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Knowledge and Good Manufacturing Practices of Fish Drying Processor in Camarines Sur, Philippines

Irene P. Daet[1]; Myrna C. Bigueja[2]; Glend S. Sales[3]

[1,2]Partido State University, College of Fisheries and Marines Sciences, Sagnay, Camarines Sur, Philippines
[3]Partido State University, College of Science, Goa, Camarines Sur, Philippines

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Abstract: The fish drying methods used by processors in the region are generally similar, from preparation to the final product. Differences primarily exist in salt concentration, species, size of fish, and preparation methods. The typical process begins with the receiving of fresh raw materials, followed by the selection of fish for either whole or split drying. Whole fish are usually dried immediately after catching. Larger fish are split in half, gutted, washed, and salted. The amount of salt added depends on the size of the fish. They are then arranged in plastic containers or "bañeras" and left overnight. The next day, the fish are placed on bamboo trays and sun-dried. After drying, the fish are allowed to cool before sorting and packaging...The drying process relies primarily on natural sun drying, which takes one to three days depending on fish size, air humidity, and sunlight intensity. Based on the survey, no processors in the region use solar dryers. Introducing solar dryers is recommended as they reduce drying time, improve hygiene, and protect fish from environmental factors. Packaging plays a critical role in maintaining the quality of dried fish during transport and marketing. Commonly used packaging materials in the region include cardboard cartons and wooden boxes. Knowledge on Good Manufacturing Practices (GMP), Hygienic Practices (HP) and Standard Sanitation Operating Procedures (SSOPS) are poor and rarely adopted. Hence the product produce will lead to spoilage, reduced shelf-life and potential health hazard. Poor compliance for safety standard increase the risks that consumer maybe exposed to unsafe products, resulting food borne illness. Therefore, Dried fish processors require capacity-building better facility design and government NGO support

Keywords: *Knowledge, Good Manufacturing, Practices, Fish, Drying, Processor*.

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I. INTRODUCTION

Camarines Sur, Philippines, is blessed with abundant fishery resources. The province has seven coastal municipalities where fishing and fish processing serve as primary sources of income. Many fish caught in these areas are initially low-cost but increase in value when processed into preserved products. Camarines Sur supplies dried fish not only throughout the region but also across the country. Therefore, it is necessary to investigate whether local fish processors are following safety standards in fish drying.

These low-cost fish are highly perishable and spoil easily. The simplest and most immediate way to preserve them is by sun-drying. Fish drying is one of the oldest and most popular methods of preservation. In this process, fish are salted immediately after catching and then dried in open areas to remove moisture, which is the main cause of spoilage. Drying removes water from the fish, shrinks muscle tissues to form a characteristic rigid yet elastic texture, reduces water activity, and inhibits enzyme activity and microbial growth (Alam, A.N., 2023) [1].

In Camarines Sur, the most common practice involves salting bulk-caught fish before drying. Salt not only accelerates moisture removal but also prevents the growth of spoilage-causing microorganisms and deters flies from contacting the products. However, excessive salt content can negatively affect the flavor of dried fish, making it overly salty and sometimes less acceptable to consumers.

Traditional fish drying remains the easiest and lowest-cost preservation method. Fish can be dried almost anywhere; small fishes like anchovies are often salted and dried immediately under the sun in open areas. However, this method is not entirely safe, as fish may be contaminated with microorganisms or infested by insects.

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This study aims to assess the knowledge and implementation of Good Manufacturing Practices (GMPs) among fish processors in Camarines Sur. It also seeks to provide guidance and training on safer, more effective drying methods that preserve fish quality while minimizing contamination.

II. METHODOLOGY

This study was conducted to assess the knowledge and Good Manufacturing Practices (GMPs) of fish-drying processors in Camarines Sur. Data were collected through field visits to processing areas and interviews using a researcher-prepared questionnaire.

A draft questionnaire was initially developed and pre-tested with selected fish processors in nearby coastal areas. Pre-testing provided insights that helped improve and refine the questionnaire to ensure clarity and relevance. The final questionnaire was prepared based on the Philippine National Standard (Bureau of Product Standards & Food and Drug Administration. (2010)[2].

