**Fish Drying and Marketing Systems in Selected Areas of Bangladesh: A Comprehensive Study on Processing, Species Utilization, and Socio-Economic Impact**

**ABSTRACT**

Fish drying is a traditional and vital method of fish preservation in Bangladesh, contributing significantly to the socio-economic conditions of coastal and inland communities. This study investigates the fish drying and marketing systems in selected areas of Bangladesh, focusing on the processing techniques, species utilized, and the socio-economic impact on local communities. The research was conducted in three drying yards (Nazirartek, Chalan Beel, and Kuliarchar) and three dry fish markets (Asadganj, Saidpur, and Massimpur) from January to December 2020. A total of 93 fish and shellfish species were identified for drying, with marine and freshwater species being processed through traditional sun-drying methods. The study highlights the importance of fish drying in providing livelihoods for thousands of people, particularly women, and its role in the national economy. However, challenges such as lack of modern technology, poor infrastructure, and contamination issues were identified. The paper concludes with recommendations for improving the quality, safety, and profitability of dried fish products through policy interventions, better infrastructure, and the adoption of modern drying techniques.

**Keywords:** Fish drying, Sun-drying, Marketing systems, Socio-economic impact, Traditional preservation.

**Introduction:**

Bangladesh boasts a rich diversity of fish, with nearly 300 freshwater species, 35 exotic species, 475 marine species, 36 shrimp species, and 24 prawn species (Rahman, 1989; Hossain et al., 1999). As a riverine country with abundant aquatic resources, fish plays a crucial role in the daily lives of many Bangladeshis. With a total fish production of 45.03 lakh metric tons in FY 2019-20, aquaculture contributes 57.38% of the total production, making Bangladesh self-sufficient in fish production .A diverse environment is the basis for this fish production (Alam et al., 2023) . Fish supplies about 60% of the daily animal protein intake (67.8 g/day per capita), surpassing the target of 60 g/day (Alam et al., 2023., DoF 2023,). Fish is a vital and accessible protein source (Bhuiyan et al., 2004), with dried fish (locally known as *Shutki*) being particularly popular. Dried fish is a concentrated source of protein and minerals, helping combat protein malnutrition.

Sun-drying, the oldest fish preservation method, remains essential in developing regions. This traditional process involves drying fish in open air using sunlight to evaporate moisture, ideally reducing the moisture content to below 15-16% to inhibit microbial and enzymatic activity. Coastal areas, rivers, and haors are prominent for dry fish production, especially from mid-October to mid-April. During winter, large quantities of fish are caught from freshwater and marine sources, as fishing activities peak due to calm weather conditions in the Bay of Bengal and coastal areas. However, the lack of buyers, transportation, and fair pricing often necessitates drying unsold fresh fish, making winter the peak season for dry fish production.

Dried fish is typically stored in warehouses near coastal towns. Improper drying, especially of high-value fish like Chinese pomfret and Indian salmon, often leads to infestations by beetles and mites, exacerbated by humid monsoon conditions. To prevent infestations, fishermen use harmful insecticides, posing health risks to both users and consumers. Despite these challenges, sun-dried fish production is gaining popularity as an important protein source, particularly in coastal, central, and northeastern regions (Nowsad, 2007). However, the quality of many traditional sun-dried products remains unsatisfactory (Nowsad, 2005).

Bangladesh has the third largest aquatic fish biodiversity in Asia, after China and India (Khanom et al., 2024, Alam et al., 2024). The dry fish industry supports many livelihoods and contributes significantly to Bangladesh's economy, with a total production of 62,561 metric tons in 2019-20. Dried fish is marketed through various channels, with Asadganj in Chittagong being the largest dried fish market. Fish drying occurs in regions lacking modern preservation and transportation infrastructure, relying on traditional methods that require improvement. Dried fish from areas like Sonadia, Kotubdia, Cox's Bazar, and Khulna is supplied to markets across Bangladesh, including Chittagong Hill Tracts, Sylhet, Dhaka, and Rangpur, as well as exported to countries like Singapore, the UK, the USA, and the UAE (Kleih et al., 2003).

