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Ribbon fish processing value chain in Gujarat: An overview

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Abstract

Nutritionists all over the world are unanimous in their opinion that fishery resources can meet the protein requirements of the growing population. Fish is considered a cheap high-quality protein that prevents malnutrition in developing countries. The seafood industry provides both food and livelihood to millions of people. Among the marine fish landings, ribbon fishes accounted for the second highest share of 4.46%. However, in terms of value, it was 4.2% at the landing centre and 4.4% at the retail level in 2021. Ribbon fish is generally preferred by the consumer because of its chewy, not too oily, not too fishy meat, and easy to remove bones. It is processed as whole frozen, surimi, dried, and fish meal products. In Gujarat, around 90% of the ribbon fish catch is directly frozen as whole and exported to non-EU countries. Though the ribbon fish plays a major role in the seafood economy of Gujarat, documentation of its nutritional value, processing methods, and quality issues is limited. The present study provides comprehensive knowledge about ribbon fish processing methods and its marketing in Gujarat

Keywords
Fish processing, Ribbon fish, Fish value chain, Gujarat

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Introduction

Seafood is known as a good source of easily digestible protein with balanced essential amino acids, and lipids with the composition of therapeutic and essential fatty acids, minerals, and other micronutrients enriched with biologically beneficial elements. The seafood industry provides both food and livelihood to millions of people and ensures the food sovereignty of many countries across the continents. The volume of global fish production amounted to 184.6 million tons in 2022, up from 178.1 million tons in 2021. Fish is one of the most widely consumed foods in the world, and it is becoming more popular over time. In India, 14.5 million people depend directly or indirectly on fisheries activities. In 2022-23, the total value of India's exports of aquatic products reached USD 8.1 billion. China and India together account for more than 45% of global fish production before COVID 19 and it has declined by 2 % in 2020 (FAO, 2020). The COVID-19 pandemic has brought an array of challenges for the international trade of aquatic products.

Marine fishery resources

The estimated marine fish landings along the coast of India during 2021 was 3.05 million tons, an increase of about 11.8 % compared to the landings in 2020, the year in which there was a decline in landings mainly because of loss in fishing days due to Covid-19 pandemic related closure of the fishery industry. The maximum marine fish landing was reported in Gujarat which contributed 18.9 % of total marine landings

followed by Tamil Nadu (18.5 %), Kerala (18.2 %), and Karnataka (18.1 %) respectively (CMFRI, 2021). Gujarat has 128 seafood processing plants including European countries (EU) and Non-EU with a total production capacity of 6844.76 tons (MPEDA, 2023). Gujarat has 42 ports to handle a variety of shipments including aquatic products. Among the aquatic products, marine products are the major exports from Gujarat including frozen fish and shrimp products. The fin fishes are usually exported as whole frozen, surimi, dry fish, and fish meal. Among the finfishes of Gujarat, a few species viz., ribbon fish, croaker, bull's eye etc. play a major role in the seafood economy of Gujarat.

Ribbon fishery resources & its market share

Ribbon fish is a pelagic fish belonging to the family Trichiuridae. In total, ten species of ribbon fishes belonging to three genera have been recorded from Indian waters. *Trichiurus lepturus* and *Lepturacanthus savala* are the major species that are landed along the Gujarat coast. Ribbon fish landing was around 1.41 lakhs tons (CMFRI, 2021). During the COVID pandemic (2020), the ribbon fish landing declined to 75,664 t, which was 24 % less compared to 2019. Pelagic fishes recorded landings of 2.18 lakh tons in 2021 with a contribution of 38 % to the total marine fish landings of Gujarat. Landings were dominated by ribbon fishes, followed by Bombay duck, anchovies, scads and oil sardine. Ribbon fishes formed about 10.49% of the total and 27.71 % of pelagic fish landings. Ribbon fish reported the second-highest share of 4.46 % in total marine fish landings but in value terms accounted for 4.20 % at landing price and 4.4 % at retail price (2021). The major catch of ribbon fish was from mechanized multiday trawl net (82 %) followed by set bag net (11 %), purse seine (5 %) and gillnet (2 %). *Trichiurus lepturus* was the major species with size range of 235-1150 mm. Mature and gravid females were observed from January to March and October to December. The visceral analysis of the fish indicated that the fish are predacious, carnivorous, and sometimes show cannibalistic and selective feeding behavior. Ribbon fish feeds mainly on *Acetes* spp., *Stolephorus* spp., *Sardinella* spp., *Dussumieria* spp., squilla, *Penaeus* spp., *Metapenaeus* spp. and intermediates *etc* (Chiou *et al*.. 2006). India is one of