The adoption index for each variable—such as GMP, Good Hygienic Practices (GHP), and Standard Sanitation Operating Procedures (SSOP)—was calculated using a Likert scale with five points:

- Always adopted (Excellent) – 5
- Often adopted (Very Good) – 4
- Sometimes adopted (Good) – 3
- Rarely adopted (Fair) – 2
- Never adopted (Poor) – 1

This scoring system is also based on the Philippine National Standard (Bureau of Product Standards & Food and Drug Administration. (2010) [2]. Prior to data collection, the researchers obtained permission from the Bureau of Fisheries and Aquatic Resources and collected a list of accredited fish processors to streamline the data-gathering process. Researchers then visited the processing areas, observed drying practices, and conducted interviews using the questionnaire. Completed questionnaires were retrieved immediately after each interview.

Data were collected from eight (8) coastal municipalities of Camarines Sur: Balatan (M1), Cabusao (M2), Calabanga (M3), Del Gallego (M4), Pasacao (M5), Ragay (M6), Siruma (M7), and Tinambac (M8). The collected data were analyzed using MS Excel, and the results were presented in tables and charts.

III. RESULTS AND FINDINGS

➢ *Knowledge on Fish Drying*

In Camarines Sur, Philippines, different types of low-cost fish are often dried immediately after catching using traditional sun-drying methods. Fishermen employ various techniques, such as placing fish on bamboo racks hung on bamboo poles or spreading them directly on fishnets laid on the sand**.** However, these traditional methods are highly susceptible to contamination from flies, insects, and microorganisms.

Despite these risks, drying remains the most affordable and commonly used fish preservation method in many developing countries [3]. In contrast, some countries have adopted modern drying technologies. According to Solanki (2020) [4], modern techniques—such as greenhouse-type driers—use a closed system that provides better hygienic conditions and ensures safer, higher-quality dried fish products.

➢ *Knowledge Earned on Fish Drying*

Table 1 Knowledge Earned by the Fish Processors on Fish Drying

Knowledge Earn	**Municipality**							
	M1	M2	M3	M4	M5	M6	M7	M8
Self-learned	77.78%	66.67%	52.63%	40%	42.86%	28.57%	92.86%	71.43%
School	0%	0%	0%	60%	3.57%	0%	0%	0%
Training/s	0%	0%	0%	0%	46.43%	0%	0%	0%
Inheritance	22.25%	33.33%	47.37%	0%	7.14%	71.14%	7.14%	14.29%

Fish drying is one of the most common fishery-related activities in the province of Camarines Sur. Among the eight municipalities studied, the majority of fish processors reported that they acquired their knowledge of fish drying through self-learning**.** Other sources of knowledge included inheritance from family members**,** formal trainings**,** and practical experience gained over time.

➢ *Knowledge in Forms Fish in Drying*

Table 2 Knowledge on Forms of Fish in Drying

Knowledge Earn	**Municipality**							
	M1	M2	M3	M4	M5	M6	M7	M8
Whole or round	50%	64.29	42.86	53.33%	12.50%	77.78%	49.12%	75%
Splitted	50%	35.71%	54.29%	40%	46.88%	22.22%	49.12%	0%
Filleted	0%	0%	2.86%	6.67%	40.63%	0%	1.75%	25%

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The most common method applied by fish processors in the eight municipalities of Camarines Sur is round-type drying, with only a few processors adopting split or filleted forms of fish drying (Table 2). Small fishes are typically dried whole, while larger fishes are usually split or filleted. In these areas, most dried fish are low-cost and small-sized, whereas larger fishes are primarily sold fresh for daily consumption. When large fishes are not sold fresh, they are split or filleted to hasten moisture removal during the drying process. Similarly, Solanki (2020) [4] reported that in Gujarat, India, small fishes are usually dried whole, whereas larger fishes are split open and spread in the sun. This practice allows moisture to evaporate more efficiently from the flesh surface, ensuring faster and more effective drying, which is particularly important in tropical climates.