Dried fish is particularly favored in Sylhet, Mymensingh, Chittagong, and Cox's Bazar. The practice of fish drying is believed to have been introduced by Arabian saints and traders, who pioneered dry fish production and marketing since ancient Egyptian times (Kreuzer, 1974). However, significant quantities of dried fish are spoiled annually due to inadequate drying, preservation, and storage, especially during peak seasons (Neuschler, 1998). Proper sun-drying of high-quality fresh fish can minimize post-harvest losses and reduce spoilage, ensuring the fish reaches consumers in good condition.

**Materials and Methods:**

**Selection of the Study Area**

This study focuses on three drying yards (Nazirartek, Chalan Beel, and Kuliarchar) and three dry fish markets (Asadganj, Saidpur, and Massimpur) to reflect the current situation in the country.

**Survey Instrument**

A structured questionnaire was developed as the primary tool for data collection. It was designed to address the main objectives of the research. Unlike exploratory research, which often uses unstructured questionnaires, this study employed a structured approach. The questionnaire is included in the appendix.

**Sample Selection**

The study targeted two groups of respondents. The first group included processors involved in dry fish production in Nazirartek, Chalan Beel, and Kuliarchar. The second group consisted of marketers engaged in the dry fish business in Asadganj, Saidpur, and Massimpur.

**Data Collection**

Data was collected through personal interviews with processors and marketers. A pre-prepared questionnaire and interview schedule were used to gather information carefully from primary sources. Rapport building with respondents was emphasized to ensure smooth and accurate data collection. Many insights were obtained through extended discussions. Before interviews, respondents were briefed on the study's objectives and assured that their data would not be misused. Photographs were also taken during the data collection process.

**Data Processing and Analysis**

Data analysis involved interpreting the collected data, which was organized and presented in tables, graphs, and other formats. After collection, the data was coded and entered into Excell 2010 version for analysis. Tabular and descriptive techniques were used, with univariate analysis being the primary method. This included simple statistical measures such as frequencies, cross-tabulations, and descriptive statistics like percentages, arithmetic means, and standard deviations to explore the composition of variables.

**Challenges During the Survey**

Although most respondents were cooperative, several issues arose during data collection. Many processors and traders lacked formal education and were hesitant to share information, fearing potential misuse of their business data. Despite assurances, workers at drying yards and shops, who were not authorized to disclose business details, often refused to provide information. Additionally, frequent income tax investigations created a sense of fear among respondents, further complicating the data collection process.

**Results:**

**Description of Dry Fish Yard:**

Nazirartek dry fish yard is the biggest dry fish yard situated in Cox's Bazar. Chalan beelis the largest and most important watershed in the North Central Bangladesh. The Chalan beelis now confined at ten upazilas (Singra, Gurudaspur, Boraigram, Chatmohar, Bhangura, Faridpur, Shahjadpur, Ullapara, Tarash and Raigonj) covering Natore, Pabna and Sirajgonj districts. The production of fish is apparently high in the months starting from September, until early January. Fishes from different landing centres are transported to many parts of the country.

Kuliarchar is an Upazila of Kishoreganj District in the Division of Dhaka, Bangladesh. The main rivers are Old Brahmaputra, Meghna, Arial Khan, Kali and Dhonu and the major haors are Chhatlar, Pachatia, Gahachorer, Dilmoksha and Ganakhali. Though the catch from inland fishery has decreased substantially over the years, the upazila still receives good catch from several haors. Dried fish production has been going on in Kuliarchar for as long as people can remember, but now they are more skilled than in the past and can do things more quickly.

**Sources of Raw Fish**

In the study are fish sun-drying is primarily a commercial activity, with a small portion reserved for household consumption. During the peak harvesting season from mid-October to mid-February (Bengali months Kartik to Magh), dry fish producers collect large quantities of raw fish due to their abundance and lower market prices. Most raw fish are sourced from *arat* (landing centers), while a smaller amount is obtained directly from fishermen if their boats are near the drying areas. Occasionally, dry fish producers use small boats to collect raw fish directly from the sea. However, it was observed that poor-quality raw materials are sometimes used for drying. The collection of raw fish is often timed with high tides, locally known as *Joba*, which occur three to four times a month, lasting two to three days each. Dry fish producers typically collect raw fish for about 10 to 12 days each month. Raw fish are transported from landing centers to drying yards using vans, small boats, or, in some cases, by head load.

