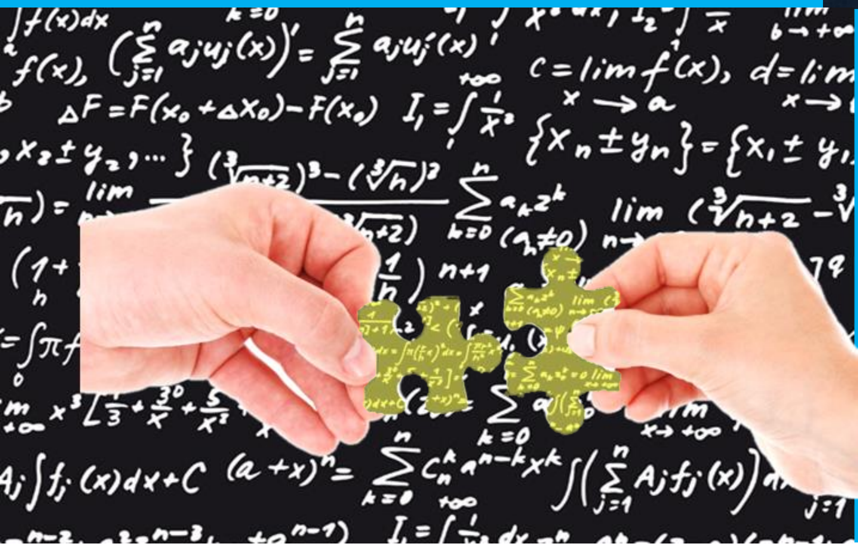
Food loss in international trade: A case study of Indonesian tuna exported to the European Union, the United States, and Japan



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Food loss in international trade: A case study of Indonesian tuna exported to the European Union, the United States, and Japan

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Abstract

The knowledge of the drivers of food losses in international trade and possible mitigation strategies is still limited. This study focused on the prevalence and drivers of food loss in Indonesian tuna exported to the European Union, the United States, and Japan. The results showed that various existing Non-Tariff Measures (NTMs) are in place to ensure food safety. However, standards and regulations differ significantly among trade partners, and are somewhat more strict than international standards, leading to higher rejection levels. Food loss is evident in the cross-border tuna trade as 20 to 30 per cent of Indonesian tuna is rejected annually. Drivers of food loss are classified as micro-level drivers consisting of post-harvest damages, lack of infrastructure and facilities; improper sanitation and hygiene in the processing unit, inability to fulfil food safety standards, and socialization of the standards and regulation. Macro-level drivers are related to the increasing use of NTMs, varying and relatively stricter food safety standards, transparency issues, trading procedures, and institutional factors. At the micro-level, it is important to improve tuna export quality infrastructure and boost the capacity of actors in the value chains to implement best practices. Increasing the socialization about the food safety standard and import regulations and international standards (particularly Codex Alimentarius) is also needed. Meanwhile, NTM streamlining and improving transparency with national trade portals and help desk services are also important to facilitate trade and reduce food loss.

Keywords: Food loss, Import rejection, Non-Tariff Measures (NTMs), Tuna

JEL Codes: F14, Q22

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List of abbreviations

BPOM	Food and Drug Supervisory Agency
CCS	Catch Certification Scheme
CFSAN	Center for Food Safety and Applied Nutrition
EQI	Export Quality Infrastructure
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
FSMA	Food Safety Modernization Act
GHP	Good Handling Practices
GMP	Good Manufacturing Practice
GSP	Generalized System of Preference
GTAP	Global Trade Analysis Project
HACCP	Hazard Analysis and Critical Control Points
IDE-JETRO	Institute of Developing Economies-Japan External Trade Organization
JAS	Japanese Agricultural Standards
MRLs	Maximum Residue Limits
MSC	Marine Stewardship Counsel
NTMs	Non-tariff Measures
RRR	Relative rejection rate
SPS	Sanitary and Phytosanitary
TBT	Technical Barriers to Trade
UNCTAD	United Nations Conference on Trade and Development

UNIDO	United Nations Industrial Development Organization
URR	Import rejection indicators, unit
USDA	United States Department of Agriculture
US-GSP	United States-Generalized System of Preference
USTR	United States Trade Representative
WITS	World Integrated Trade Solution

1. Background, objective, and method

One of the innovative approaches taken to increase the status of food security and resilience is to minimize food loss (FAO, 2019). Food loss occurs at all levels of the value chain, from upstream to distribution, processing, and cross-border trade (UNIDO and IDE-JETRO, 2013). In the era of globalization, the rejection made by the importing country has special implications for food loss, as greater rejections of imports correspond with a higher rate of food loss.

The importance of analyzing food loss in international trade has emerged as the prevalence of rejections particularly in developed countries remained high. The results of a study conducted by IPB University and the Ministry of Trade (2020) show that the cumulative case of import rejection from all countries in the period from 2014 to June 2020 was at an alarming level: 113,888 cases in the United States of America, 21,919 cases in the European Union and 4,661 cases in Japan. Interestingly, there has been a variation in the trend of import rejections among the three economies. Over the period 2014−2019, import rejections increased by 22.68 per cent in the European Union (European Union), while they decreased in the United States and Japan by 13.24 per cent and 104.76 per cent, respectively. A higher probability of export rejection turning to food loss was shown in the European Union. During the period of 2014- June 2020, the total number of rejections from all countries that were eliminated reached 10.8 per cent. Meanwhile, 6.7 per cent of Indonesia's export commodities to the European Union experience destruction and hence became food loss in international trade.

Behind these alarming rejection statistics, it is imperative to understand more specifically the drivers of the food loss in international trade and avenues to mitigate the challenges. The food loss related literature highlighted that the drivers of food loss in international trade are complex and linked back to both enabling environments as well as multiple activities involved in the commodities' value chains. The discussion of the typical drivers of food loss and waste has been typically classified into macro and micro levels drivers. Despite this distinction, both the drivers are interrelated. Several macro-level drivers of the food loss in cross-border trade are related to varying and relatively strict food safety standards of tuna amongst importing countries, which in turn can potentially rise trade costs. In addition, regulations related to the border's procedures can generate time uncertainty and the quality of the products delivered, including in tuna export. Hence it is also considered as an impediment to trade that potentially increases rejection and risks of food loss (Beestermöller, Disdier, and Lionel Fontagné 2016).

Some important micro level drivers are generally represented by the challenges of exporting countries in complying with food safety-related policies. The proxy indicator of failure in fulfilling food safety regulations is reflected by the prevalence of food and hazard notification. For the Indonesia case study, Indrotristanto and Andarwulan (2020) synthesized that the food and hazard notification, in general, consists of chemical hazards, microbiological hazards, and non-chemical and microbiological hazards. These root causes of these various hazards are strongly linked to value chains particularly in the upstream level stages, including primary production, processing, transport, storage, distribution, and marketing. The primary production critical drivers are related to environmental factors such as climate variability, pests, disease as well as market conditions concerning prices, standards, labor, and food safety operations (Spang et al, 2019). Meanwhile, in the postharvest activities in processing, transport, storage, and packaging, well-established drivers are related to insufficiency in investing capital on infrastructure, technologies, and human capital (FAO, 2011; Xue et al 2017; FAO 2016), transport risks due to insufficient refrigerated units (Parfitt, Barthel, and MacNaughton. 2010; and Kummu et al 2012), as well as improper storage facilities (Alavi et al 2012, Bradford et al 2018). Based on the aforementioned literature, the paper accommodates both these macro and micro drivers to investigate which ones should be considered key drivers of Indonesian tuna rejections in the three recipient countries, namely the United States, the European Union and Japan.

Seafood products are renowned for being a top exported commodity from Indonesia, but there is a high rejection rate for this group of products. Indrotristanto and Andarwulan, (2019) reported that the prevalence of rejection in seafood products is higher in comparison to agriculture or processed food. The underlying rejections varied covering the heavy metal and bacterial contamination (Irawati, Kusnandar, and Kusumaningrum, 2019), as well as residues from drugs and antibiotics (Fahmi, Maksum, and Suwondo, 2015; Wahidin and Purnhagen, 2018).

This research will be performed in the case study of tuna and its derived products in the United States, the European Union, and Japan. The selection of the targeted markets is because these three countries are top demanders of Indonesian tuna as 71.76 per cent of Indonesian tuna exports were destined to those three markets in 2020 (WITS, 2021). Similar to the general picture of the rejections in seafood products, it is expected that complex issues of refusals in cross-border trade also happen. This is problematic as the rejection of tuna at export markets puts unnecessary pressure on the resources used to produce them. For Indonesia, however, despite strong recognition of the importance of reducing food loss during cross-border trade, the research focusing on this issue, particularly for tuna, the main exported product of Indonesia, is limited.

Based on the study background that has been stated it can be clearly identified that key drivers of rejections macro and micro drivers of food loss in international trade have strong linkages but unclear what is the main challenge for Indonesia. Hence, we intended to investigate the main challenges for Indonesian tuna a case study. Several research questions that need to be addressed in this study cover: (1) what are the relevant non-tariff measures on Indonesian tuna import as well as export regulations and procedures; (2) how much is the prevalence and quantification of Indonesian tuna import rejection? (3) what are the main drivers of food loss in the global value chain, both behind and across the borders; and (4) what are recommendations to reduce food loss of Indonesian tuna in international trade.

To address the research questions, this paper aims to (1) analyse relevant non-tariff measures on Indonesian tuna import as well as export regulations and procedures; (2) analyse the prevalence of food loss and quantification of Indonesian tuna import rejection; (3) analyse the main drivers of food loss in the global value chain, behind and across the borders; and (4) provide recommendations to reduce food loss of Indonesian tuna in international trade.

The results of this study may enable Indonesia to reduce the loss of its exported tuna and increase its active participation in CODEX[6], considering that it is also concerned with food loss in international trade.

2. Methodology

Four stages were taken to meet the project objectives. They are as follows:

Stage 1: Examine the current market situation of Indonesian tuna in the international market, identify relevant stakeholders along the tuna value chain, conduct **interviews** through focus group discussions and also conduct in-depth interviews. At this stage, the study team hosted a focus group discussion on 12 August 2021 comprised of relevant stakeholders along the value chain of exported tuna in Indonesia (see appendices 1 and 2). Due to the Covid 19 pandemic, Indonesia had a tight social distancing policy, so the focus group discussion was held online.

Stage 2: Conduct a **literature review** to examine regulations implemented in importing countries and collect relevant data related to the number of rejections of Indonesian tuna among its main trading economies (United States, Japan, and the European Union). At this stage, secondary and primary data were used by implementing a desktop study and discussion with relevant stakeholders during the focus group discussion session.

Stage 3: Analyse the data on the prevalence of food loss in the tuna products using unit and rejection rate indicators and the main drivers of food loss of tuna in international trade. In this stage, secondary data were used to calculate import rejection indicators: the number of rejections; the unit rejection rate; and the relative rejection rate. The first indicator was calculated by adding up the rejection events that occur. The second indicator was based on the number of rejections per $1 million of imports and the third indicator consisted of the ratio of a country's share in total rejections to its share of imports.