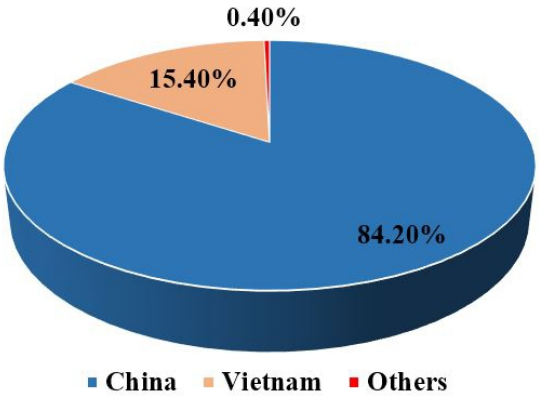

Fig. 1 Global markets of ribbon fish exported from India (2020) (in quantity)

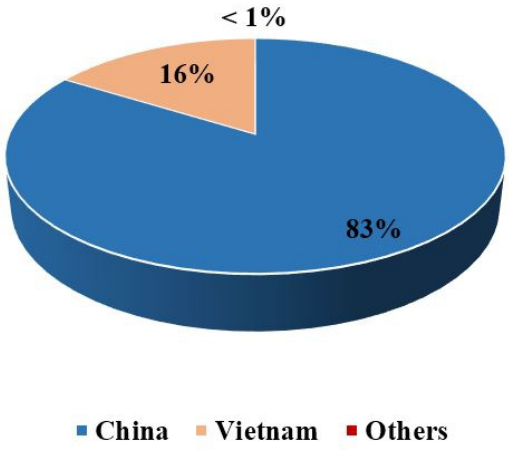

Fig. 2 Global markets of Ribbon fish exported from India (2020) (in value)

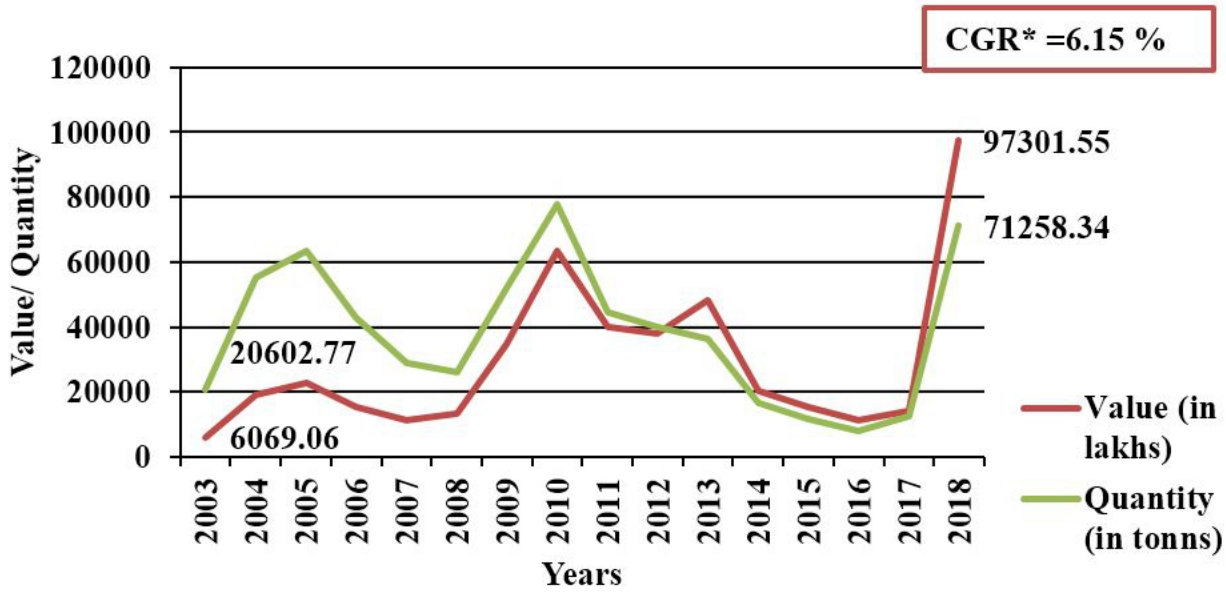

Fig. 3 Ribbon fish exported from India to China (2003 to 2018) in quantity and value