**Species Used in Sun-Drying**

A diverse range of fish and shellfish species are used for sun-drying in the study area. In Nazirartek, a total of 50 species were identified, including 40 fish species and 10 shellfish species (Table 1). These species are categorized into two groups: (i) **Major fish species**, which make up 80% of the total dried fish (e.g., Loittya, Faissa, Churi), and (ii) **Minor fish species**, which constitute 20% of the total dried fish (e.g., Shapla pata, Poa, Chingri, Koral, Rupchanda, Lakkha, Rupsha, Bhata). Major species are specifically targeted by dry fish producers, while minor species are often mixed in smaller quantities.

**Table 01: Checklist of fish and shellfish used for drying in Nazirartek,Chalan Beel and Kuliarchar**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SL** | **Local Name** | **Common Name** | **Scientific Name** | **Locations** | **Comments** |
| **Naziratek** | **Chalan Beel** | **Kuliarchar** |
| 1 | Nuna baila | Tropical sand goby | *Acentrogobius caninus* | √ |  |  |  |
| 2 | Shankhachii | Banded eagle ray | *Aetomylaeus nichofii* | √ |  |  |  |
| 3 | Bailla | Bailla | *Awaous guamensis* | √ |  |  |  |
| 4 | Shol | Striped snakehead | *Channa striata* | √ | √ | √ |  |
| 5 | Gojar | Great Snakehead | *Channa marulius* |  |  | √ |  |
| 6 | Taki | Spotted Snakehead | *Channa* *punctata* |  | √ | √ |  |
| 7 | Cheng | Walking Snakehead | *Channa orientalis* |  | √ |  |  |
| 8 | Potka | Milkspotted puffer | *Chelonodon patoca* | √ |  |  |  |
| 9 | Olua | Goldspotted anchovy | *Coilia dussumieri* | √ |  |  |  |
| 10 | Kamila | Indian pike conger | *Congresox talabonoides* | √ |  |  |  |
| 11 | Kachki | Ganges river sprat | *Corica soborna* | √ |  |  |  |
| 12 | Boal | Wallago | *Wallago* *attu* | √ |  | √ |  |
| 13 | Kukur jeeb | Largescale tonguesole | *Cynoglossus arel* | √ |  |  |  |
| 14 | Kukur jeeb | Bengal tongue sole | *Cynoglossus cynoglossus* | √ |  |  |  |
| 15 | Kukur jeeb | Long tongue sole | *Cynoglossus lingua* | √ |  |  |  |
| 16 | Lakkha | Fourfinger threadfin | *Eleutheronema tetradactylum* | √ |  |  |  |
| 17 | Churi | Smallhead hairtail | *Eupleurogrammus muticus* | √ |  |  |  |
| 18 | Tak chanda | Whipfin silver-biddy | *Gerres filamentosus* | √ |  |  |  |
| 19 | Bele | Tank goby | *Glossogobius giuris* | √ |  |  |  |
| 20 | Loitta | Bombay-duck | *Harpadon nehereus* | √ |  |  |  |
| 21 | Stingray | Honeycomb stingray | *Himantura uarnak* | √ |  |  |  |
| 22 | Somudra koi | Tripletail | *Lobotes surinamensis* | √ |  |  |  |
| 23 | Snapper | John's snapper | *Lutjanus johnii* | √ |  |  |  |
| 24 | Tara baim | Lesser spiny eel | *Macrognathus aculeatus* | √ |  | √ |  |
| 25 | Mullet | Flathead grey mullet | *Mugil cephalus* | √ |  |  |  |
| 26 | Poa | Pama croaker | *Otolithoides pama* | √ |  |  |  |
| 27 | Rup chada | Silver pomfret | *Pampus argenteus* | √ |  |  |  |
| 28 | Rup chada | Chinese silver pomfret | *Pampus chinensis* | √ |  |  |  |
| 29 | Rup chada | Black pomfret | *Parastromateus niger* | √ |  |  |  |
| 30 | Bata | Greenback mullet | *Planiliza subviridis* | √ |  |  |  |
| 31 | Lakkha | Sixfinger threadfin | *Polydactylus sexfilis* | √ |  |  |  |