- *Type of Equipment, Tools and Utensils Used in Fish Drying*

Table 3 Knowledge on Type of Equipment, Tools and Utensils Used in Fish Drying

Knowledge Earn	**Municipality**							
	M1	M2	M3	M4	M5	M6	M7	M8
Plastic Container	41.03	0%	14.71%	20.83%	4.35%	20%	24.075	25%
Basin	15.38%	37.50%	22.06%	33.33%	30.43%	20%	25%	12.50%
Pail	12.82%	4.17%	25%	12.50%	26.52%	20%	24.07%	6.25%
Bañera	30.77%	20.83%	26.47%	29.17%	26.09%	20%	24.07%	37.50%
Paddle	0%	0%	0%	0%	0%	2.17	0%	0%
Drying Trays (Kaping)	100%	100%	100%	100%	100%	100%	100%	100%

Based on the results, no specialized equipment is used in the processing of dried fish; processors rely solely on basic tools and utensils. All processors use **"**kaping**"**—a locally produced flat bamboo material—for drying fish. Common tools include plastic containers, basins, pails, and bañeras, which are typically used during the salting process. Some processors also reported using bolos, chopping boards, gloves, knives, drums, Styrofoam trays, and other trays during drying.

These results indicate that, since drying is considered the simplest method of fish preservation, processors rely only on ordinary tools and utensils**.** However, these tools do not conform to the Philippine standards for dried fish processing and may compromise food safety. Therefore, there is a need to provide training to processors on the use of appropriate tools and safe handling practices to ensure the production of hygienic and high-quality dried fish.

- *Knowledge on Type of Packaging Materials Used in Fish Drying*

Table 4 Type of Packaging Materials Used in Fish Drying

Knowledge Earn	**Municipality**							
	M1	M2	M3	M4	M5	M6	M7	M8
Cartoons	41.03	0%	14.71%	20.83%	4.35%	20%	24.075	25%
Polyethylene Plastic	15.38%	37.50%	22.06%	33.33%	30.43%	20%	25%	12.50%
Karagumoy basket	12.82%	4.17%	25%	12.50%	26.52%	20%	24.07%	6.25%
Bañera	30.77%	20.83%	26.47%	29.17%	26.09%	20%	24.07%	37.50%
Bamboo trays	0%	0%	0%	0%	0%	2.17	0%	0%
Wood boxes	100%	100%	100%	100%	100%	100%	100%	100%

Dried fish products have low water content and low water activity, which reduces the risk of microbial growth. However, the main challenges during handling and storage are water adsorption by the product surface from the surrounding environment and insect infestation (Solanki, 2019) [4]. Packaging plays a critical role in transporting and marketing these products.

As shown in Table 4, commonly used packaging materials in this sector include cardboard cartons and wooden boxes. However, these materials do not adequately ensure product quality. At the retail level, old newspapers and plastic bags ("sando" bags) are often used for packaging. These materials are not recommended by the FDA in the Philippines and are considered unsafe for food packaging. Therefore, vacuum packaging is recommended for fish processors to protect the product and extend its shelf life.

- *Knowledge on Processing of Fish Drying by the Fish Processors*

The fish drying methods and processes applied by fish processors in the area are generally similar, from preparation to the final product. They primarily differ in terms of salt concentration, size and type of fish species, and the method of preparation.

The typical steps in fish drying are as follows: First, fresh raw materials are received. The fish are then selected based on whether they will be dried whole or split. Whole fish are usually dried immediately after catching. Sometimes, they are washed in seawater, placed in a plastic container with added salt, and left overnight. After salting, the fish are spread on fish nets or bamboo trays ("kaping") and dried under the sun.

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Larger fish, on the other hand, are split in half, gutted, washed, and salted. The salted fish are arranged in plastic containers or "bañeras" and left overnight. The following day, they are placed on bamboo trays and sun-dried. After drying, the fish are allowed to cool before sorting and packaging.

The amount of salt added depends on the size of the fish, though the most common ratio is 1:1—one-part salt to one-part fish—to aid in moisture removal. According to Rubaiy. et. al. (2020) [5], salting is a physical and chemical process in which salt penetrates the fish's body, drawing out moisture from the muscles, causing weight reduction, and preserving the fish.