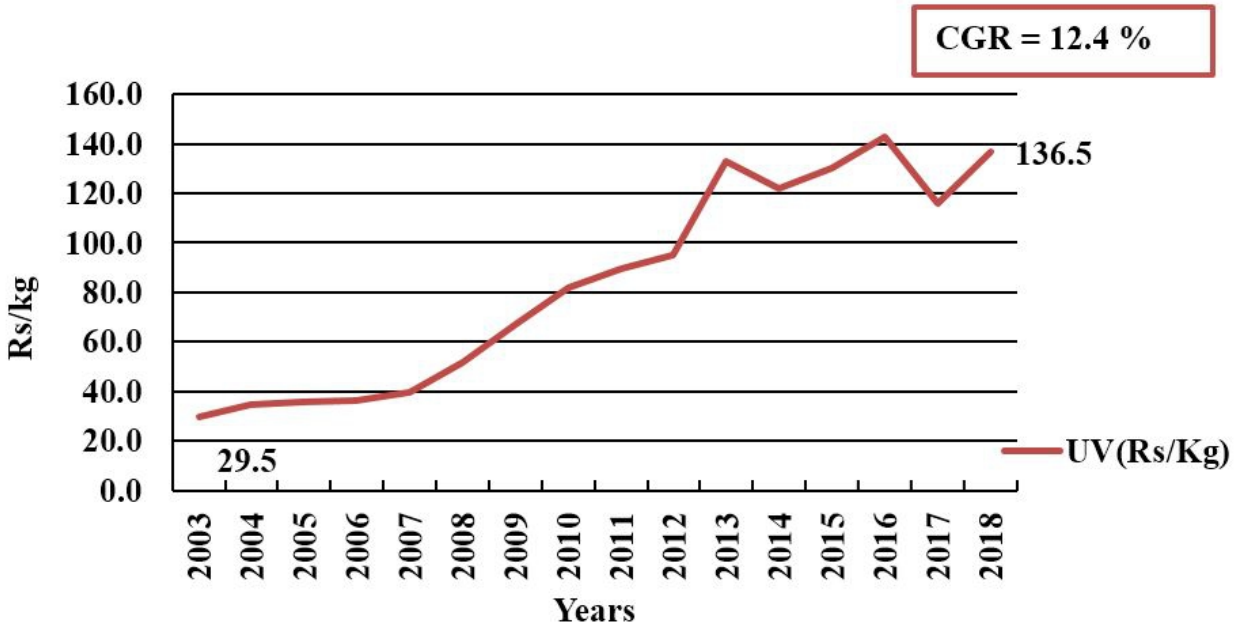

Fig. 4 Ribbon fish exported from India to China Unit price (Rs/Kg) 2003 to 2018

the largest exporters of ribbon fish to the global market. Figure 1-2 shows the market destination of ribbon fish exports from India (2020). China is the top importer of Indian ribbonfish, and Gujarat contributes a major export share. It is evident from Figure 3 – 4 that over the last 15 years (2003-2018), China plays a major role in the import of Indian ribbon fish with a compound growth rate (CGR) of 6.15 % in terms of quantity and 12.5 % in case of unit price (DGFT-India database, 2018).

Nutritional composition of ribbon fish

The fresh smallhead hairtail ribbon fish (*Lepturacanthus savala)*and largehead hairtail ribbon fish *(Trichiurus lepturus)* showed a higher protein content range of 17.7-20.05 %, crude fat content of 1.6-2.08 % and ash content range of 0.76-3.2 % respectively (Joshi et al., 2014 & Chandra *et al.*, 2014). The sun-dried ribbon fish (*Trichiurus haumela*) had a protein content of 58.36±0.46 %, crude fat of 11.24±0.36 % and a moisture content of 18.66±0.42 % (Siddiky *et al.*, 2017).