| 32 | Sardinella | Fringescale sardinella | *Sardinella fimbriata* | √ |  |  |  |
| 33 | Bishtara | Spotted scat | *Scatophagus argus* | √ |  |  |  |
| 34 | Shark | Spadenose shark | *Scoliodon laticaudus* | √ |  |  |  |
| 35 | Phasa | Scaly hairfin anchovy | *Setipinna taty* | √ |  |  |  |
| 36 | Phasa | Common hairfin anchovy | *Setipinna tenuifilis* | √ |  |  |  |
| 37 | Chewa | Burmese gobyeel | *Taenioides buchanani* | √ |  |  |  |
| 38 | Ilish | Hilsa shad | *Tenualosa ilisha* | √ |  |  |  |
| 39 | Chandan ilish | Toli shad | *Tenualosa toli* | √ |  |  |  |
| 40 | Churi | Largehead hairtail | *Trichiurus lepturus* | √ |  |  |  |
| 41 | Coral | Barramundi | *Lates calcarifer* | √ |  |  |  |
| 42 | Pitambor | Guiter fish | *Rhinobatus granulatus* | √ |  |  |  |
| 43 | Pangus | Pangas catfish | *Pangasius pangasius* | √ |  |  |  |
| 44 | Baim | Shal baim | *Mastacembelus armatus* | √ |  | √ |  |
| 45 | Bagda chingri | Giant tiger prawn | *Penaeus monodon* | √ |  |  |  |
| 46 | Chingri | White shrimp | *Penaeus indicus* | √ |  |  |  |
| 47 | Chingri | Brown shrimp | *Metapenaeus monoceros* | √ |  | √ |  |
| 48 | Lobster | Mud spiny lobster | *Panulirus polyphagus* | √ |  |  |  |
| 49 | Lobster | Slipper lobster | *Thenus orientalis* | √ |  |  |  |
| 50 | Kakra | Crab | *Neptunus pelagicus* | √ |  |  |  |
| 51 | Perki | Needle cuttlefish | *Sepia aculeata* | √ |  |  |  |
| 52 | Perki | Squid | *Loligo sp* | √ |  |  |  |
| 53 | Octopus | Octopus | *Octopus sp* | √ |  |  |  |
| 54 | Jellyfish | Jellyfish | *Scyphozoa sp* | √ |  |  |  |
| 55 | Pabda | Pabdah Catfish | *Ompok pabda* |  |  | √ |  |
| 56 | Ayre | Long-Whiskered Catfish | *Sperata aor* |  |  | √ |  |
| 57 | Tengra | Striped Dwarf Catfish | *Mystus vittatus* |  |  | √ |  |
| 58 | Chapila | Indian River Shad | *Gudusia chapra* |  |  | √ |  |
| 59 | Darkina | Flying Barb | *Esomus danricus* |  |  | √ |  |
| 60 | Bele | Tank Goby | *Glossogobius giuris* |  |  | √ |  |
| 61 | Sharpunti | Olive Barb | *Puntius* *sarana* |  | √ |  |  |
| 62 | Titpunti | Tikto Barb | *Puntius* *ticto* |  | √ | √ |  |
| 63 | Jatipunti | Pool Barb | *Puntius sophore* |  | √ | √ |  |
| 64 | Meni | Gangetic Leaf Fish | *Nandus* *nandus* |  | √ |  |  |
| 65 | Kholisha | Banded Gourami | *Trichogaster* *fasciata* |  | √ | √ |  |
| 66 | Kakila | Freshwater Gar Fish | *Xenentodon* *cancila* |  | √ | √ |  |
| 67 | Mola | Mola Carplet | *Amblypharyngodon* *mola* |  | √ | **√** |  |
| 68 | Dhela | Cotio Fish | *Osteobrama cotio cotio* |  | √ | √ |  |
| 69 | Chela | Razobelly Minnow | *Salmophasia* *bacaila* |  | √ |  |  |
| 70 | Keski | Ganges River Spat | *Corica* *soborna* |  | √ | √ |  |
| 71 | Gol Chanda | Indian Glassy Fish | *Parambassis* *ranga* |  | √ |  |  |
| 72 | Nama Chanda | Elongate Glass Perchlet | *Chanda* *nama* |  | √ | √ |  |
| 73 | Isa Chingri | River Prawn | *Macrobrachium* *idella* |  | √ |  |  |
| 74 | Tengra | Striped Dwarf Catfish | *Mystus* *vittatus* |  | √ |  |  |
| 75 | Kalobuzuri | Striped Dwarf Catfish | *Mystus* *tengara* |  | √ |  |  |
| 76 | Gulsha | Day's Mystus | *Mystus bleekeri* |  | √ | √ |  |
| 77 | Batasi | Batashi | *Neotropius atherinoides* |  |  | √ |  |
| Total Species= | 51 | 20 | 23 |  |

