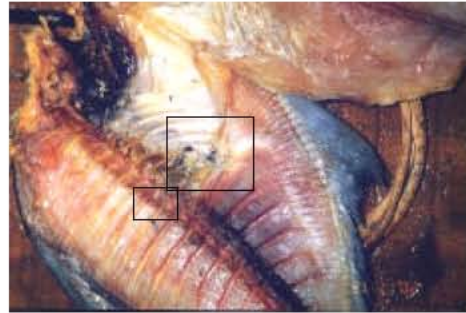


Fig. 15: Insect/fly larvae on traditional dried Chinese pomfret



Fig. 13: Soaking of near to dry fish in diluted insecticide



Fig. 16: Treatment of dried Chinese pomfret with diluted insecticide



Fig. 14: Near to dry Bombay duck being sprayed with insecticide

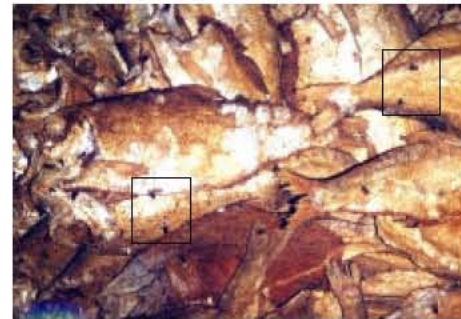


Fig. 17: Fly (with box) around traditional sun-dried fish during storage

cause considerable qualitative and quantitative loss of dried products. Besides, some other insects e.g. hornets, bees cause quality and economic loss during sun drying.

In case of larger size e.g. long jew fish, white gunter, indian salmon, indian mackerel, ribbon fish, big-eye tuna etc. are splitted and are dried suspending them from drying scaffolds (Fig. 12). These are made by bamboo or wooden poles and tying bamboo bars or thick rope is passed on them, in lines, one above another. When the fishes are half-dry, they are again treated with

insecticides, either by soaking (Fig. 13) or spraying (Fig. 14). In this condition, fishes get dried completely in 7 days or more. Small size fishes are spread on bamboo made mat or on sandy beach, where they take 4-7 days for drying depending on weather condition. After the drying process is completed, the products are collected from drying yards to the storage room and piled for few days. This enables the products to cool down and reach a state of equilibrium in relation to the surrounding environment.



Fig. 18: Storage of traditional sun-dried Bombay duck in jute bags



Fig. 19: Secondary market for traditional sun-dried fish products



Fig. 20: Retail marketing of traditional sun-dried fish products

Dried fish products are then put in jute made bags according to buyers' requirement. It was observed that the producers use chemicals in dried products to prevent the insect infestation (Fig. 15 and 16). It is suspected that such chemicals may create health hazards. Usually no measures are taken to prevent moisture absorption during storage, marketing and transportation. This allows the growth of moulds and fungus around the dried products. Fly and insects are very common in the dried products storage facilities (Fig. 17). The packages are stored finally

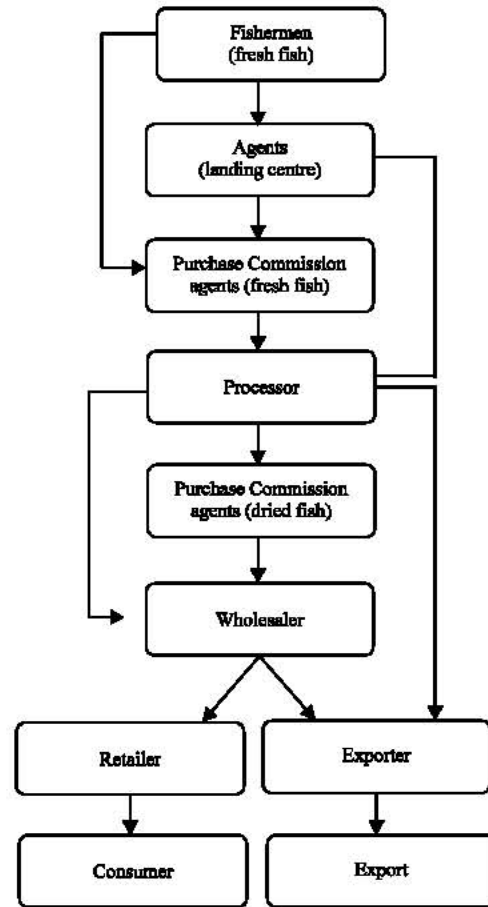


Fig. 21: Flow chart of marketing channel of raw materials and traditional sun dried products