The drying process in the region is primarily natural sun drying, which takes one to three days depending on fish size, air humidity, and sunlight intensity. Hassan and Al-Hakim (1985) [6] and Al-Asod et al. (2000) [7] noted that drying removes water from food, lowering moisture to a level where microbial growth is inhibited and enzyme activity is minimized, thereby preventing spoilage.

Based on the survey, no fish processors in the region use solar dryers; all rely on natural sun drying. Therefore, the use of solar dryers is recommended to speed up the drying process. Majeed and Al-Halphi (2007) [8] concluded that the reduction in moisture content of fish and meat was higher when using solar dryers compared with natural sun drying. Additionally, products dried using solar dryers are isolated from external environmental factors, protecting them from changes in weather conditions.

IV. KNOWLEDGE IMPLEMENTATION OF GOOD MANUFACTURING PRACTICES (GMPS)

To maximize the benefits of appropriate technology, dried fish processors require access to adequate services and facilities, including potable water, water treatment systems, effluent management, drainage, toilets, waste disposal, laboratories and equipment, cold storage, receiving and processing areas, storage facilities, rest/dining areas, and processing machinery. These facilities are essential to ensure Good Manufacturing Practices (GMPs) and the production of safe, wholesome products. Proper storage facilities are necessary to prevent post-processing losses and waste, while potable water and adequate drainage are critical to minimizing microbial contamination. According to Fairley et al. (2013) [9], drainage is a crucial component that significantly affects the hygienic performance of food production facilities. Without proper drainage, stagnant water may accumulate, producing unpleasant odors and attracting flies that can contaminate fish during drying.

Based on the data generated, the major response among dried fish processors was that hygienic practices and Standard Sanitation Operating Procedures (SSOPs) were rarely adopted. This may be due to the perception that implementing SSOPs entails additional costs and inputs, which small-scale processors may not be able or willing to invest in. Moreover, many of these processors operate on a small scale, as evidenced by the limited tools, equipment, and facilities at their disposal, which further constrains their ability to implement formal hygiene and sanitation measures effectively. Consequently, these limitations contribute to the production of dried fish under suboptimal sanitary conditions, potentially affecting product quality and safety.

To assess the level of GMP implementation in fish-drying facilities, the researchers visited local processing areas. It was found that many processors did not comply with the provisions of the Food and Drug Authority (FDA), which serves as the national regulatory body for ensuring safe and wholesome food production. During informal interviews, some processors reported that they were unable to use the required infrastructural facilities due to limited capital, while others were unaware of regulatory policies on food production. Given the high perishability of fish, proper handling immediately after catching and during preservation is critical to ensure safety and quality [8]. Adequate fish-drying infrastructure and facilities are therefore essential for producing high-quality dried products. The availability and adequacy of such facilities in a fish processing plant directly determine the type and quality of products that can be safely produced in a given processing area.

As shown in Table 5, the majority of dried fish processors still rely on traditional drying methods. Consequently, the implementation of GMPs is largely inadequate, particularly in terms of infrastructural facilities. This may be due to the additional costs associated with upgrading infrastructure, as many processors consider simple tools and materials sufficient for their operations. However, relying solely on traditional drying methods does not guarantee the production of high-quality, safe products. Therefore, Local Government Units (LGUs) should consider investing in modern fish-drying technologies to support local processors and improve product quality, safety, and market competitiveness.

- *Knowledge on Fish Drying Infrastructural Facilities*

Highly perishable foods, such as fish and other fishery products, require careful handling to preserve their quality and ensure safety. Immediately after harvest, fish should be preserved using appropriate methods—such as chilling, freezing, salting, or drying—to prevent spoilage and inhibit microbial growth (Samarajeewa, U. (2024) [10]. In this context, adequate fish-drying infrastructure and facilities play a crucial role in producing high-quality dried products. Raised drying racks, for example, reduce exposure to contamination and speed up drying, improving both safety and value (FAO, 2014) [11]. Proper drying equipment, hygienic racks, and well-maintained storage areas help ensure that the final product meets safety and market standards, while minimizing the risk of microbial deterioration (FAO, 2020) [12].