**Fish drying season**

It was noted that the majority of dry fish producers typically begin their fish drying operations around mid-October and continue until mid-April (in Bengali, from Kartik to the end of Baishakh). From mid-September to October (in Bengali, from Aswin to mid-Kartik), these producers spent their time constructing bamboo racks, pools, or chatai (mats) to prepare for the drying process. The peak season for fish drying was observed to be from mid-October to mid-February (in Bengali, Kartik to Magh) (Figure 01). During this period, there was ample sunlight and lower wind moisture, which facilitated effective fish drying. It was also observed that nearly all dried fish producers dedicated their entire day (12 to 15 hours) to fish drying activities during the peak season. In some cases, women also participated in the fish drying process.

**Figure 01:** Fish drying season in Nazirartek dry fish yard

**Method of sun drying**

Different activities were done before drying the fish including sorting, scaling, gutting, dressing, washing, salting, drying and marketing in the study area (Figures 02). The method of sun drying is given below:

8. Storage (in tent, temporarily)

1. Collection of raw fish

2. Washing of raw fish

3. Salting of raw fish

(50-250 g salt / kg of raw fish)

4. Dressing and splitting of raw fish (done for large fishes only)

5. Drying under the sun (2-6 days)

6. Sorting of dried fish

7. Packaging (in plastic

and hessian bags, bamboo baskets)

9. Marketing and selling

 (Marketed in Sayadpur by train, bus and truck)

1. Collection of large raw fish

2. Sorting of raw fish

3. Dressing, gutting, splitting of raw fish

4. Washing (With river/pond water)

7. Packaging (Jute bags, bamboo baskets, polythene)

5. Salting

6. Drying under the sun

 (5-7 days)

8. Storage (2-20 days depends on sell to aratdar)

9. Marketing and selling

1. Collection of raw fish

2. Washing of raw fish

3. Salting

4. Spreading on the rack

7. Storage (2-20 days depends on sell to aratdar)

5. Drying under the sun

 (3- 5 days)

6. Packaging (Jute bags, bamboo baskets, polythene)

8. Marketing and selling

 Nazirartek Chalan Beel Kuliarchar

Figure 02: Flowchart for drying Activities of fishes in Nazirartek, Chalan Beel And Kuliarchar Dry Fish Yard.

**Marketing system of dry fish**

Almost all dried fish traded internally through privet channels. The market structure varies from area to area. Different category of stake holders such as producers/processors, beparis, aratdars, wholesalers and retailers and their activities were found to complete the marketing chain. The sale is normally carried out through a commission agent (Aratdar) who conducts public auctions. They sell the dry fish to whole sellers and retailers (Nickaries). Dried fish consumed at a distance from this market is transported by distributor (Paikers) to other markets, usually whole sales markets in district towns. Aratdars play a leading role in this market. They can play several brokerage functions at the same time. This includes commission agent whereby they obtain a percentage fee of the auctioning price (i.e., normally 3-5%).

**Species availability**

The study area was well-known for both Freshwater marine fish . Availability of species was varied from season to season. Retail price of the dried fishes was found to be varied according to the species, size, quality of the final products etc. (Table 02).