Stage 4: Propose practical recommendations to help minimize food loss of Indonesian tuna in international trade. This stage was carried out by synthesizing the results from

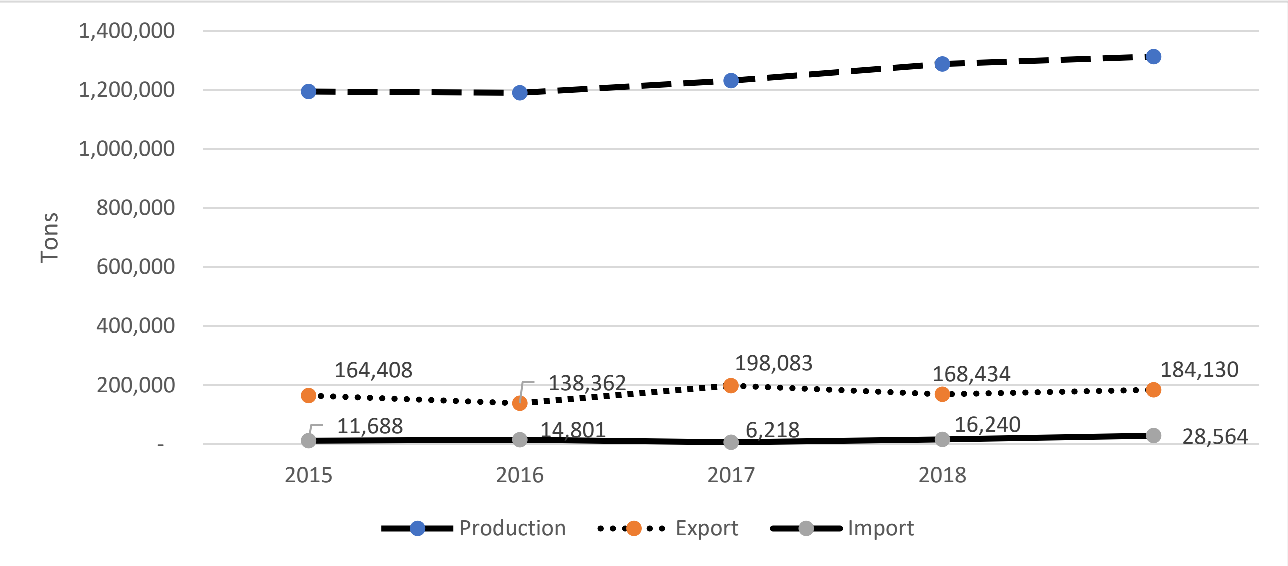
[6] The topic of food loss in international trade is discussed at the Codex Committee on Food Import and Export Inspection and Certification Systems (CCFICS).

stages 1 to 3.

3. Current market situations of Indonesian tuna in the international market

In the global market, Indonesia is one of the largest producers of tuna, skipjack, and mackerel; production of these three types of fish increased during the period 2015−2019 from 1.19 million tons in 2015 to 1.31 million tons in 2019 (figure 1). During that period, approximately 13 per cent of tuna was exported and only a limited amount of tuna was imported by Indonesia, less than 2 per cent. Figure 2 shows a positive trade balance for the tuna commodity in Indonesia.

Figure 1: Indonesia tuna production, exports, and imports in 2015−2019 (tons)



Source: Sugandhi (2021)

A comprehensive review of the trade balance of tuna in Indonesia shows that the growth of exports and imports, both in terms of value and quantity, tend to fluctuate (table 1). However, as outlined previously, Indonesia had a positive trade balance over the period 2012−2020, as indicated by the higher value of exports compared to imports. The country’s trade balance surplus for tuna increased from $1.04 billion in 2013 to $1.27 billion in 2020.

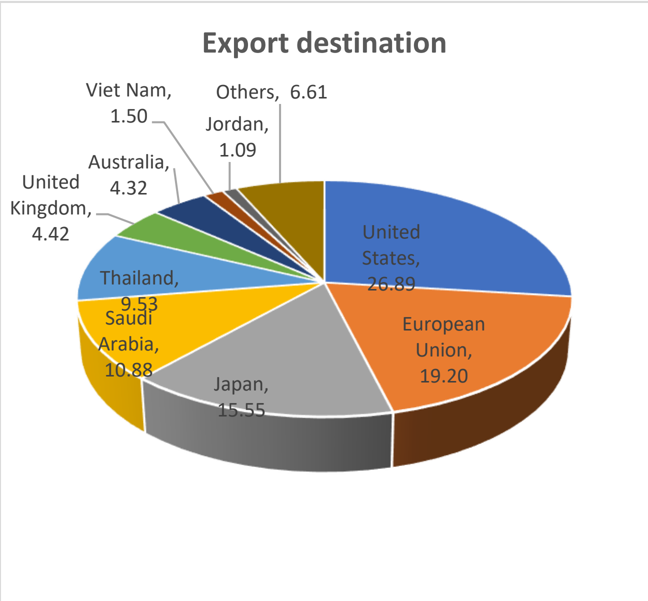
Table 1: Indonesia trade balance for tuna, 2012-2020

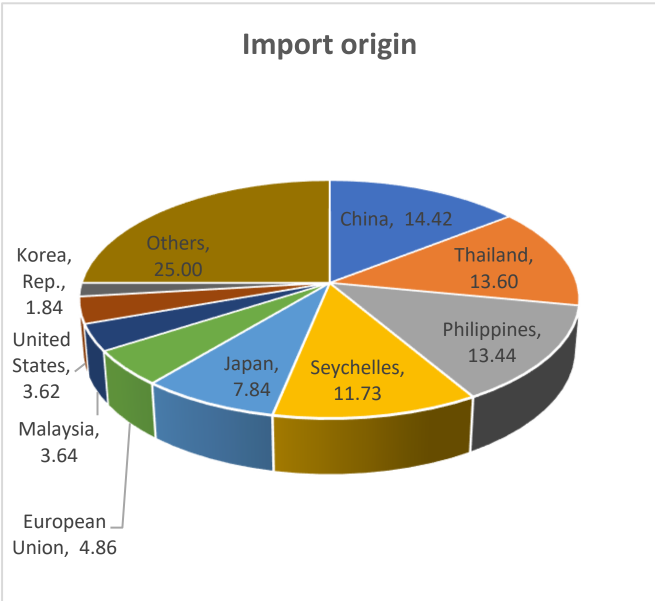
Year	Trade value (millions USD)			Growth of trade value (%)		Quantity (millions kg)		Growth of quantity (%)	
	Gross export	Gross import	Trade balance	Gross export	Gross import	Gross export	Gross import	Gross export	Gross import
2012	1,066.65	30.33	1,036.32			231.85	9.58		
2013	1,094.74	14.9	1,079.84	2.63	-50.88	240.69	4.46	3.81	-53.44
2014	977.82	19.21	958.61	-10.68	28.93	248.18	4.25	3.11	-4.72
2015	875.57	23.68	851.89	-10.46	23.26	215.57	10.46	-13.14	146.21
2016	865.6	26.01	839.59	-1.14	9.86	203.01	10.16	-5.83	-2.86
2017	1,029.06	9.87	1,019.19	18.88	-62.05	221.64	5.44	9.18	-46.49
2018	1,283.93	38.9	1,245.03	24.77	294.05	246.92	16.96	11.41	211.97
2019	1,362.20	44.68	1,317.52	6.1	14.85	269.02	20.58	8.95	21.32
2020	1,311.13	44.3	1,266.83	-3.75	-0.83	286.69	24.45	6.57	18.8

Source: WITS (2021); author's calculation

Indonesia is ranked sixth globally among economies that export tuna after Thailand, China, Spain, Ecuador, and Taiwan, Province of China. Figure 2 shows that the main export destination countries of Indonesian tuna from 2012 to 2020 were the United States (26.89 percent) followed by the European Union (19.20 percent), and Japan (15.55 percent). The majority of tuna species exported by Indonesia are tuna (of the genus Thunnus), skipjack and bonito (Sard), and yellowfin buds (Thunnus albacar) (see table 2).

Figure 2: Share of Indonesia tuna export and import by destination and the import origin Economies, 2012−2020 (%)





Sources: WITS (2021); author's calculation

Table 2: Indonesia export value and quantity for tuna, 2012−2020

Product Description	Trade Value in USD	Quantity in Kg	Share in % Trade Value /Total Trade Value
Albacore or longfinned tunas	208,340,148	84,548,139.02	2.11
Atlantic and Pacific bluefin tuna	6,331,194	1,176,460.16	0.06
Bigeye tunas (Thunnus obesus)	175,587,415	44,530,665.49	1.78
Southern bluefin tunas (Thunnus	5,108,292	603,245.50	0.05
tunas (of the genus Thunnus)	2,270,269,443	335,411,316.52	23.01
Tunas, skipjack and bonito	6,218,157,131	1,382,976,859.77	63.02
Yellowfin tunas (Thunnus albacare)	982,900,689	314,323,150.69	9.96
Atlantic and Pacific bluefin tuna	418	122.00	0.00
Total	9,866,694,730	2,163,569,959.15	100.00

Sources: WITS (2021); author's calculation

In the United States market, there are four types of tuna imported from Indonesia, skipjack, bonito, yellowfin, and the genus *Thunnus* (table 3). From 2012 to 2020, Indonesia recorded a surplus in the trade balance with the United States, an indication the country is the most important trade partner for Indonesia for tuna. Based on the value of exports, the tuna most widely exported to the United States is Tunas (of the genus Thunnus) with a quantity reaching 86 thousand tons. While the types of Tunas, skipjack, and bonito (Sard) are the most imported in quantity, the export value is smaller than previous. It indicates that the price for this type of tuna is lower than others. Indonesia also imports several types of tuna from the United States, although overall, Indonesia still has a trade balance surplus.

Table 3: Indonesia export value and quantity for tuna to the United States, 2012−2020

Product description	**Trade value ($1,000)**		**Quantity (kg)**	
	Gross export	**Gross import**	**Quantity export**	**Quantity import**
Albacore or longfinned tunas (Th	1,529.52	0.00	260,105.00	0.00
Atlantic and Pacific bluefin tuna	737.71	0.00	55,741.00	0.00
Bigeye tunas (Thunnus obesus)	8,473.50	0.00	1,144,237.36	0.00
Southern bluefin tunas (Thunnus	1,096.60	0.00	141,151.00	0.00
Tunas (of the genus Thunnus)	752,760.76	3,299.90	86,364,516.95	934,067.00
Tunas, skipjack and bonito (Sard)	440,402.82	400.13	104,910,712.67	104,690.00
Yellowfin tunas (Thunnus albacore)	121,745.02	859.26	15,397,184.32	168,726.00

Source: WITS (2021); author's calculation

The tuna species exported to Japan by Indonesia are relatively diverse, namely Albacore, bluefin, bigeye tuna, southern bluefin tuna, tuna, skipjack, bonito, and yellowfin tuna. Similar to the United States market, Japan is an important trading partner for Indonesia for tuna commodities, as indicated by the trade balance surplus for the majority of tuna species traded between these two countries during the period 2012−2020.