A study reported that the protein hydrolysate from ribbon fish (*Lepturacanthus savala)* viscera waste was found to have higher antioxidant and ACE-1 inhibitory activity (Yathisha *et al.,* 2021). The solvent-extracted oil from the muscle of Ribbon fish (*Lepturacanthus savala)* showed antibacterial activity against three pathogenic bacteria (both Gram positive and Gram negative) out of ten human pathogenic bacteria (Roni *et al.,* 2017).

Quality issues in fresh ribbon fish

The major catches of ribbon fish were found to be from the mechanized multiday trawlers. This multiday fishing of 7- 15 days with insufficient ice resulted in a huge quality loss of ribbon fish. So, the major quality problem faced during ribbon fish processing in Gujarat is belly bursting due to the autolysis and bacteriological activities, leading to loss of nutritive value and quality of ribbon fish. To prevent belly bursting, a dip treatment in 5% brine for 30 min is recommended. The quality index score of multiday fishing ribbon fish catch was 4.76 ±1.17 and in the case of single-day fishing, it was 3.20±1.08 in Veraval, Gujarat (Solanki *et al.*, 2016). The freshness of the fish can be maintained by proper washing with potable water and icing and immediate transportation to the processing unit from the fishing harbor by refrigerated van or insulated vehicle. Chilling of fish just above the freezing point was found to stop self-digestion and retard microbial activity. Chitosan coated smallhead hairtail ribbon fish (*Lepturacanthus savala)* had an extended shelf life of 7-9 days in refrigerated (4±1°C) conditions (Renuka *et al.*, 2016).

Types of ribbon fish processing methods in Gujarat

Whole frozen Ribbon fish processing

Ribbon fish is generally processed as whole frozen, surimi, dried, and fish meal products. Around 90% of the ribbon fish catch is directly frozen as whole. The ribbon fish is individually wrapped or packed in bulk before freezing. The major frozen export product is whole frozen with 4 different size grades *viz*., 100-200, 200-300, 300-400 and 400 up (Fig.5). Generally, fish is packed in 10 kg master cartons and exported. The wholesalers and or the commission agents act as market intermediaries in ribbon fish marketing between the fishermen and the processor. Nearly 150 persons are involved as commission agents in Gir-

Fig 5. Fresh & whole frozen ribbon fish

somnath district, and around 175-180 non-EU plants and merchant exporters were doing whole frozen ribbon fish processing just before the Covid-19 outbreak. The government was providing 7% incentive to exporters as a freight subsidy till December 2019. The process flow of dried ribbon fish is shown in the process flow diagram (Fig.6)

Frozen ribbon fish surimi

Surimi is a fish paste prepared from deboned fish and is used to make imitated products. It is an intermediate product and different types of products can be developed from surimi depending on the creativity, innovation, and knowledge of the one involved in this line. Surimi is free from lipids, water-soluble or sarcoplasmic proteins, and other impurities for use in the manufacture of intermediate products. Ribbon fish is one of the major species used for surimi production in Gujarat. Gir-Somnath district has 7 surimi plants with a production capacity of 329 tons/year (Table 1). The whole or headed, and gutted ribbon fish with the grades of 100-200, 200-300, 300-400 and 400 are used for surimi production (Fig.7). The average surimi yield from ribbon fish was found to be 25-27%. The process flow of frozen ribbon fish surimi is shown in the process flow diagram (Fig.9).

Ribbon fish meal

Fish meal is a natural and well-balanced source of high-quality protein used primarily in domestic animals, poultry, and aquaculture diets. The waste generated from the surimi processing is sold through commission agents to the fish meal production units. In 2021, there were five plants in Gir-somnath district that produced fish meal from ribbon fish with a production capacity of about 20 tons/day/factory. The protein content of the fish meal is almost 60 % and cost Rs. 70-80/kg. The fish meal is exported to China, Taiwan and Japan.