in rooms of earthen floor at room temperature until marketing (Fig. 18-20).

**Quality aspects of dried products:** The survey reveals that both quantitative and qualitative losses amounting 10-30% occur with the dried product through spoilage and insect attack during and after drying. This is mainly due to spoilage of fish during handling and deficiencies in post-harvest handling, transportation and marketing. The other reasons of the quality loss in dried products are due to loss of freshness of the raw material before being dried. In most cases the fishes which are not sold in the fish market are used as raw materials for preparation of the dried products. By this time, considerable quality loss occurs in raw materials and subsequently high quality of the finished products is not achieved. Good quality of the raw material is essential for production of any value-added products because once the quality of the raw material is lost, there is no way to improve the quality of

the final product by any means of processing and preservation techniques.

The study reveals that there is little or no knowledge among the workers about the sanitation and hygienic methods of handling, transportation, processing and preservation. All these above mentioned factors contribute significantly to the quality loss of the final products. In all the marketing chain, the products are marketed without adequate packaging. As a result, in tropical country like Bangladesh, where relative humidity is high almost throughout the year, the dried products absorb moisture from the environment. Therefore, the water activity increases and there is a chance of bacterial spoilage in each stage of marketing, particularly during storage.

The survey also reveals that there is a wide spread use of insecticide in dried products to avoid the infestation and bacterial spoilage. This is true in all stages of marketing chain until the product reaches to the consumer. White powder in dried products in the retail and wholesale market is most common in Chittagong and Cox's Bazar dried fish market. This is due to the mould growth at higher water activity ( $a_w$ ).

**Investigation on marketing system of traditional dried fishery products:** The marketing system of traditional dried fishery products is shown diagrammatically (Fig. 21).

Wholesaler purchase processed dried products from small-scale processors or through other intermediate commission agents. It was observed during the period of investigation that processors were not directly involved with the retailing of their products. The wholesaler distributes the products to the retail seller and the products finally reach to the consumer through retailer. As a result the consumer buys the products with a higher price.

**Cost-benefit of the dried fishery products:** Marketing margins and profitability of different intermediaries for dry fish were estimated. Table 2 shows the amount of marketing margin and marketing profit made by the traders of different step of marketing. Results were presented for individual species and average of all selected species and finally, total marketing margin and marketing profit were estimated.

**Amount of profit:** Table 2 shows that the maximum and minimum value of fresh fish species used as raw material for the production of traditional dried product. For an example the price was maximum 112.50 Tk kg<sup>-1</sup> for chinese pomfret at landing station and 8 Tk kg<sup>-1</sup> for bombay duck at fisheries ghat, respectively. For dried fish, maximum price of 450 Tk kg<sup>-1</sup> for chinese pomfret at retail market and 45 Tk kg<sup>-1</sup> for bombay duck at primary market, respectively. The maximum amount of 18.5 Tk kg<sup>-1</sup> profit is made for chinese pomfret and minimum amount of 6.5 Tk kg<sup>-1</sup> profit is made for silver jew fish in primary and secondary market, respectively. The Table 2 also shows the average amount of profit made by selling dried products. The maximum and minimum values are 12.24 Tk kg<sup>-1</sup> at primary market level and 8.0 Tk kg<sup>-1</sup> at secondary market level.