Table 4: Indonesia export value and quantity of Tuna to Japan, 2012−2020

Product description	Trade value ($1,000)		Quantity (kg)	
	Gross export	Gross import	Quantity export	Quantity import
Albacore or longfinned tunas	1,910.86	2,628.50	563,27.75	980,929.00
Atlantic and Pacific bluefin tuna	2,265.61	75.68	492,989.00	1,392.00
Bigeye tunas (Thunnus obesus)	57,485.38	7.21	9,650,760.10	4,311.00
Southern bluefin tunas (Thunnus)	181.58	0.00	25,307.00	0.00
Tunas (of the genus Thunnus)	110,476.45	312.49	14,809,742.30	13,895.63
Tunas, skipjack and bonito (Sard)	478,077.17	1,735.35	84,950,569.51	275,717.00
Yellowfin tunas (Thunnus albacore)	116,960.76	5,111.84	24,687,377.90	2,411,418.00

Sources: WITS (2021); author's calculation

The European Union is also a key trading partner for Indonesia related to tuna. Indonesia recorded a trade balance surplus with the trading bloc during the period 2012−2020 (table 5). The types of tuna that are the mainstay of Indonesian exports to the European Union are skipjack, bonito, and the genus Thunnus. It is important to note that Indonesian tuna exported to the European Union face higher import duty rates than those applied to other tuna exporting countries, such as Viet Nam and Thailand (Sugandhi, 2021). The high tariffs on tuna import duties affect the competitiveness of Indonesian tuna in that market. In comparison, in the United States market, the tariff on Indonesian tuna imports has been zero percent since 2015. The United States provides US-Generalized System of Preference (US-GSP) facilities to Indonesia by exempting import duties on Indonesian fishery products. Several Indonesian fishery products, especially tuna, get American GSP facilities through this scheme, so the import tariff for tuna is 0%. On October 29, 2020, the United States Government, through the United States Trade Representative (USTR) officially issued a decision to extend the granting of the Generalized System of Preferences (GSP) facility to Indonesia.

Table 5: Indonesia export value and quantity for tuna to the European Union, 2012−2020

Product description	Trade value ($1,000)		Quantity (kg)	
	Gross export	Gross import	Quantity export	Quantity import
Albacore or longfinned tunas	45,913.59	186.69	17,635,381.30	53,001.00
Atlantic and Pacific bluefin tuna	13.92		2,400.00	
Bigeye tunas (Thunnus obesus)	5,968.21	380.73	2,648,912.43	272,414.00
Southern bluefin tunas (Thunnus)	3.11	0.00	1,036.00	0.00
Tunas (of the genus Thunnus)	103,435.53	313.31	20,130,330.02	111,574.00
Tunas, skipjack and bonito (Sard)	545,279.37	451.90	113,734,578.47	127,606.00
Yellowfin tunas (Thunnus albacare)	49,027.37	4,082.17	18,452,645.14	2,106,210.00

Sources: WITS (2021); author's calculation

4. Overview of Indonesian tuna value chains

This section discusses the value chains of exported Indonesian tuna. The value chain covers the activities carried by the actors along the tuna value chain (from production, processing, distribution, and export) (Kaplinsky, 2000; FAO, 2014). The inefficiency in the value chain system could lead to food loss and waste (FAO, 2014). By mapping the value chain, the critical points of loss for exported tuna commodity can be identified as well as the relevant interventions.

Along the value chain, there are two main food loss driven including upstream and downstream activities (Spang et al*.,* 2019). Upstream activities include production, harvest, post-harvest, and distribution process. At the upstream stage, the food loos could occur due to damage, spillage, pests/diseases, weather/climate change impacts, degradation, discard, excess supply, and spoilage (Delgado, Schuster, and Torero, 2021). According to Spang et al*.* (2019), the output and profitability depend mainly on factors beyond the control of farmers, which are environmental aspects (e.g., weather, pests, and disease) and market conditions (e.g., prices, labor availability, food safety scares, and marketing standards). Mostly agricultural products are culled during harvest when the product does not meet market-based quality specifications. From the postharvest side, after the fresh agricultural products are harvested, they require proper handling, processing, storage, and packaging to reduce the risks of postharvest losses. If those are not properly handled, agricultural products are more risked to be easily damaged. This poor handling could be because of insufficient investment in postharvest infrastructure, technologies, and human capital.

Meanwhile, the downstream driven is more related to the overall economic condition, and aspects of wholesale and retail, restaurants and food service institutions, and households (Spang et al*.,* 2019). The market, regulatory, and sociocultural standards for food quality, aesthetics, safety, and abundance, as well as, the food supplier (restaurants and other institutions) inventory management, household food management, and consumer behavior, all represent the key drivers of food loss. FAO (2014) highlights the main drives of food loss and waste in the value chain, which are inadequate storage, imperfect information, lack of access to financial resources, outdated technology, lack of technical knowledge, limited market access, outdated, inadequate or inefficient production and harvest techniques, transportation of food over long distances, and technology innovation. Since the paper focuses on food loss (not waste), the study team focuses on on-farm activities (harvest and post-harvest, processing, distribution, and export).

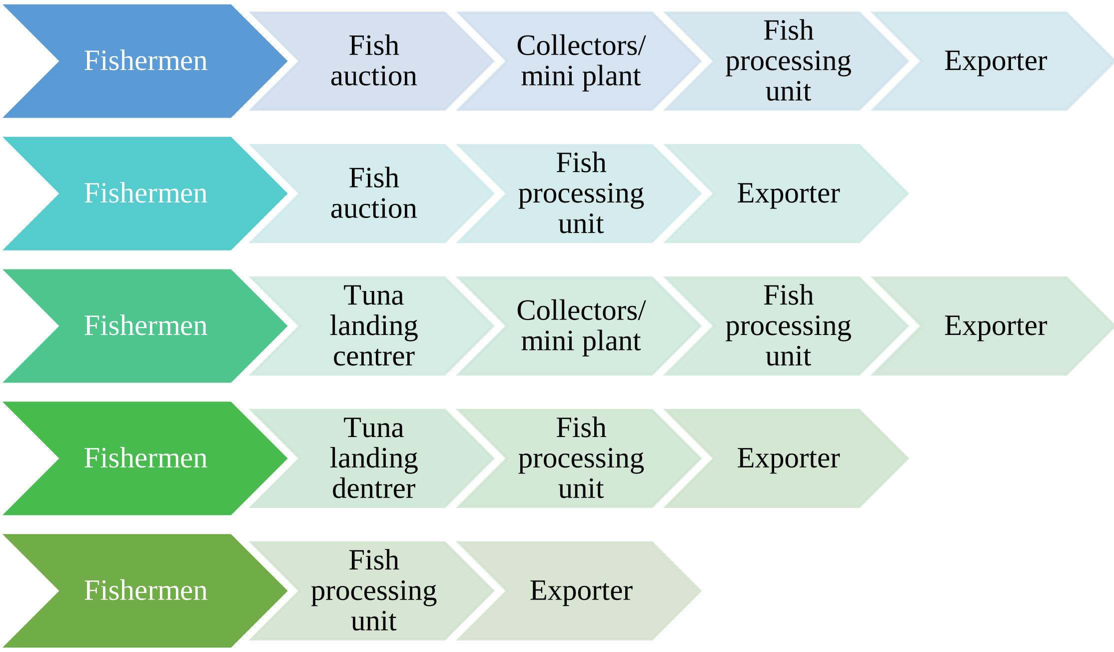
The results from the focus group discussion and desk study conducted by the study team reveal that for the export of tuna to the market destination, the value chains can be classified into five channels (figure 2), starting with the supply of tuna fishing by fishermen. Some important considerations in fishing are the temperature and hygiene of fishing vessels and landing ports. Sugandhi (2022) pointed out that not all Indonesian vessels are installed with an appliance to record and monitor the tuna temperature automatically, as it is required particularly by the European Union. Regarding hygiene practice, many fishermen in Indonesia are urgently needed to improve their compliance on hygiene particularly when they loin the tuna in the vessels. It is highly important make sure that the vessels, tools and appliances are hygienic so that it will not cross contaminate the tuna loins. Block ice for storage and handling is critical to maintain sanitary standards and product quality.

Other sites involved in the value chains are fish auction sites and tuna landing centres in ports. The actors at these sites actors provide various services and facilities to manage the fish catch, including pre-processing facilities, cold storage, auctioning, and marketing centres.

Other intermediaries involved in the value chain of tuna can be classified as traditional collectors. Their primary function is solely to collect tuna and supply it to the fish processing unit that produces processes fish products for local and export markets. The activities carried out in the fish processing unit are loining, packaging, smoking, and freezing of tuna. Usually, the fish processing unit is equipped with cold storage and air blast freezer storage. One of the most important regulations to be implemented is hazard analysis critical control points (HACCP), which is applied in many countries around in the world. HACCP is a quality assurance system based on awareness or attention that some type of hazard will arise at various points or stages of production, but action can be taken to control the hazards. It is a form of risk management developed to ensure food safety through a preventive approach that is deemed to guarantee the production of safe food. The main purpose of HACCP is to anticipate hazards and identify control points. Another use for HACCP is the application of preventive measures rather than relying on testing the final product (MMAF, 2016). Specifically, the fish processing unit that exports to the European Union must have a certificate of application HACCP Grade A at the time it is inspected by the competent authority and has received an approval number directly from the European Union Commission.

According to MMAF (2016), HACCP Grade A is given to fish processing units that have surveillance testing every three months with the maximum tolerable deviations of six [6] minor violations, five [5] major violations, and none of the serious and critical violations. The last stage before the export of tuna products is the issuance of a health certificate by a competent authority to guarantee that the product complies with the system that ensures the quality and safety of tuna products. Currently, the composition of tuna products by quality in Indonesia is mostly classified as grade III (60 percent), grade II (30 percent), and grade I (10 percent), highlighting the urgency to improve the quality of tuna. According to MMAF (2016), for grade III tuna, the downsides are related to the colour of the flesh, the skin muscle is less elastic, and it is not in the whole form. This grade is insufficient for the export requirements. The acceptable export quality grades are grades I and II in which the meat color is fresh blood red, clean, and the eyes are bright, the skin is clean with bright colors, has an elastic meat texture, and in the form of a whole fish.

Figure 3: Indonesian Tuna value chains



Source: Sugandhi (2021)

5. Relevant non-tariff measures on Indonesian tuna export

Export and import activities also have impacts on the rate of food loss. Globalization and international trade played a significant role in increasing the opportunities for the export of agricultural products. However, the trade among countries stimulates them to impose non-tariff measures for the overseas goods entering their countries, including agricultural products. Non-tariff measures (NTMs) mainly aim to protect the local products' competitiveness, public health, and environment, which could be in a form of import and sanitary regulation, as well as requirements on HACCP process and food safety standards.

At the global level, the drivers that cause export tuna rejection are the increasing use of NTMs that have the potential to transform to NTBs and hence increase trade costs and lack of research, justification, and scientific basis, inadequate consultations process related to the implementation of NTMs. The non-transparent implementation of the NTMs policy has led to several cases of product rejection in the international market. Some of the settings of food safety standards/regulations by trade partner are higher than those set by the international standards, which is for the case of fisheries trade CODEX (see IPB and Indonesian Ministry of Trade, 2020). This will cause a greater probability for the developing countries, which have limitations and challenges in the value chain, to face the rejection. Some of the food loss incidents are due to rejection from export destination countries that the imported products do not meet the standards set in the regulations. When the regulations/standards are different across countries, and even different with the CODEX, it could cause difficulties for the producers/exporters to comply with the standards. According to Indonesian Ministry of Trade (2013), the rejection of some exports of Indonesian fishery products shows that there is still an inability to apply standards, especially to meet the standards of export destination countries. This inability is due to the lack of readiness/ability to meet the standards and the gap between Indonesian National Standards (SNI) and existing standards.