Dried ribbon fish

The low-quality ribbon fish were dried and mainly sold domestically, especially in neighboring Maharashtra state (Fig.8). The moisture content of the dried ribbon

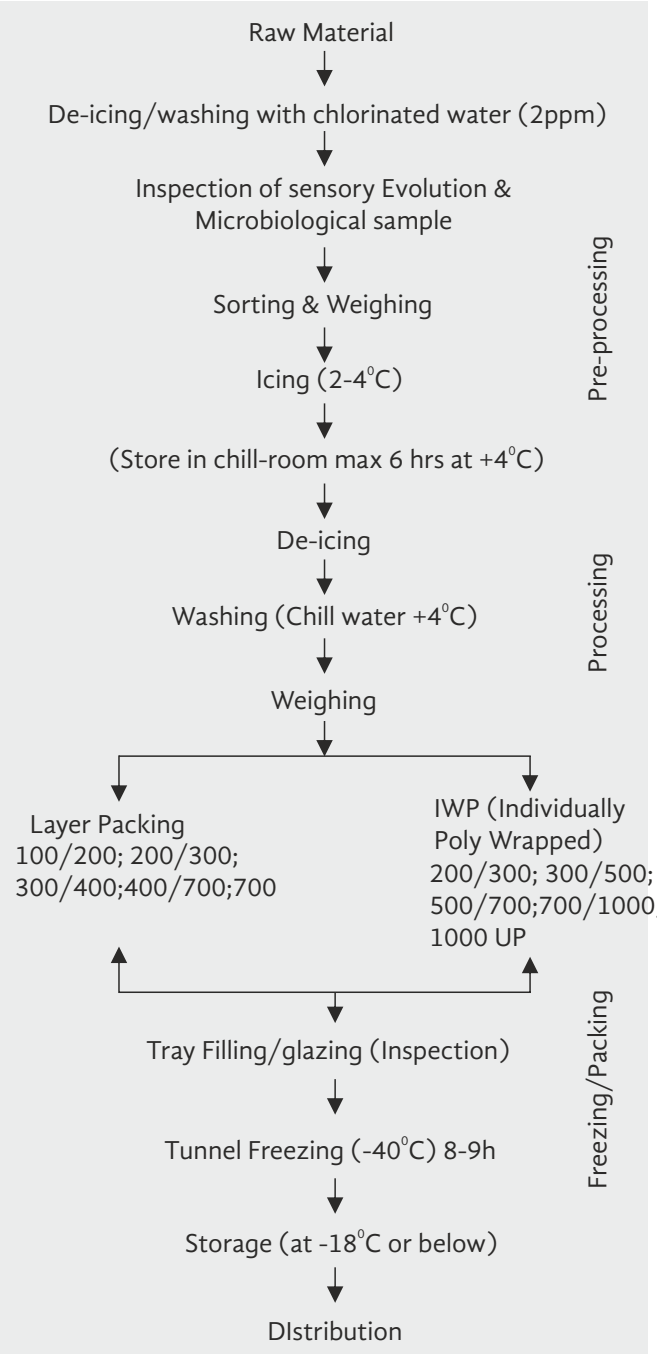

Fig 6. Process flow diagram of freezing of ribbon fish

Table 1. List of surimi plants in Gujarat

S.No	Name of the establishment	Address
1	M/s. Amar Food Products	Jawar Naka, Porbandar-360575, Gujarat, India.
2	M/s. AmarSagar Seafood Pvt. Ltd.	Survey No.29, Jawar Naka, Porbandar-360575, Gujarat, India.
3	M/s. Deepak Foods.	Plot No. 3 To 8, Somnath Road, Veraval, Gir-Somnath-362269, Gujarat, India
4	M/s. Gadre Marine Export Pvt.Ltd. (Surimi Unit)	Plot No.130/1, Holiday Home Road, Chorwad-362250, Dist. Junagadh, Gujarat
5	M/s. K. R. Sea Foods Pvt. Ltd.	Plot No. 1006/1007, GIDC Estate, Veraval-362269, Gujarat, India
6	M/s. Kan Victual Pvt.Ltd	R/S. No. 796, Paiki, All Weather Port Road, Bokhira, Porbandar, Gujarat-360575
7	M/s. Silver Star Exports	Javar Village, Porbandar - 360575, Gujarat, India