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Table 5 Infrastructural Facilities in Dried Fish Processing

Infrastructural Facilities	Weighted Mean	Adjectival Rating
Availability of Potable Water	2.78	Partially Adequate
Water Treatment Facilities	2.11	Not Adequate
Effluent Treatment Facilities	1.67	Not Adequate
Drainage Facilities	1.89	Not Adequate
Toilet Facilities	2.00	Not Adequate
Waste Disposal Facilities	2.22	Not Adequate
Laboratory Equipment Facilities	1.78	Not Adequate
Cold Storage Facilities	1.89	Not Adequate
Receiving and Processing Area	2.22	Not Adequate
Storage Facilities	2.11	Not Adequate
Rest/ Dining Room for the Workers	2.22	Not Adequate
Equipment and Machineries	1.78	Not Adequate
Overall Adequacy of Facilities	2.33	Not Adequate
Legend: 1 (never adopted), 2 (rarely adopted), 3 (sometimes adopted), 4 (often adopted) and 5 (always adopted)		

To maximize the benefits of appropriate technology, dried fish processors require access to adequate services and facilities**,** including potable water, water treatment systems, effluent management, drainage, toilets, waste disposal, laboratories and equipment, cold storage, receiving and processing areas, storage facilities, rest/dining areas, and processing machinery. These facilities are essential to ensure Good Manufacturing Practices (GMPs**)** and the production of safe, wholesome products.

Proper storage facilities are also necessary to prevent post-processing losses and waste, while potable water and adequate drainage are critical to minimizing microbial contamination. According to Fairley et al. (2013) [9], drainage is a crucial component that significantly affects the hygienic performance of food production facilities. Without proper drainage, stagnant water may accumulate, producing unpleasant odors and attracting flies that can contaminate fish during drying.

As shown in Table 5, the data indicate that the majority of dried fish processors still rely on traditional drying methods**.** Consequently, the implementation of GMPs is largely inadequate, particularly in terms of infrastructural facilities. This may be due to the additional costs associated with upgrading infrastructure, as many processors consider simple tools and materials sufficient for their operations. However, relying solely on traditional drying methods does not guarantee the production of high-quality, safe products. Therefore**,** Local Government Units (LGUs) should consider investing in modern fish-drying technologies to support local processors and improve product quality, safety, and market competitiveness.

- *Knowledge Hygienic Practices*

A major goal of the food processing industry is to provide safe, wholesome and acceptable food to consumers, and effective control of microorganisms is essential to achieving this objective (Baggen-Ravn et al., 2003) [13]. Therefore, hygienic practices are particularly important when handling fish and other fishery products, as these commodities are highly perishable and prone to microbial spoilage due to their high moisture content, neutral pH and nutrient-rich composition (FAO, 1995) [14]. Poor hygiene during harvesting, handling, processing or storage can introduce pathogenic bacteria such as *Salmonella*, *Vibrio* spp., *Staphylococcus aureus* and *Listeria monocytogenes*, which pose significant risks to consumer health (ICMSF, 2002) [15].

During the processing of dried fish, strict adherence to hygienic practices is crucial to prevent contamination prior to drying. Contamination at early stages can compromise the safety and quality of the final product, as many microorganisms may survive initial handling and proliferate before moisture reduction inhibits their growth (FAO/WHO, 2009) [16]. Good hygienic practices (GHP) include maintaining clean processing surfaces, preventing cross-contamination, ensuring proper personal hygiene of workers, and using clean water and equipment throughout the processing chain (Codex Alimentarius, 2020) [17]. Application of these practices not only reduces microbial load before drying but also enhances the shelf life and market value of dried fish products.