In many developing countries, institutional facilities and infrastructure are suboptimal or even non-existent. In addition, developing countries often lack skilled workers and laboratories. This makes companies in developing countries often not know whether the exported products meet the standards of the importing country. In addition, the lack of awareness and information about different regulations and demands of the market and food safety in developed countries will also lead to rejection. Import regulations and related procedures create more challenges for the main actors along the domestic value chain to produce qualified agricultural products that comply with the import and export regulations. The details of the tuna import and export regulations will be elaborated in the section below.

5.1 Agri-food import and export regulations and procedures

As noted previously, the top three export destinations of Indonesian tuna are the United States, Japan, and the European Union. Accordingly, the focus of this section is on regulations related to imported tuna set by these three destinations and regulations set by Indonesia when the country imports and export tuna.

5.1.1 Tuna import regulations in the United States

In general, based on the United States Federal Food, Drug and Cosmetic Act, importers of food products intended for United States interstate commerce are responsible for ensuring that the products are safe, sanitary, and labelled according to United States requirements.[7] The labelling requirements for food and beverages are regulated by the Food and Drug Administration (FDA) (CPSC, 2021). According to FDA (2013), some of the information required on the product label includes the country of origin, name of the food, net quantity of contents, ingredients list, nutrition labelling and claims (including nutrient content claims, health claims that also follow the qualified health claims, and structure/function claims). According to Food Safety and Inspection Service (2021), product dating is also required for frozen and canned foods. A calendar date must have the day, month, and year. Moreover, immediately adjacent to the date, there must be a phrase explaining the meaning of that data (such as “Best if Used By”). In the can, “can codes” are required, which enable the tracking of the product in interstate commerce and

[7] All imported food is considered to be interstate commerce

makes it possible for manufacturers to rotate their stock and locate their products in the event of a recall.

Imported food products are subject to FDA[8] inspection when offered for import in the United States ports of entry. The agency may detain shipments of products offered for import if the shipments are found not to comply with the country's requirements.[9] The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (the Bioterrorism Act) directs FDA, as the food regulatory agency of the Department of Health and Human Services, to take additional steps to protect the public from threats to its the food supply and other food-related emergencies. Along with other provisions, the Act requires that FDA receive prior notification of food, including animal feed, that is imported or offered for import into the United States. In the final rule, the notification of imported food, including food for animals, should report the name of any country to which the article has been refused entry.

The Federal Drug Administration is responsible for the safety of all fish and fishery products entering the United States. It uses tools to identify immediate or potential threats and the best course of action to protect public health and safety, HACCP, Foreign Inspections and Global Presence, New Screening System for Imports, Foreign Country Assessments, Food Safety Modernization Act (FSMA), Integrated Food Safety System and National Residue Monitoring Program and Consumer Information.

a. Hazard Analysis and Critical Control Points is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from all stages, including from raw material production, procurement, and handling, to manufacturing, distribution, and consumption of the finished product. For imported seafood, these measures include the following:
    (a) Inspections of foreign processing facilities;
    (b) Sampling of seafood offered for import into the United States;
    (c) Domestic surveillance sampling of imported products;
    (d) Inspections of seafood importers;
    (e) Evaluations of filers of seafood products and foreign country program assessments;
    (f) Relevant information from foreign partners and FDA overseas offices.

[8] The Food and Drug Administration is not authorized under the law to approve, certify, issue licences or otherwise sanction individual food importers, products, labels or shipments. Importers can import food into the United States without prior sanction by FDA, as long as the facilities that produce, store, or otherwise handle the products are registered with FDA, and prior notice of incoming shipments is provided to FDA.
[9] Both imported and domestically produced food products must meet the same legal requirements in the United States.

b. Foreign Inspections and Global Presence through strengthened and better coordination of the international engagement of FDA. The agency has established permanent FDA posts abroad in strategic locations.
c. The agency is using a new screening system for imports, the Predictive Risk-based Evaluation for Dynamic Import Compliance Targeting (PREDICT), to improve the current electronic screening system by targeting higher-risk products for examination and sampling and minimize delays in shipments of lower-risk products.
d. Foreign Country Assessments are systems reviews that offer a broad view of the ability of the country's industry and regulatory infrastructure to control aquaculture drugs. These assessments are used to evaluate the country's laws for, and implementation of, the control of animal drug residues in the aquaculture products shipped to the United States.
e. The Food Safety Modernization Act covers the activities of the FDA on seafood safety. The Act represents the first major overhaul of the food safety law in more than 70 years and is transforming the agency's food safety program. The Act sets new safeguards to prevent, rather than react to food safety problems and provides important new tools to FDA to ensure that imported seafood is as safe as domestic seafood.
f. Integrated Food Safety System, in collaboration with the President's Food Safety Working Group, is modernizing food safety efforts by building partnerships with consumers, industry, and regulatory partners.
g. National Residue Monitoring Program complements the new Food Safety Modernization Act. This program is intended to ensure that foods are not contaminated with illegal animal drug residues.
h. Consumer information offered through the government-wide FoodSafety.gov website provides a platform that displays the latest recalls and food safety alerts from FDA and USDA.

For all types of food, including in the form of fish and seafood, it is important to ensure that the products are safe for consumers. Fish and fishery products are susceptible to degradation resulting from time/temperature exposure. Proper commercial handling, including adherence to Current Good Manufacturing Practice (21 CFR part 110), which focuses on good manufacturing practices for holding and storing human food, as well as warehousing and distribution. This helps prevent products from decomposing before reaching consumers. Nevertheless, decomposed fish and fishery products are periodically detected in interstate commerce and warrant regulatory action.

The following regulatory action guidance applies to all fish and fishery products, except scombrotoxin-forming species of fish, which are addressed in CPG Sec. 540.525 Decomposition and Histamine Raw, Frozen Tuna and Mahi-Mahi; Canned Tuna; and Related Species (CPG 7108.24). The guidance also does not apply to dried fish or fish sauce/paste products. In the Federal Food, Drug, and Cosmetic Act (FDC Act), section 402(a)(3) [21 U.S.C. 342(a)(3)], it is stated that food shall be deemed to be adulterated "if it consists in whole or in part of any filthy, putrid, or decomposed substance, or if it is otherwise unfit for food.” The criteria in this guidance do not establish an acceptable level of decomposition in food. If the presence of decomposition is detected in a subsample, the subsample “fails” the decomposition evaluation, in the following cases:

(a) Twenty per cent or more of the edible portion contains definite and persistent sensory attributes indicative of decomposition as determined by qualified FDA seafood sensory analysts;
(b) An appropriate chemical indicator of decomposition is detected by original and check analysis using a method approved by Center for Food Safety and Applied Nutrition (CFSAN). For this direct reference authority, indole at levels greater than or equal to 25 micrograms indole per 100 grams sample, based on the AOAC, 18^{th} Edition, Method 35.1.35 (981.07), is an appropriate chemical indicator of decomposition for all shrimp products.

Decomposition in fish, such as tuna and mahi-mahi, is also detected by organoleptic evaluation and elevated histamine levels in the muscle tissue. In addition to being an indicator of decomposition, when ingested at sufficiently high levels, histamine causes scombroid poisoning. Cases of scombroid poisoning have been traced to the consumption of raw, frozen, and canned tuna and raw and frozen mahi-mahi. Tuna and mackerel are most frequently involved in instances of histamine poisoning, but this may be partly the result of the rate of consumption of these species worldwide. According to FDA, the temperature limit for histamine is 4.4 degrees Celsius (Trilaksani, 2021). Samples of tuna or mahi-mahi found to meet criteria a., b., or c. (below) should be considered adulterated within the meaning of 21 U.S.C. 342(a)(3):

a. Histamine level equal to or greater than 50 parts per million (ppm) in at least two subsamples by both the original and check analyses;
b. Organoleptic evidence of decomposition, except honeycombing in canned tuna, is found in at least two subsamples by an analyst qualified in organoleptic testing, and the findings are confirmed by a national expert in organoleptic testing;
c. Honeycombing is found in two subsamples by an analyst qualified in organoleptic testing and confirmed by a national expert in organoleptic testing.

Moreover, there are also food additives regulations that provide for the addition of sodium nitrite in smoked, cured, tuna, sable, salmon, and shad. For tuna, as well as other seafood products, the United States has set a limit on the sodium nitrite concentration in edible portions, determined by analysis of a composite sample consisting of equal portions from a minimum of ten subs, exceeds 15 ppm. For an indication of methyl mercury, in tuna, the limit is expressed as mercury over 1 ppm (edible portion only).

In the United States, not only food additives and an indication of mercury, but the uneviscerated fish products also are regulated. Uneviscerated, salt-cured, whole fish products have caused several outbreaks of botulism and death. Botulism is a severe form of food poisoning caused by ingesting foods containing a neurotoxin produced by *Clostridium botulinum*. *C. botulinum* spores are ubiquitous in fishery products and the marine environment. The spores represent a public health hazard when conditions are suitable for vegetative cell growth and toxin production.

The Federal Drug Administration considers uneviscerated fish that are salt-cured, dried, or smoked to be a potentially life-threatening health hazard. In addition, fillets, parts, or other products derived from uneviscerated fish pose the same potential health hazard as the original product. Accordingly, with the exception of small, uneviscerated fish as described above, FDA considers uneviscerated fish that has been salt-cured, dried, or smoked and products made from them to be adulterated within the meaning of section 402(a)(4) of the Federal Food, Drug, and Cosmetic Act, in that the product has been prepared, packed, or held under insanitary conditions whereby it may have been rendered injurious to health. These products are hazardous whether stored at ambient temperature, refrigerated, frozen, or packaged in air, vacuum, or a modified atmosphere.

The Federal Drug Administration may consider taking regulatory action (seizure or detention) against any uneviscerated fish greater than five inches in length that is salt-cured, dried, or smoked, or any product derived from such uneviscerated fish, in interstate commerce.