Fig.7. Processing of ribbon fish surimi

Fig.8. Drying of ribbon fish

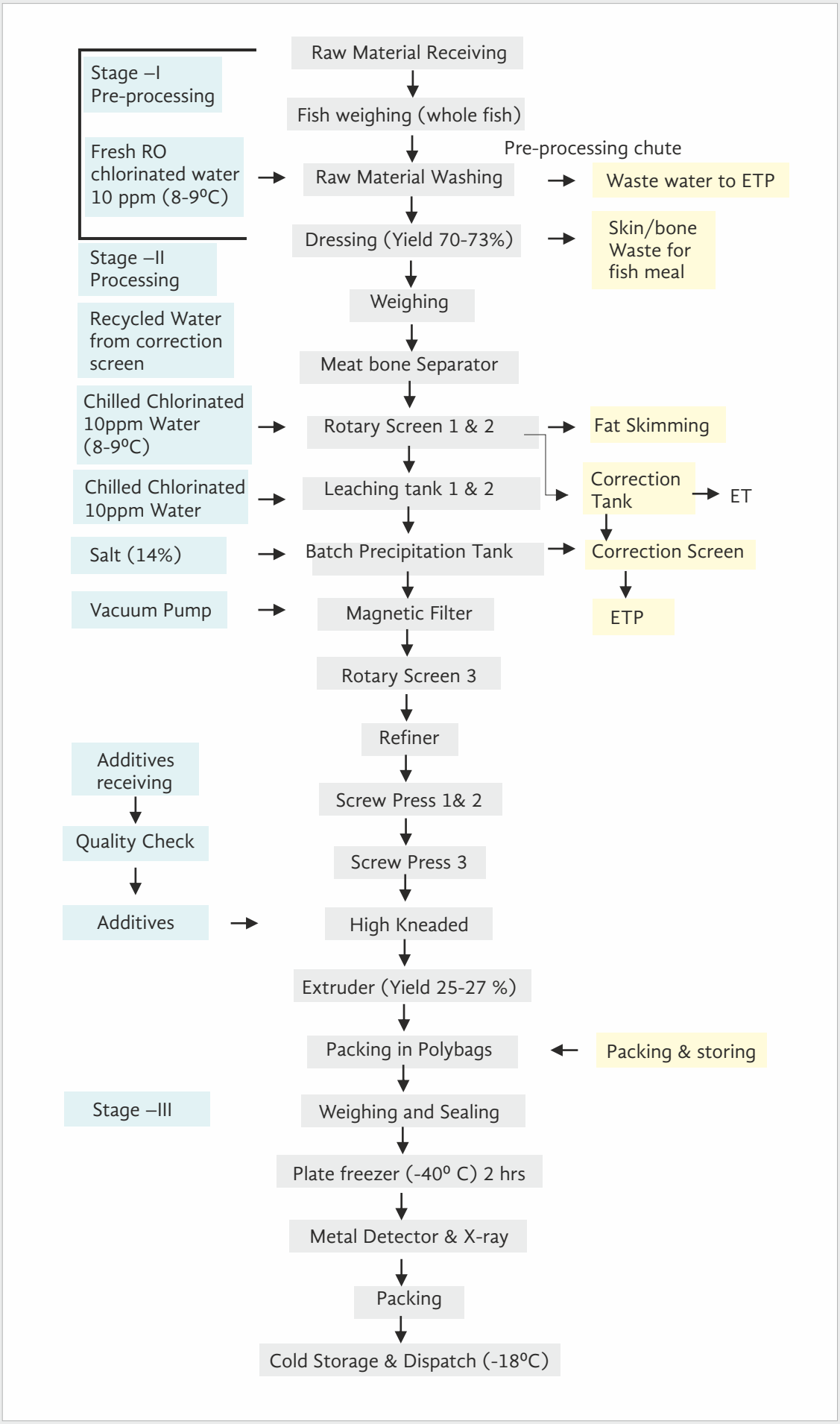

Fig 9. Process flow diagram of surimi processing of ribbon fish

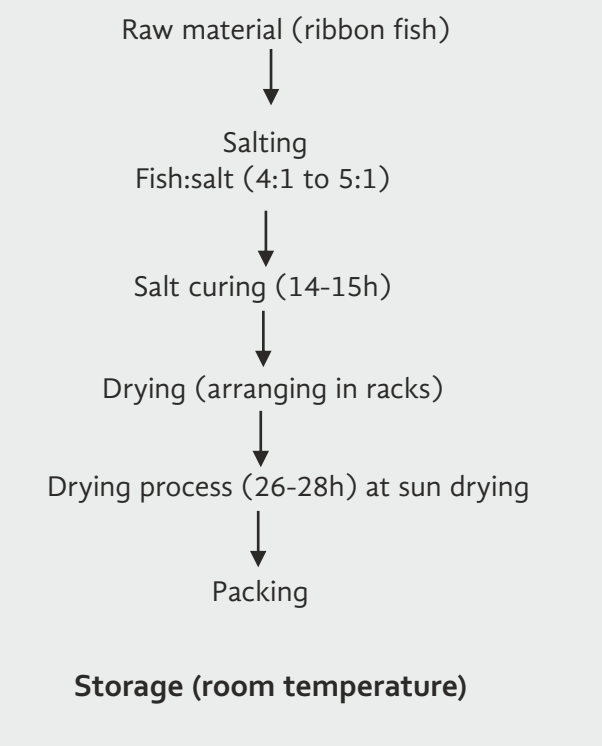

Fig 10. Process flow diagram of dry fish processing of ribbon fish

fish is in the range of 14 - 20 %. More than 95 % of ribbon fish landing in Gujarat was exported to especially China as a whole frozen product, surimi product, and fish meal. The process flow of dried ribbon fish is shown in the process flow diagram (Fig.10).

Ribbon fish marketing in Gujarat

The ribbon fish is predominantly marketed in bulk at the fish landing centers along the Gujarat coast. There were about 150 wholesalers and commission agents who exclusively dealt with ribbon fish marketing. The wholesalers, who deal with fairly large quantities of ribbon fish, fix the price based on the size and quality of ribbon fish landed and meant for processing. They work closely with the purchasing section of the seafood processing firms who quote their price through SMS on a particular day. The small-scale wholesalers who dealt in lower volumes auctioned fish destined for dry fish processing and fish meal processing. The ribbon fish were weighed in landing centres and were transported in refrigerated vans/ insulated vehicles/*chakkada* to the seafood factory for further processing after the auction. *Chakkada* is the local public transport vehicle used for multiple activities in Gujarat, especially in the Saurashtra coast. It is used for transporting ice, oil barrels, fisherfolk, provisions for fishing trips, fish waste, fishing materials viz., craft and gear materials, fuel tanks, etc. The predominant marketing channel for ribbon fish trade in Gujarat is fishermen/boat owner to wholesaler/commission agent to the processor through auction. The domestic consumption of ribbon fish within Gujarat is negligible i.e. less than 2 % of the landing. Door-to-door vending is not common in Gujarat.

Ribbon fish fishery after Covid-19