Table 6 Infrastructural Facilities in Dried Fish Processing

Infrastructural Facilities	Weighted Mean	Adjectival Rating
Availability of Potable Water	2.78	Partially Adequate
Water Treatment Facilities	2.11	Not Adequate
Effluent Treatment Facilities	1.67	Not Adequate
Drainage Facilities	1.89	Not Adequate
Toilet Facilities	2.00	Not Adequate
Waste Disposal Facilities	2.22	Not Adequate
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Cold Storage Facilities	1.89	Not Adequate
Receiving and Processing Area	2.22	Not Adequate
Storage Facilities	2.11	Not Adequate
Rest/ Dining Room for the Workers	2.22	Not Adequate
Equipment and Machineries	1.78	Not Adequate
Overall Adequacy of Facilities	2.33	Not Adequate
Legend: 1 (never adopted), 2 (rarely adopted), 3 (sometimes adopted), 4 (often adopted) and 5 (always adopted)		

Table 6 shows the Hygienic Practices in Dried Fish Processing. The data that indicating that hygienic practices are rarely adopted by local dried-fish processors is deeply concerning, as it suggests a significant gap in awareness and implementation of basic sanitation procedures. Such deficiencies can lead to serious food safety and quality issues. For instance, a study of small-scale *tuyo* (dried, salted fish) processors in Rosario, Cavite, found that although their post-harvest practices followed a "code of practice," they did not comply with Good Manufacturing Practices (GMP) **(**Ching, A. A. A., Luna, M. B. Z., & Ragaza, J. A.2024) [18]. This non-compliance was associated with higher microbial loads in the product: aerobic plate counts reached 7.82–8.36 log CFU/g, and process water showed extremely high microbial contamination (e.g., total coliform > 3.2 log MPN/mL **(**Ching, A. A. A., Luna, M. B. Z., & Ragaza, J. A.2024) [18].

These hygienic lapses are not just theoretical risks. Poor sanitation during drying and processing can facilitate the growth of pathogenic and spoilage microorganisms. For example, in dried anchovies, high water activity and inadeq0uate salt content allow histamine-producing bacteria (like *Staphylococcus aureus* and *Enterobacter*) to proliferate (Amascual, R. H., Panganoron, H. O., Gamba, A., & Irene, E, 2023) [19]. Elevated histamine levels in dried fish not only spoil product quality but also pose health hazards, such as scombroid poisoning, which can lead to symptoms like flushing, headaches, and gastrointestinal distress (Amascual, R. H., Panganoron, H. O., Gamba, A., & Irene, E, 2023) [19].

Furthermore, the traditional and small-scale nature of many dried-fish operations exacerbates the problem: processors are often family-based, working in limited-capital facilities, and rarely receive formal training or support (FAO, 2005) [20]. Without investments in infrastructure (like proper drying racks or raised trays) and proper sanitation protocols, the risk of cross-contamination is high. Indeed, undesirable practices have been documented, such as drying fish directly on the ground, using unclean water, and exposing fish to flies — all of which significantly compromise hygiene (APEC, 2007[21].

These findings imply that local dried-fish processors may be producing unsafe or substandard products, not necessarily out of negligence, but due to lack of knowledge, training, and infrastructure. The public health risk is non-trivial: unsafe dried fish has been linked to contamination by microbes, infestations, and even the use of harmful insecticides in some contexts. Rahat, M. ET.AL., (2024) [22]. Moreover, the poor implementation of GMP in related sectors underlines this gap: research in small-scale smoked-fish enterprises in the Philippines found *very low conformity* to hygiene and sanitation requirements. Otilla, A. d., et.al., (2022) [23].

➢ *Knowledge Standard Sanitation Operating Procedures*

Table 7, generated, the major response among dried fish processors was that hygienic practices and Standard Sanitation Operating Procedures (SSOPs) were rarely adopted. This may be due to the perception that implementing SSOPs entails additional costs and inputs, which small-scale processors may not be able or willing to invest in. Moreover, many of these processors operate on a small scale, as evidenced by the limited tools, equipment, and facilities at their disposal, which further constrains their ability to implement formal hygiene and sanitation measures effectively. Consequently, these limitations contribute to the production of dried fish under suboptimal sanitary conditions, potentially affecting product quality and safety.