5.1.2 Tuna import regulations in Japan

Import regulations and procedures in Japan are governed by the Food Sanitation Act, Product Liability Act, and Act on Specified Commercial Transactions (JETRO in ITPC Osaka, 2020). The procedure for importing seafood and tuna into Japan is presented in appendix 3. To be able to export food products to Japan (including seafood), the producers must meet the relevant sanitary and phytosanitary requirements. These requirements include hygiene and sanitary control of establishments (the hygiene control methods are based on HACCP), raw material quality control, good hygiene in manufacturing and processing, and good hygiene in product storage, transportation, and distribution. Producers must also attain Japanese Agricultural Standards (JAS) certification, under which maximum limits for chemicals and contaminants are set and no prohibited additives and traceability can be found in the products.[10]

The Japanese regulations for importing seafood, including tuna, are governed by the following laws: (a) the Foreign Exchange and Foreign Trade Act; (b) the Food Sanitation Act, and (c) the Customs Act (JETRO in ITPC Osaka, 2020). In addition, under the Foreign Exchange and Foreign Trade Act, in the section on seafood import activities to Japan, these products must be subject to restrictions, such as import quotas, import approvals, and import acknowledgment of which the three restrictions are approved by the Japanese Ministry of Trade. Under the Food Sanitation Act, Notification No. 370 of the Ministry of Health, Labor and Welfare on "Standards and Criteria for Food and Additives", seafood and its preparation must pass the test on food sanitation, which is

[10] See https://connectamericas.com/content/sanitary-and-phytosanitary-requirements-exporting-japan

carried out to assess the type and details of raw materials, and test the type and content of, among others, additives, residues pesticides, and mycotoxins. Import bans may be imposed on foods if additives, pesticides, or other content prohibited in Japan are found in the product, or when their levels exceed approved limits. As such, seafood and its processed products must be inspected at the production site before being imported. Under the Customs Act, there are rules regarding the prohibition of importing cargo with labels that falsify the origin and content of the products being sold.

Under the Food Sanitation Act, the sale of products that contain hazardous or toxic substances or that have poor hygiene is prohibited. The sale of packaged seafood and its processed products must comply with regulations related to labelling,[11] as well as provisions on safety labelling, such as indicating food additives, allergy information, raw materials and source, and genetic modification. Fishery products, which include a wide variety of products but not unprocessed products, must also comply with the Product Liability Act, for the safety of contents, containers, and packaging concerning food poisoning issues. This Act regulates the liability of manufacturers (including importers) to consumers regarding product damage or product defects. The Act on Specified Commercial Transactions protects consumers regarding direct commercial transactions made in the sale of seafood and its preparations through mail order, direct marketing, or telemarketing. Under the Act on the Promotion of Sorted Garbage Collection and Recycling of Containers and Packaging, importers who sell products using containers and packaging that are also regulated by other laws and are covered in the packaging rules section, must be responsible for recycling. However, small-scale companies below a certain size are not obligated to do this.

Procedures for import and sales authorization are subject to three main topics which are Import Control, Food Sanitation Inspection, and Import Declaration. Under the import control topic, the importers need to apply for Import Quota, Import Approval, and Import Acknowledgement. The import quota application procedure is shown in appendix 4. Tuna is subject to import quota under the Foreign Exchange and Foreign Trade Act, and the importers must obtain import quota and import approval from the Minister of Trade (JETRO, 2011). The import approval procedure is presented in appendix 5. Import approval applications must be submitted to the Minister of Trade (through the Trade Control Department, Bureau of Trade and Economic Cooperation). Regarding import recognition, to import tuna by ship (excluding albacore, southern bluefin, bluefin, and bigeye tuna), the required documents must be submitted to the Minister of Trade to obtain import acknowledgment; once acknowledged, the import process can begin. To import fresh or chilled bluefin tuna, southern bluefin tuna, and fish except those mentioned above, a certificate must be submitted to customs authorities for import acknowledgment.

Seafood and its processed products are subject to food sanitation, which is conducted to assess the types and details of the raw ingredients, and to test the types and contents

[11] This law and related regulations are discussed further in another section.

of additives, pesticide residues, and mycotoxins (JETRO, 2011). The food sanitation inspector at the quarantine station inspects the product to examine whether the item meets the regulations under the Food Sanitation Law. During the document examination, the food sanitation inspector validates the following items (based on the information reported in a notification form):

(a) Whether the imported food complies with the manufacturing standards regulated under the Food Sanitation Law;
(b) Whether the use of additives complies with the standards;
(c) Whether the poisonous or hazardous substance is contained;
(d) Whether the manufacturer or the place of manufacturing has a record of sanitation problems in the past.

Meanwhile, under the Customs Business Act, import declarations must be made by the importer or assigned to a registered customs specialist. To accept the entry of cargo into Japan from a foreign country, an import declaration must be made to the customs office for the area where the cargo is stored. Cargoes that require customs inspection undergo the necessary inspections. In most cases, under the Domestic Animal Infectious Diseases Control Law, a cargo quarantine and in-depth inspection for fish products (also for livestock and dairy products) are mandatory. Japanese inspectors verify that the imported products are compliant with Japan's food import and food safety regulations related to ingredients, materials, and additives. They can also go as far as testing the imported product in laboratories. If the fish products do not comply with the regulation, the products will be rejected (GourmetPro, 2021). The critical thing in here is to keep the temperature of the fish container below 4.4 degree Celsius while waiting for and during the process of inspection. Higher temperatures usually correspond to higher histamine risk (CODEX, 2003; FAO and WHO, 2020). After the inspection finished as well as after payment of customs duties and national and local consumption taxes, import permits can be granted (JETRO, 2011).

According to ITPC OSAKA (2020), the labelling of fishery products must be made in Japanese and comply with the following laws and regulations: (1) Act for Standardization and Proper Labeling of Agricultural and Forestry Products; (2) Food Sanitation Act; (3) Measurement Act; (4) Health Promotion Act; (5) Act on the Promotion of Effective Utilization of Resources; (6) Act against Unjustifiable Premiums and Misleading Representations: and (7) intellectual asset-related laws, such as the Unfair Competition Prevention Act and the Trademark Act. When importing and selling fresh fishery products, the importer must provide the following information on the label to meet the required label standards for fresh food, as stated in the Act for Standardization and Proper Labeling of Agricultural and Forestry Products: product name; country of origin; content; and name and address of the importer. For imported processed fishery products (also for those packaged in containers), as regulated in the Food Sanitation Act, the importers must provide the information about product name; ingredients; content; expiry date; storage method country of origin; and name and address of the importer.

The substance name of additives used must be listed in decreasing order from highest to lowest content on the label following the Food Sanitation Act. The substance name and use of the additives must be indicated for the sweeteners, antioxidants, artificial colors, colour formers, preservatives, whiteners, thickeners/stabilizers/gelators/bodying agents, antifungal agents, and antimold agents. For details on usage and storage standards of additives, Notification No. 370 of the Ministry of Health, Labour and Welfare "Standards and Criteria for Food and Additives" prescribes the maximum allowable limit of approved additives for each food article. Following the Food Sanitation Acts to prevent health hazards for consumers with specific allergies, labelling of specific ingredients, shown in appendix 3, are required.

When selling fish and its processed products, the importer must weigh the product following the Measurement Act and indicate the weight in grams on the label. The expiry date of the product when stored according to the given preservation method in the unopened state must be indicated on the label in accordance with the Act for Standardization and Proper Labeling of Agricultural and Forestry Products and the Food Sanitation Act. The expiration date label consists of an expiration date and a "best by" date. Quality labelling standards for processed foods, defined by the Act for Standardization and Proper Labeling of Agricultural and Forestry Products, require the name of the country of origin to appear on labels of imported foods.

Preservation methods to retain flavour in an unopened state until the "best by" date must be indicated on the label following the Act for Standardization and Proper Labeling of Agricultural and Forestry Products and the Food Sanitation Act. Foods that require an expiration date label should be marked “Preserve under 10°C” while those requiring a “best by” date label should be marked “Keep out of direct sunlight at room temperature”. However, preservation methods can be omitted from labels for foods that can be stored at room temperature.

The Act for Standardization and Proper Labeling of Agricultural and Forestry Products requires labelling in the following cases: (a) "defrosted" for frozen products that have been thawed, and (b) "farmed" for farmed seafood. The name and address of the importer must be indicated on the label as specified under the Act for Standardization and Proper Labeling of Agricultural and Forestry Products and the Food Sanitation Act.

The nutritional components and calorie count must be indicated on the labels of seafood and processed products in accordance with the nutritional labelling standards prescribed by the Minister of Health The required information consists of nutritional components, structural components, such as amino acids in protein and types of components, such as fatty acids in fat. If general, names, such as “vitamin” are labelled instead of describing the specific names of nutrients, ingredients must be listed. Components must be indicated in the following order and unit:

(a) Calories (kilocalories)
(b) Protein (grams)
(c) Fat (grams)

(d) Carbohydrate (grams)
(e) Sodium
(f) Other nutritional components

In the case of containers and packaging, imported products that meet the following requirements must be labelled concerning the type of container or packaging. When the containers and packaging of imported products are printed, they must be labelled or engraved in Japanese.

5.1.3 Tuna import regulations in the European Union

The key elements of the regulatory environment for the fishery industry in the European Union are as the following:

First is, Common Fishery Policy. This policy sets the number of quotas on fish and entails four specific substances: production, quality, grading, packaging, and labelling; fishermen's protection from market dynamics; minimum prices of fish; and the requirement on fisheries trading with partners outside the European Union. Also included in this policy is the Common Organization of the Markets system, which permits non-European Union countries to export fish at reasonable prices to attain price stability and fair trading.

Second, the European Commission Supports the Domestic Fishery Industry via the Financial Instrument of Fisheries Guidance. The goals of this guidance are to improve the quality of fishing fleets, processing and marketing facilities, and ports in the European Union.

Third, control over the Illegal Fishing Council EC Regulation No 1005/2008, enacted on 1 January 2010, under which it is mandatory to provide a catching certificate stating that the product does not come from illegal, unreported, and unregulated fishing activities.

Another important regulation is linked to the health control of fishery products intended for human consumption. There are four aspects to the regulation: (a) country health approval; (b) approved establishment; (c) health certificates; and d) health control. Country Health Approval is a procedure to ensure the country complies with European Union Public and Animal Health conditions and follows the requirements of the Health and Consumer Protection Directorate-General of the European Commission regarding the facilities, such as cold storage, manufacturing plants, vessels, and production areas. If the compliance is satisfactory, the countries are added to a positive list of eligible countries that can export fisheries products to the European Union.

Health certificates released by the competent authority are also mandatory to ensure that the exported fisheries products are safe and fulfil the quality-related requirements. A verification checking mechanism of health control is also performed by veterinarian officials. The European Union has the right to implement an import ban if there is evidence of significant risks of products to human and animal health. The limit of histamine contents accepted by European countries is 50 ppm (Berjia and Brimer, 2013) whereas the temperature limit for histamine is 1.2 degrees Celsius by the European Commission (Trilaksani, 2021). Several strict labelling requirements also are in place, including information on the commercial and scientific designation of the species, information on methods of production, and the location of catch. It is also essential to ensure that the fisheries products are wholly obtained in the originating country to be eligible for Generalized System of Preferences (GSP) status. All of the processed food incuding canned tuna exported to the European Union also must comply with labeling rules, including product name and description, scientific terms, country of origin, and raw materials. It is also related to nutritional content, expiration date, barcode, certification logo, special storage methods (if required), and methods of product use (Dewi, 2018). All such information must be clearly legible and easily found by consumers. Specifically for fishery products, the label includes the brand in English and Latin, the method of production (sea catch or freshwater), and the fishing area. Due to the prohibition of histamine, salmonella, and pesticides, there is also a ban on using hydrolyzed protein to increase tuna weight. Considering a fraud against consumers, the European Union government prohibits it.