The catch of ribbon fish reduced drastically due to Covid-19 outbreak-related fishing restrictions imposed and as a result, its export to the Chinese market has reduced substantially. The estimated landing of ribbon fish was 75,664 tons in 2020, recording a decrease of 24 % compared to 2019. Lower demand from China and less availability of containers due to the disruption of the supply chain brought down Indian seafood exports by nearly 20 %. The local price of ribbon fish also declined by almost 30-60 % during the Covid-19 pandemic in 2020. The use of ribbon fish for the production of dried fish and fish meals has increased due to a decline in exports. The dried ribbon fish is mainly sold in markets of West Bengal and the fish meal is transported to Andhra Pradesh and Tamil Nadu for the manufacture of animal feed. However, Indian exports grew during 2020-21 with frozen ribbon fish worth USD 76 million being exported. The demand from major countries is returning to pre-Covid levels with China, with USA and UK now increasingly sourcing frozen ribbon fish from India.

Conclusion

The present review focuses mainly on the processing and marketing of ribbon fish from Gujarat. Ribbon fish is considered a versatile fish as far as Gujarat fisheries is concerned. The ribbon fish exported as a whole to non-EU countries without any value addition reduces the export value of fish. The value addition of ribbon fish can provide economic benefits to the seafood export in Gujarat. As the demand from many countries is increasing, the value addition of ribbon fish will increase the foreign exchange earnings of the country. Similarly, there is a need for employing improved drying methods that reduce the problem of the presence of sand and extraneous foreign materials, dust, and, inadequate salting. Even though, the local consumption of ribbon fish is considerably low in Gujarat, there is scope for export potential in the domestic as well as international markets that needs to be explored with special emphasis on value addition.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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