**Table 02:** Retailer price of most selling dry fish in Asadganj, Saidpur, and Massimpur dry fish market

|  |  |  |  |
| --- | --- | --- | --- |
| SL | Local Name | Scientific Name | Retail price (BDT/Kg) |
| Asadganj | Saidpur | Massimpur |
| 1 | Lakkha | *Eleutheronema tetradactylum* | 2000-3000 |  |  |
| 2 | Rupchada | *Pampus sp.* | 1500-2500 |  |  |
| 3 | Loitta | *Harpadon nehereus* | 300-500 |  |  |
| 4 | Churi (Small Size) | *Trichiurus lepturus* | 300-700 |  |  |
| 5 | Churi (Big Size) | *Trichiurus lepturus* | 800-1500 |  |  |
| 6 | Maitya | *Euthynnus affinis* | 1000-1300 |  |  |
| 7 | Poa | *Otolithoides pama* | 250-500 |  |  |
| 8 | Chewa | *Taenioides buchanani* | 100-150 |  |  |
| 9 | Mola | *Amblypharyngodon mola* | 250-400 |  |  |
| 10 | Icha Chingri | *Metapenaeus monoceros* | 400-1000 |  |  |
| 11 | Mola | *Amblypharyngodon mola* |  | 250-300 |  |
| 12 | Chapila | *Gudusia chapra* |  | 250-300 |  |
| 13 | Punti | *Puntius sp.* |  | 150-200 |  |
| 14 | Boal | *Wallago attu* |  | 600-800 |  |
| 15 | Chanda | *Chanda nama* |  | 200-250 |  |
| 16 | Tengra | *Mystus sp.* |  | 400-600 |  |
| 17 | Keski | *Corica soborna* |  | 250-350 |  |
| 18 | Baim | *Mastacembelus sp.* |  | 500-700 |  |
| 19 | Loittya | *Harpadon nehereus* |  | 300-500 |  |
| 20 | Isa Chingri | *Macrobrachium sp.* |  | 250-400 |  |
| 21 | Loitta | *Harpadon nehereus* |  |  | 500-700 |
| 22 | Keski | *Corica soborna* |  |  | 400-600 |
| 23 | Baim | *Mastacembelus sp.* |  |  | 500-800 |
| 24 | Chanda | *Chanda nama* |  |  | 300-400 |
| 25 | Rup Chanda | *Pampus sp.* |  |  | 1500-2000 |
| 26 | Boal | *Wallago attu* |  |  | 500-800 |
| 27 | Shol | *Channa striata* |  |  | 800-1200 |
| 28 | Mola | *Amblypharyngodon mola* |  |  | 300-450 |
| 29 | Tengra | *Mystus sp.* |  |  | 400-600 |
| 30 | Icha | *Macrobrachium sp.* |  |  | 400-600 |

**Discussion:**

A variety of fish species is utilized in sun drying within the study regions. The selection of fish for commercial sun drying is based on both their availability and market demand. Reza et al. (2005) conducted research on traditional drying methods of commercially significant marine fish in Bangladesh, noting that poor-quality raw materials were commonly used, which aligns with the findings of the current study. Latif et al. (1983) examined the dried fish processing industry in the east coast states of Kelantan and Terengganu, where many producers emphasized the importance of fish freshness for high-quality dried products, corroborating the present findings. According to Faruque et al. (2012), major fish species used for drying include Loittya (Harpadon nehereus), Poa (Panna microdon), Phasa (Setipinna phasa), Taposi (Polynemus paradiseus), Chhuri (Lepturacanthus savala), Boiragi (Coilia dussumieri), Fatra (Raconda russeliana), Rupchanda (Pampus chinensis), and Pama (Otolithes pama), which are similar to the species identified in this study. Nowsad (2004) also reported similar fish species being dried in coastal areas like Cox's Bazar.

In this study area, drying occurs seasonally, particularly from July to March, with the peak drying season between September and October, as noted by Flowra et al. (2012). Some producers were observed not to wash their raw fish adequately, with small fish often dried directly in the sun without prior dressing. This observation aligns with findings by Samad et al. (2009). Larger fish typically underwent gutting and splitting processes. Occasionally, low-quality damaged fish were sourced from landing centers for drying. Each producer gathered the necessary amount of fresh fish for sun drying based on availability and pricing. Sorting raw fish varied by area; Flowra et al. (2012) noted that sorting was prevalent in the Chalan Beel areas of Bangladesh, typically conducted after raw fish collection.

Generally, producers employed commercial salts for drying, but most did not adhere to a specific salting ratio. If fish were collected at night, slightly more salt was used to preserve freshness compared to daytime collections. Salt addition was also noted, although mostly low-quality salt was utilized.