Food safety certification is one of the mandatory certificates to export tuna to European Union. Food safety certification implements a system of quality assurance and safety of fishery products. Business actors are required to have a certificate of good fish handling practices. This certification is complemented by regulations related to importing raw materials and food, including fish products. According to the European Union's rules, there are three rules (1) EC No 178/2002: Obligation of resources, namely production instrument, Hazard Analysis Critical Control points, and traceability. (2) EC No. 882/2004: Obligations of result, namely the safe level of the product (e.g., histamine content, contamination), and (3) EC No. 884/2004: Obligation of control, namely regulation of verification, data and storage management, legal support (Presilla and Atmaja, 2020). For example, if suddenly there is an inspection of the European Union into Indonesia, at least business actors, both consumers, and fishers, are checked for completeness of permits. Once the food safety certificates is already in possession, meaning the completeness of documents, completeness of identity, and completeness of goods (physical). When one such inspection took place, the European Union wanted all of these export products to agree to the three types of checks (Henderson, 2021).

In order to facilitating tuna export, the Government of Indonesia monitors, such as checking how to disassemble the temperature to ensure the quality and quantity of fish quality and monitoring plant residues. In addition, The Catch Certification Scheme (CCS) has been implemented since January 1, 2003, to ensure the entire production process starting from catching, processing, packaging, transporting, and shipping according to standards. This rule applies full traceability to fishery products and is also relevant to the hygiene package regulations. This rule records the product's origin until it enters the European Union market, meaning complete information about the place, method, quantity, and product entered is complete. Then there is the Certification of Origin, a rule set by the European Union to determine the origin of an item, namely the origin of the product being produced, not the origin of the product being shipped (Presilla and Atmaja, 2020).

5.1.4 Tuna import regulations in Indonesia

The definition of imported goods, in accordance with the Customs Law,[12] indicates that imported goods are goods that are entered into the customs area and are subject to import duty. Importers carry out self-assessments related to form-filling activities, form submission and determination of the HS code, and calculation of import duties and obligations for commodities including checking if the commodities are indicated as prohibited or restricted goods. After the importer submits the assessment form, the customs system automatically checks whether it is following the rules, especially related to the regulation of goods prohibition or restrictions.

If the application does not comply with these rules, it will be rejected, and the importer must then follow the resubmission procedure by submitting related data and all documents to complete the requirements specified in the prohibition and restriction rules. If the import application complies with the rules, it is entered directly into the computer system and a billing (payment) is issued for later payment by the importer.

The imported products are categorized as to whether they enter Indonesia via the green, yellow, or red routes. The red line is a service process and supervision of the release of imported goods by conducting a physical inspection and document review before the issuance of the Letter of Approval for the Release of Goods. This red line is for high-risk imports, which are usually imposed on new importers, imports for high-risk goods, goods regulated by the government, and re-imports (see Directorate General of Customs and Excise, 2014). The yellow lane is a service process in which imported goods can be released without a physical inspection, but a document review is carried out before the issuance of the Goods Release Approval Letter (SPPB), which is intended for imported goods that are at moderate risk or imports for which documents and requirements have not yet been completed (Directorate General Customs and Excise, 2014; DDTC News, 2020). The green line is the process of servicing and supervising the release of imported goods by not carrying out a physical inspection but examining documents after the issuance of the Letter of Approval for the Release of Goods (SPPB); it applies to commodities that are not included in the list of commodities on the red line (Directorate General of Customs and Excise, 2014).

Every item related to an import to Indonesia is inspected (both documents and physical goods) by the Directorate General of Customs and Excise. The inspection is carried out to determine the amount of levy that must be paid for the shipment of goods and ensure that the shipment does not include goods that are prohibited from being imported or for goods that require a restriction permit.

[12] Customs Law No. 10 of 1995 revised in Customs Law No. 17 of 2006

Regarding import bans and restrictions, several objectives of the prohibition and restriction of imported goods are, among others, to protect public security and public interest, protect domestic industry, and maintain the balance of payments. The Ministry or Technical Institute determines what types of products are subject to import restrictions. For seafood and fish products, the determination of the products subject to restrictions is carried out by the Ministry of Marine Affairs and Fisheries. To import tuna and its processed products, importers need to comply with the restrictions; in other words, for tuna and its processed products to enter Indonesia, certain document requirements and permits from the relevant agencies are required.

To check for compliance with requirements and permits, supervision is carried out on imported tuna and its processed goods entering Indonesia, which is divided into border supervision and post-border supervision. Border supervision is carried out by the Directorate General of Customs and Excise, while post-border supervision is carried out by relevant ministries and institutions. For border control in the import of fresh tuna (HS Code 0301, 0302, 0303, and 0304), to enter Indonesia, importers need to complete a product carrier media release approval document (KI-D7) and a product release certificate (KI-D12), issued by the Agency for Fish Quarantine, Quality Control, and Safety of Fishery Products. To obtain the KI-D7 and KI-D12 documents, importers need to complete the required documents, one of which is a health certificate for the imported product issued by the relevant agency from the country of origin. Based on the Minister of Marine Affairs and Fisheries of Indonesia regulation No. 74/PERMEN-KP/2016 all fresh and processed fish that enter Indonesia need to be accompanied by a fish health certificate and a fish processing product health certificate. Under the regulation, to obtain a release certificate, the carrier media listed in the imported product is not infected with pests and diseases and fulfils the quality assurance and safety of fishery products so that they can be imported into Indonesia. Those health certificates are based on HACCP and also on fish and fish carrier quarantine activities. Moreover, to obtain the health certificates, laboratory examinations of test samples need to be carried out. Some of the test samples will do the organoleptic test[13] and evaluate the level of parasites, bacterial mycotics, and/or viruses (Indonesia Fish Quarantine Inspection Agency, 2021).

For post-border supervision of imported fish products and their processed products, the required documents must be completed. Approval of imported products is further regulated under the regulation of the Indonesian Ministry of Trade[14]. Regarding the

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[13] Organoleptic test or commonly called sensory test is a test method using the human senses as the main tool for measuring product acceptance (see https://www.sensoryspectrum.com/post/organoleptic-testing-or-sensory-testing) .

[14] Regulation of the Minister of Trade No. 66 of 2018, which was later amended in the Minister of Trade Regulation No. 23 of 2019

import of processed tuna (HS Code 1604), post-border supervision[15] is only carried out through document inspection in the form of import certificates issued by the Food and Drug Supervisory Agency (BPOM) and surveyor reports from the Indonesian Ministry of Trade.

In Indonesia, the requirements for the safety of fish products are regulated in SNI (Indonesian National Standards). For histamine levels, SNI requires histamine levels to only be allowed at maximum of 100 ppm. Meanwhile, details regarding the maximum product storage temperature is 4.4 degrees Celsius (Indonesian Ministry of Trade, 2013). Moreover, the Indonesian Food and Drug Supervisory Agency (2020) also regulates the labelling requirements for human processed foods. Some of the important information that needs to be added to the product label is the name of the food (or name of the product), ingredients list, net quantity of content, name, and address of manufacturers (and importers), halal information, production date and code, date of expiration, distribution permit number, and origin of certain foodstuffs, such as the explanation if the food products contain material from animal or plant in a single or mixed form or processed products or their derivative products related to the halal status of the product.

5.1.5 Tuna export regulations in Indonesia

In accordance with the Customs Law,[16] products that have been loaded or will be loaded for transport from the customs area are treated as export goods. Regarding Indonesian tuna export activities, the basic rules related to export duties are Regulation of Minister of Finance PMK. No. 145/PMK.04/2007 s.t.d.d. PMK No. 21/PMK.04/2019 concerning customs provisions in the export sector, PMK No. 214/PMK.04/2008 s.t.d.d. PMK No. 86/PMK.04/2016 concerning the collection of export duties, Regulation of Directorate General of Customs and Excise No. 32/BC/2014 s.t.d.d. Director-General of Customs and Excise No. 07/BC/2019 concerning customs management in the export sector, and the Regulation of Director General of Customs and Excise No. 21/BC/2018 jo. No. 07/BC/2020 regarding export customs notification.

To encourage exports by raising the competitiveness of exported goods, speed and certainty are essential for exporters, so the government only carries out document checks and physical inspections to a minimum. Based on Article 5 Paragraph (1) PMK No. 145 of 2014, the obligation to submit export customs notification does not apply to the following goods:

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[15] Post-border supervision is a supervision for imported products (and import activities) that is carried out after it leaves the customs area and has circulated in the community (free circulation/market) which is supervised by the relevant ministries/institutions (see Regulation of Ministry of Trade No. 51 of 2020). Customs area are areas with certain boundaries at seaports, airports, or other places designated for the traffic of goods (exports and imports) which are fully under the supervision of the Directorate General of Customs and Excise (see https://news.ddtc.co.id/apa-itu-kawasan-pabean-23353).

[16] Customs Law No. 10 of 1995 revised in Customs Law No. 17 of 2006

(a) Passenger's personal belongings
(b) Transport crew’s belongings
(c) Border crossing goods
(d) Postal items up to a maximum weight of 100 kg

Export activities are also mostly carried out through self-assessment by exporters. Some complementary customs documents required are an invoice, packing list, and required licensing documents. Monitoring of tuna exports is carried out by the Directorate General of Customs and Excise. Two complementary customs documents, exports need to fill out are a health certificate and/or KI-D4 (Load Approval Letter) issued by the Ministry of Marine Affairs and Fisheries. This is in accordance with the Regulation of the Minister of Marine Affairs and Fisheries[17] which is mandatory to check and go through fish quarantine, and quality to ensure the safety of fishery products.

Based on the regulations, Indonesia, Japan, the United States, and the European Union have set strict standards for fishery products marketed in their respective countries or areas, including tuna products. Each economy sets its standards covering several aspects, such as monitoring, testing, and inspection procedures. Generally, proof of conformity to their standards is manifested in the form of certifications. In exporter countries, such as Indonesia, failure to fulfill the certificates results in rejections for tuna products, which, in turn, contributes to the food loss in international trade activities.

[17] The Regulation of the Minister of Marine Affairs and Fisheries No. 18 of 2018 concerning Types of Commodities Mandatory Inspection of Fish Quarantine, Quality, and Safety

5.1.6 Comparison of tuna food safety standard and import regulations in Indonesia, Japan, the United States, and the European Union

FTo understand better the import regulations of tuna and its processed foods in Indonesia, Japan, the United States, and the European Union, the recent information outlined previously is summarized in table 7. The table includes (a) the hygiene control method according to the HACCP system, (b) the test for any harmful and toxic material in the products, and (3) product labelling.