Table 7 Standard Sanitation Operating Procedures in Dried Fish Processing

Standard Sanitation Operating Procedures	**Weighted mean**	**Adjectival Rating**
Safety of water that used in fish drying processing and cleaning processing plant	2.13	Rarely Adopted
Condition and cleanliness fish contact surfaces, including utensils, gloves and outer garments	1.75	Rarely Adopted
Prevention of cross contamination	2.25	Rarely Adopted
Maintenance of hand washing, sanitizing and toilet facilities	2.oo	Rarely Adopted
Proper labeling, storage and use of toxic compounds	1.75	Rarely Adopted
Control of employee health conditions that could result in the microbiological contamination	1.88	Rarely Adopted
Exclusion of pests from the food plant	1.38	Rarely Adopted
Legend: 1 (never adopted), 2 (rarely adopted), 3 (sometimes adopted), 4 (often adopted) and 5 (always adopted)		

Based on the data generated, *"rarely adopted"* emerged as the most common response among dried fish processors regarding their compliance with Standard Sanitation Operating Procedures (SSOPs). One key reason for this low adoption rate is the additional financial, material, and labor inputs required to implement formal sanitation systems. This challenge is well-documented among small-scale fisheries: a study by *Oxford Academic* found that limited infrastructure

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(e.g., lack of refrigeration), technical capacity, and sanitation programs significantly hinder implementation of food safety systems in small-scale fisheries (Gamarro, EG,et.al, 2023) [24]. Moreover, small-scale processors often face severe economic constraints; for example, small-scale fishers lack access to capital and improved processing technologies, limiting their ability to invest in safe post-harvest handling (Tadifa,G.C., et.al, 2022) [25]. Adding to this, an FAO technical paper highlights how cash-flow limitations and the structural economic realities of small-scale processors (especially women) make investment in rigorous sanitation or quality assurance systems difficult (Bavinck, M. A. ET.AL., (2023)[26]. This study shows that the processors were producing at a small scale, as shown by their limited tools, equipment, and facilities. This is consistent with other research: for instance, Ching, Luna, and Ragaza (2024) [18] documented that "tuyo" (dried fish) processors in Rosario, Cavite, Philippines, often lacked adequate facilities and training, which negatively impacted product quality and microbiological safety Ching, Luna, and Ragaza (2024) [18] . Similarly, an undergraduate thesis on GMP readiness among micro- and small-scale fish processors found that many processors lacked awareness of Good Manufacturing Practices (GMP) and had not attended food-safety trainings; in fact, more than 85% of respondents did not know what GMP entailed (Garcia, K. M. R. Year) [27]. Therefore, the combination of high perceived cost (or risk), limited technical capacity, and small-scale operation likely explains why SSOPs are not widely adopted by dried fish processors in your study.

V. CONCLUSION AND RECOMMENDATIONS

The fish drying methods employed by processors in the region are generally similar, spanning from the initial preparation to the final dried product. Variations mainly occur in salt concentration, fish species, fish size, and preparation techniques. Typically, the process begins with the receipt of fresh raw materials, followed by the selection of fish for either whole or split drying. Whole fish are usually dried immediately after catching, while larger fish are split in half, gutted, washed, and salted. The amount of salt applied depends on the size of the fish. The salted fish are placed in plastic containers or "bañeras" and left overnight. The following day, the fish are arranged on bamboo trays and sun-dried. After drying, the fish are allowed to cool before sorting and packaging.

The drying process in the region relies primarily on natural sun drying, which can take between one and three days depending on fish size, air humidity, and sunlight intensity. Based on the survey, no processors currently use solar dryers. The introduction of solar dryers is strongly recommended, as they can reduce drying time, improve hygiene, and protect the fish from environmental contamination.

Currently, the most common packaging materials include cardboard cartons and wooden boxes, which are not suitable for dried fish products due to poor protection from moisture, pests, and contamination. Knowledge and implementation of Good Manufacturing Practices (GMP), Hygienic Practices (HP), and Standard Sanitation Operating Procedures (SSOPs) are generally poor and rarely adopted. This lack of compliance contributes to product spoilage, reduced shelf-life, and potential health hazards. Consumers are therefore at increased risk of exposure to unsafe products, which may lead to foodborne illnesses.

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