The drying process varied depending on fish size and type, as well as consumer preferences. High amounts of salt were often used during cloudy weather conditions. In some cases, larger fish, such as coral fish, were cut into smaller pieces for drying. This practice was similarly reported by Flowra et al. (2012) and Shamim et al. (2014). Sugathapala et al. (2012) studied salt-based dry fish processing and marketing among fishers at Minneriya reservoir in Sri Lanka, indicating that less salt was used in that study area's fish compared to this one, likely due to the climatic differences in Bangladesh, where lower moisture levels shorten the drying period.

Drying duration differed according to weather factors such as sunlight intensity, temperature, humidity, wind flow, rainfall, and day length. Under normal weather conditions, drying times ranged from 3-5 days, depending on fish size, consistent with findings from other studies in the Chalan Beel areas (Flowra et al., 2012; Samad et al., 2009), which indicated drying durations of 2-6 days based on raw fish size. The sun drying practices observed align with the methods reported by Samad et al. (2009), where people in the Chalan Beel areas dried fish using bamboo racks or fishing nets on the ground for commercial purposes. Similar findings on sun drying techniques were noted by Shamim et al. (2014).

Typically, dry fish producers yield 30-35 kg of dried fish from 100 kg of raw fish. Occasionally, the products were contaminated with soil, dirt, and blowflies. Reza et al. (2005) highlighted that traditional drying in Cox's Bazar's sandy beaches often resulted in contamination with sand, insects, and microorganisms. Bhat et al. (2013) reported that conventional drying methods in Bandipora, Kashmir, were unscientific and could lead to serious health concerns. Similar findings were echoed by Immaculate et al. (2013), noting that the poor quality of dried fish was often due to unhygienic processing practices, inadequate salting, use of spoiled fish, and lack of airtight packaging. Sometimes, producers applied insecticides to raw fish before drying to prevent insect infestations. The marketing process for dried fish begins with the producer, who supplies the product to aratders, wholesalers, and retailers before it reaches consumers, or it can go directly from producer to retailer and then to consumers. This finding aligns with the research of Samad et al. (2009), and similar results have been observed by Flowra et al. (2010), Marine et al. (2014), and Shamim et al. (2014). Pricing typically reflects the average costs of the products, and the price of dried fish varies based on size and quality. Faruque et al. (2012) noted comparable prices for major dried marine fish at the Asadganj dry fish market, which supports our findings. The study area also revealed several key issues. Fersoushi et al. (2015) identified similar challenges in the dry fish marketing sector in the Rangpur division. Additionally, Ahmed et al. (2007) reported that tilapia traders faced difficulties including poor road and transport infrastructure, high transportation costs, inadequate ice supply, unhygienic conditions, lack of credit options, poor market facilities, and political issues like strikes and roadblocks. Thus, it is essential to offer institutional and organizational support, extension services, and additional research alongside enhancing knowledge of dried fish marketing.

**Conclusion:**

Drying is an efficient way to utilize bycatch and provides income for underprivileged communities. However, dry fish marketing faces challenges such as poor hygiene, inadequate infrastructure, limited modern techniques, and insufficient government support. While middlemen are often seen as exploitative, their profits are not excessively high due to the perishable nature of fish. The current cooperative system may not offer cost-effective solutions, highlighting the need for increased competition, particularly during the assembly phase, where financial dependency and poor communication disadvantage fishermen.

The study recommends policy interventions to help producers break free from non-institutional lenders and secure better profits, alongside strengthening domestic regulations for international trade. Key recommendations include:

* Developing a Code of Practice for salted products aligned with FAO and CODEX standards.
* Improving transportation between coastal areas and towns.
* Regulating the salt-to-fish ratio.
* Introducing supervised credit systems and portable drying units to prevent deforestation.
* Ensuring regular cleaning of drying chambers and providing healthcare in coastal regions.
* Reducing costs and enhancing producers' bargaining power in wholesale markets.
* Implementing land-based transportation and improving safety with coast guard support.
* Reducing middlemen's profit shares and expanding market networks for producers.
* Banning insecticides/pesticides in production, using clean utensils, and adopting durable packaging.
* Storing products in low-temperature, low-humidity conditions.

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