Table 6: Comparison of tuna import regulation in the United States, Japan, the European Union, and Indonesia

Requirements	**Definition**	**United States**	**Japan**	**European Union**	**Indonesia**
Hygiene control method based on HACCP	Yes/no	Yes	Yes	Yes	Yes
Hygiene control during packing, transportation and distribution	Yes/no	Yes	Yes	Yes	Yes
	Detail information	Good Manufacturing Practice in Manufacturing, Packing, or Holding Human Food;	The products entering Japan should be of good hygiene in manufacturing, processing, product storage,	Country Health Approval can be a method to control the facilities, such as cold storage, manufacturing plants,	All fresh and processed fish needs to be accompanied by a fish health certificate and a fish processing product health certificate, the carrier media listed in the import activities (listed in the documents) should not infected with pests and

Requirements	Definition	United States	Japan	European Union	Indonesia
		Warehousing and Distribution	transportation and distribution	vessels and production areas.	diseases. Carrier Media are animals, animal products, fish, fish products, and others that can carry fish pests and diseases
Test for any harmful and toxic material	Yes/no	Yes	Yes	Yes	Yes
	Detail information	Organoleptic evaluation and histamine test sample, food additives test and indication of mercury, also seizure or detention for uneviscerated fish products	Seafood and its preparations must pass the test on food sanitation (content of additives, residues pesticides and mycotoxins)	Important regulation linked to health control of fishery products: (a) country health approval; (b) approved establishment; (c) health certificates and (d) health control	The laboratory examinations of test samples are to test the level of parasites, bacterial mycotics and/or viruses, and to do an organoleptic test
	Yes/no	Yes	Yes	Yes	Yes

Requirements	Definition	United States	Japan	European Union	Indonesia
Product labelling	Detail information	Country of origin, name of food, net quantity of contents, ingredients list, nutrition labelling, claims and product dating	• Fresh food: product name, country of origin, content, and name and address of the importer. • Processed fishery products: product name, ingredients, content, expiry date, storage method, country of origin, and name and address of the importer.	Product labelling is regulated under the Common Fishery Policy	Name of the food, ingredients list, net quantity of content, name and address of manufacturers (and importers), halal information, production date and code, date of expiration, distribution permit number, and origin of certain foodstuffs

Related to the strictness level of food safety standards and regulation, the strictest standards and regulation is owned by European Union (Indonesian Ministry of Trade, 2013; Trilaksani, 2021). Based on the discussion above, it is known that the European Union regulate the maximum limit of tuna container/storage temperature (to prevent the presence of histamine) at 1.2 degree Celsius, meanwhile the United States and Indonesia require it at maximum 4.4 degree Celsius. Related to Carbon Monoxide (CO) level, the European Union requires that the CO should be not detected, whether in Indonesia (SNI) it has not been specified (Indonesian Ministry of Trade, 2013; Sabrina, 2019). Not only looking at the contaminant rate, the traceability and whether the fish is obtained from legal activities that is related to Illegal, Unreported and Unregulated or called IUU fishing regulation are also the points that are highlighted by the European Union (Indonesian Ministry of Trade, 2013; European Commission, 2022).

Moreover, in CODEX, frozen tuna products must be rejected if the skin or mucus is pale or yellow-brown in color, the gills are gray-brown, and have abnormal odors such as ammonia, milk lactate, sulfite or rancid odors. Then, CODEX also requires good inventory control in terms of fish storage. In terms of packaging, not only clean, but packaging materials are also required not to pollute the fish and must be included in the food grade category. Meanwhile, this is not explained in SNI. Then, SNI also has drawbacks compared to the standards from the United States of America, which SNI does not include some contaminants as quality requirements such as *polychlorinated biphenyil* contamination with maximum 2 ppm and residues of veterinary drugs that should not be detected (Indonesian Ministry of Trade, 2013). Table 8 shows the detail of the differences, particularly on contaminants content and the main concern of each trade partner has.

Table 7: The differences level of food safety standards and import regulation in the United States, Japan, the European Union, and Indonesia

Indicator	European Union	United States	Japan	Indonesia	CODEX
Strictness level*	High	Medium	Medium	Medium	
*Salmonella (25 gr)***	Negative	Negative	Not Specified	Negative	Not Specified
*Histamine (ppm)***	50	50	50	100	100
*Mercury (mg/kg)***	1	1	0.3	1	1
*Lead/pb (mg/kg)***	0.3	Not Specified	Not Specified	0.4	Not Specified
*Cadmium (mg/kg)***	0.1	3	Not Specified	1	Not Specified
*Eschercia coli (mpn/g)***	1.8	2.3	2.3	1.8	Not Specified
*Listeria monocytogenesis (25 gr)***	Negative	Negative	Not Specified	Negative	Not Specified
*Clostrodium botulinum***	Negative	Negative	Negative	Negative	Not Specified
Most standards that have been the main concern by trade partners***	antibiotic levels, traceability, heavy metal contamination test, histamine levels, CO content, Salmonella content	salmonella content, fish physical condition, histamine levels, and filthiness	salmonella content, fish physical condition, histamine levels, and filthiness		

Source: *) Trilaksani, 2021; **)Sabrina, 2019 and Trilaksani, 2010, ***) Indonesian Ministry of Trade, 2013

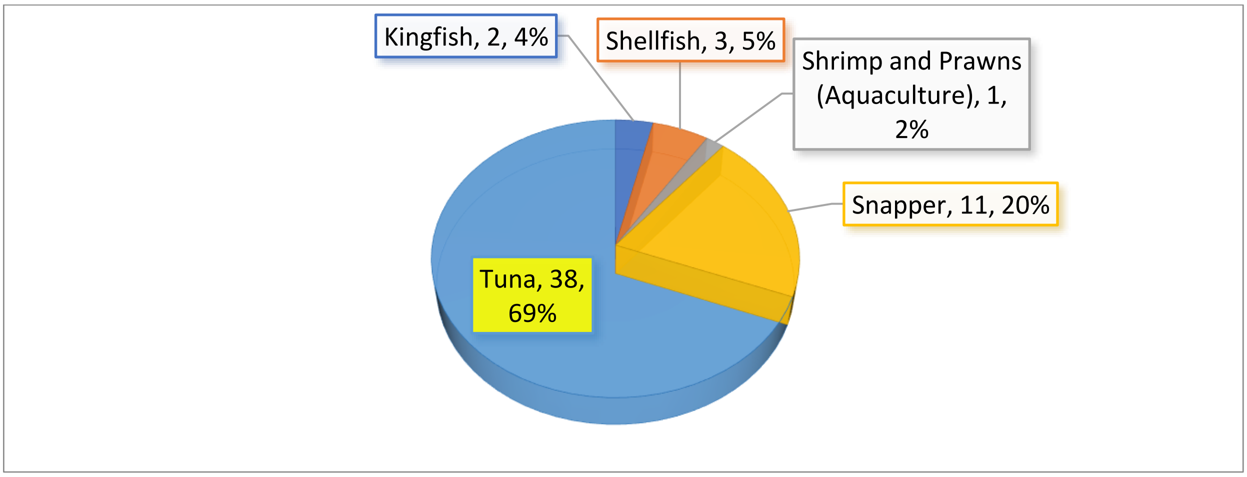
6. Analysis of the prevalence and quantification of Indonesian tuna import rejection

As outlined previously, higher rejection in cross-border trade results in a higher prevalence of food loss. This section includes a discussion on the rejection cases of Indonesian tuna sent to the United States, Japan the European Union.

Rejection Cases of Indonesia Tuna in the United States

The majority of rejection cases of Indonesian tuna occurred in the United States; over the period January−June 2021, there were 38 rejections, or 69 percent, of total fishery exports including tuna (figure 4). Further examination of historical 2014−2021 data shows that the number of cases of rejection of Indonesian tuna exports to the United States tended to decrease (table 9).

Figure 4: Food and Drug Administration refusals of all Indonesian seafood products from January to June 2021



Source: Sugandhi (2021)

Table 8: Incidents of refusal of Indonesian tuna in United States from 2014 to 2021[18]

Refusal charges	2014	2015	2016	2017	2018	2019	2020	2021	Total	Share (%)
Filthy, putrid	50	81	136	22	46	48	27	2	**423**	**69.92**
Contains salmonella	19	9	2	14	11	4	12	25	**96**	**15.87**
Contains histamine			1	7		12	3	3	**26**	4.30
Filthy, putrid; contains salmonella	11		7	2					**20**	3.31
Contains histamine; filthy, putrid					2			7	**9**	1.49
Contains listeria monocytogenes					6	2			**8**	1.32
Contain of Hepatitis A virus					8				**8**	1.32
Packed under insanitary conditions; misbranded: labelling is not prominently placed in two or more languages						4			**4**	0.66
Filthy, putrid; misbranded: failure to complete package form and label, no information about measure and nutrition, unusual name of food							3		**3**	0.50
Filthy, putrid; misbranded: labeling is misleading		2							**2**	0.33
Misbranded: labelling is not in two or more languages; packed under insanitary conditions						2			**2**	0.33
Contains histamine; misbranded: no indication of the quantity of the contents in terms of weight, measure								1	**1**	0.17
Filthy, putrid; misbranded: name of ingredients not common		1							**1**	0.17
Filthy, putrid; misbranded; no information about manufacturer, measure, nutrition, and unusual name of food							1		**1**	0.17
Contains histamine; violation of its placement, form and/or contents statement		1							**1**	0.17
Total	**80**	**94**	**146**	**56**	**73**	**72**	**46**	**38**	**605**	**100.00**

Source: FDA (2021)

Based on information in table 8, salmonella, filth, and histamine are the main factors behind the refusal of Indonesian tuna in the United States. Refusals due to filth only occurred in the composting process. Filth testing was carried out using a sensory test that was sensitive to the sense of smell, even though it should have been tested in a more measurable way using a laboratory test because it is related to decomposition. In

[18] Data 2021 cover the periods of January-June

Indonesia, filth-related tests are carried out, but the calibration method and measurement are different from those in the United States. Thus, it causes rejection of Indonesian tuna export.

Salmonella is the second most common reason for rejecting Indonesian tuna exports to the United States (15.87 per cent). During the period 2014−June 2021, 96 shipments were rejected due to salmonella. Salmonella is a very dangerous bacterial pathogen, as it has gastroenteritis bacteria, which causes enteric fever. In foodstuffs, any traces salmonella is forbidden due to the danger posed. The presence of salmonella indicates contamination occurred during the production process and the lack of a good sanitation system in the production process of fishery commodities. Salmonella in food does not cause changes in colour or taste, so it is not detected through the five senses (Ray, 1996).

Rejection Cases of Indonesia Tuna in Japan

Indonesian tuna also was rejected in Japan. The incident cases in Japan, however, were lower compared to those in the United States. Over the period 2012−2019, 10 shipments of Indonesian tuna were rejected in Japan (table 10). In 2019, only one shipment of Indonesian tuna was rejected in Japan. As shown in table 10, the main causes of rejection were the following:

- Violation of compositional standard (coliform bacteria positive);
- Violation of compositional standard (live bacteria count);
- Undesignated additive (carbon monoxide detection);
- Salmonella positive.

The majority of tuna exported from Indonesia to Japan is in the form of canned tuna (from yellowfin tuna (*Thunnus*), albacore or long-finned tunas, tunas, skipjack, and bonito) and frozen tuna (Tuna tataki, yellowfin, tuna kiriotoshi, tuna hazai, and sushi slice). Before being delivered, the products are tested for feasibility showing that the quality of the exported products has met the requirements to be accepted by the Japanese market. However, the rejection still occurred. For the canned tuna, the rejections are mainly due to labelling problems such as incomplete information on food shelf life, expiration date, and nutritional facts.