In dry fish marketing, irrespective of species of fish marketed, marketing margin and profit are almost doubled. High value of dry fish claimed higher marketing cost leaving higher marketing margin as well as marketing profit for intermediaries. The study reveals that, processors in primary market received higher marketing profit followed by retailers and aratdars in consumer market and secondary market, respectively. However, considering all selected species, total marketing margin and profit kg<sup>-1</sup> were Tk 44.60 and 32.34, respectively.

Table 2: Marketing margin and marketing profit of traditional dry fish in domestic market

Marketing steps	Value (Tk kg <sup>-1</sup> )						Average profit/step
	Silver jew fish	Bombay duck	Big eye tuna	Chinese pomfret	Ribbon fish	Average	
<b>Fishermen/landing station/fisheries ghat (fresh fish)</b>							
Purchase price (PP) (Average price)	-	-	-	-	-	-	-
Marketing cost (MC) (Average price)	-	-	-	-	-	-	-
Sale price (SP) (Average price)	15.0	8.0	10.0	112.5	13.0	-	-
Marketing margin (MM) (MM=SP-PP)	-	-	-	-	-	-	-
Marketing profit (MP) (MP=MM-MC)	-	-	-	-	-	-	-
<b>Primary market (collector/ processor)</b>							
Purchase price (PP) (Average price)	52.5	28.0	35.0	394.0	45.5	111.00	
Marketing cost (MC) (Average price)	6.0	5.5	4.8	6.5	5.5	5.66	



Table 2: Continue

Marketing steps	Value (Tk kg <sup>-1</sup> )						Average profit/step
	Silver jew fish	Bombay duck	Big eye tuna	Chinese pomfret	Ribbon fish	Average	
Sale price (SP) (Average price)	67.5	45.0	48.0	419.0	65.0	128.90	12.24
Marketing margin (MM) (MM=SP-PP)	15.0	17.0	13.0	25.0	19.5	17.90	
Marketing profit (MP) (MP=MM-MC)	9.0	11.5	8.2	18.5	14.0	12.24	
<b>Secondary market (whole sale/ar atdar)</b>							
Purchase price (PP) (Average price)	67.5	45.0	48.0	419.0	65.0	128.90	
Marketing cost (MC) (Average price)	5.0	4.5	2.0	2.5	4.5	3.70	
Sale price (SP) (Average price)	79.0	60.0	55.0	431.0	78.0	140.60	8.0
Marketing margin (MM) (MM=SP-PP)	11.5	15.0	7.0	12.0	13.0	11.70	
Marketing profit(MP) (MP=MM-MC)	6.5	10.5	5.0	9.5	8.5	8.00	
<b>Consumer market (retailer)</b>							
Purchase price (PP) (Average price)	79.0	60.0	55.0	431.0	78.0	140.60	
Marketing cost (MC) (Average price)	2.5	2.0	3.5	3.5	3.0	2.90	
Sale price (SP) (Average price)	90.0	75.0	70.0	450.0	95.0	156.00	12.1
Marketing margin (MM) (MM=SP-PP)	11.0	15.0	15.0	19.0	15.0	15.00	
Marketing profit (MP) (MP=MM-MC)	8.5	13.0	11.5	15.5	12.0	12.10	
<b>Total marketing margin and profit</b>							
Total marketing margin	37.5	47.0	35.0	56.0	47.5	44.60	-
Total marketing profit	24.0	35.0	24.7	43.5	34.5	32.34	-

On an average 3.5 kg = 1 kg dried fish. Accordingly, purchase price considered the value of 3.5 kg fish for 1 kg dried fish

Fish drying is an old traditional practice in Bangladesh. Considerable post harvest losses occur in different stages of handling, transportation and before and after drying due to lack of knowledge of the people engaged in various stages of processing and marketing chains. The post harvest quality loss of the fishes needs to be minimized by improving the handling, transportation and preservation through creating awareness among various actors and infrastructure development. Development of low cost solar drying may be alternative to replace the traditional drying practices for small scale fish processors for producing high quality dried fish products. Marketing and distribution system of the dried products need to be improved as well by reducing marketing chain.

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