Table 9: Incidents of refusal of Indonesian Tuna in Japan from 2012 to 2017

PItems	2012	2013	2014	2015	2016	2018	2019	2107	**Total**
Frozen food served without heating: frozen tuna tataki								1	**1**
Frozen fresh fish and shellfish for raw consumption: frozen yellow fin tuna block		1							**1**
Frozen fresh fish and shellfish for raw consumption: frozen tuna Kiriotoshi	1	1							**1**
Frozen fresh fish and shellfish for raw consumption: frozen yellowfin tuna Saku (tuna frozen Saku)			1						**1**
Frozen fresh fish and shellfish for raw consumption:frozen yellowfin Tuna Hazai						1	1		**1**
Frozen sushi slice				1					**1**
Frozen tuna: frozen yf blood meat					1				**1**
Frozen yellow fin tuna haramo				1					**1**
Total	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**10**

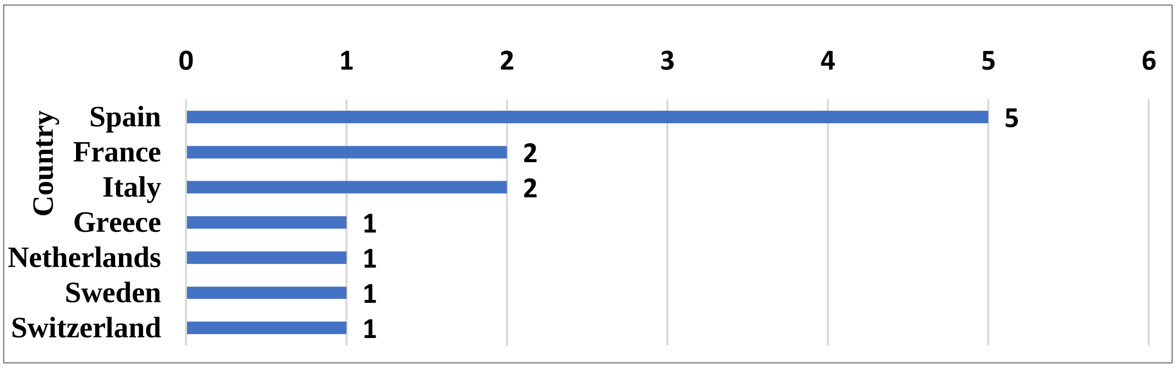
Source: Japan, Ministry of Health, Labour and Welfare (2021)

Rejection Cases of Indonesia Tuna in the United States

The market share of Indonesian tuna in the European Union is relatively small compared to Spain, Ecuador, and the Philippines due to high import tariffs (figure 5). The type of tuna exported is canned tuna, which is subject to an import tariff of 20 percent. In terms of rejections, Spain had the highest number (five cases) of rejected shipments of Indonesian tuna during the 2014−2021 period (figure 6). The main reason for the rejections was the presence of histamine, forcing the European Union to ban the shipment. Other causes were the presence of carbon monoxide and temperature control issues. The rejected tuna was valued at $1.841 million during the 2014−2020 period. Some of the rejected commodities are destroyed, which then becomes food loss and some can still be re-imported to other countries after being treated. Notably, India is one of the countries that buy many commodities that have been rejected and re-imported to other countries.

Based on the breakdown analysis for the European Union during the period 2014−2019, the cumulative number of rejection cases for IIndonesian tuna exports was five cases in Spain, two cases in France, and one case in Italy, Greece, Netherlands, Sweden, and Switzerland during 2014-2021. Food safety is the definitive source for attaining a competitive advantage in the fisheries trade, considering that consumers in developed countries have higher awareness in terms of product quality and safety. To attain tuna product quality and safety, it is crucial to ensure that the standard implemented by each country in the European Union and industry standards is harmonized. The follow-up action of import rejection includes product destruction, hence contributing to increasing food loss. Trilaksani (2021) estimates that the approximate percentage of Indonesian tuna food loss relative to the total number of import rejections in global trade reached 10-25 per cent during the past 5 years.

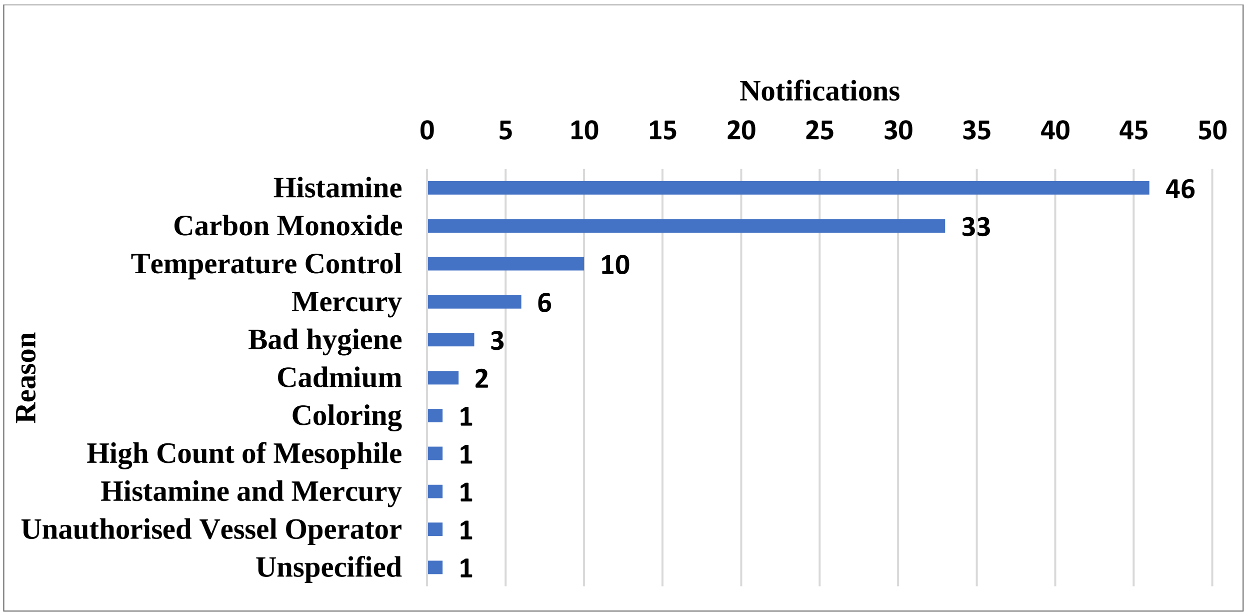
Figure 5: European Union RASFF Notifications for Indonesian tuna and tuna products by notifying country 2014− 2021



Source: European Union RASFF in Sugandhi (2021)

The top five main underlying reasons for the rejection of Indonesian tuna are levels of histamine, carbon monoxide, temperature control issues, mercury, and bad hygiene (figure 6). Histamine was the cause of the rejection of 46 cumulative cases in the European Union. Rising levels of histamine are specifically linked to hygiene problems and mishandling. Temperature is one of the key factors determining histamine levels. Recommendations of temperature limit for histamine vary, namely 4.4 degrees Celsius by the FDA of the United States and 1.2 degrees Celsius by the European Commission. In addition, the maximum tolerance of histamine limit also differs. FDA and European countries have put the safe limit at 50 ppm and the Indonesian standard body has set it at 100 ppm (Berjia and Brimer, 2013; Trilaksani, 2021). According to Irawati, Kusnandar, and Kusumaningrum (2019), the primary root causes of high levels of histamine content in tuna are (a) inadequate handling of tuna in the primary production chain (fishermen and collectors), (b) cold chain management is not fully performed, (c) insufficient standards implemented for fishing vessels standards and temperature (d) lack of socialization and training related to fish handling both onboard and at suppliers, (e) monitoring for histamine is not adequately performed and (fi) fishing units (UPI) procured tuna from unregistered suppliers.

Figure 6: European Union RASFF notifications for Indonesian tuna and tuna products by reason 2000–2021



Source: European Union RASFF in Sugandhi (2021)

Import rejection indicators, unit rejection rate (URR), and relative rejection rate (RRR) are used to provide further analysis of food loss at the different stages of export and import activities globally (tables 11 and 12). However, due to data limitation issues, these analyses are only performed for the United States market.

The unit rejection rate is defined as the number of rejections per $1 million of exports over the period of analysis. This indicator, which constitutes a direct measure of the rate of non-compliance of tuna in the United States market, is viewed as a major driver of food loss. Based on the calculation of the import rejection of Indonesian products, the URR of Indonesia in the United States market ranged from 0.00061 in 2014 to 0.0009 in 2020. The average value of URR during the period 2014-2020 was 0.001, which was lower than the rate for Japan and China. An increase in the URR value for Indonesian tuna was most probably the result of relatively lower compliance or more restrictive NTMs implemented in the United States market. It can be inferred that the probability of food loss in Indonesian tuna exports to the United States tended to increase as the rejection rate rose over the period of analysis To avoid food loss in the tuna trade, Indonesia must improve its compliance with standards and quality in the United States. Despite a relatively low export volume, Japanese tuna exports had the highest URR, indicating that the country's compliance level with United States regulations and standards is less than other major exporting countries.

Table 10: 11 Unit rejection rate Indonesia with trading countries: United States

Exporters	2014			2020			2014−2020		
	Rejection cases	Import value (million United States dollars)	Unit rejection rate	Rejection cases	Import value (million United States dollars)	Unit rejection rate	Rejection cases	Import value (million United States dollars)	Unit rejection rate
Japan	186	3 528	0.05271	231	4,272	0.0541	232	5 439	0.0426
Costa Rica	32	10 038	0.00319	5	20,454	0.0002	17	14 ,492	0.0012
Canada	318	20 910	0.01521	399	16,065	0.0248	303	21 106	0.0144
Indonesia	68	111 911	0.00061	202	216,550	0.0009	216	160 224	0.0014
Spain	129	18 096	0.00713	32	16,565	0.0019	100	20 315	0.0049
Ecuador	31	116 124	0.00027	13	133,114	0.0001	30	132 273	0.0002
Colombia	101	26 656	0.00379	317	8,912	0.0356	228	11 342	0.0201
China	1,136	119 669	0.00949	2,175	13,396	0.1624	1,288	88 247	0.0146
Mexico	614	34 493	0.01780	1,064	63,901	0.0167	908	41 636	0.0218
Thailand	120	478 361	0.00025	114	689,166	0.0002	139	481 684	0.0003
Viet Nam	120	150 844	0.00080	69	255 159	0.0003	110	197 899	0.0006
Australia	77	2 738	0.02813	81	5 386	0.0150	64	7 367	0.0087
Brazil	68	3 445	0.01974	83	6 291	0.0132	121	7 585	0.0160
Republic of Korea	336	11 070	0.03035	330	11 351	0.0291	376	11 501	0.0327
South Africa	2	2 103	0.00095	8	6 872	0.0012	22	4 003	0.0055

Source: FDA (2021), calculation

In addition to URR, RRR is also a useful indicator of trade standards compliance challenges faced by developing countries, including Indonesia. It also indicates how compliance progresses because of increasing capacity in obtaining the required standards. Consistent with URR analysis, the value of RRR for Indonesia in the United States market was higher in 2020 compared to 2014. The share of Indonesian tuna import rejection grew at a higher level relative to the import share. The higher RRR also validates that Indonesian tuna exports have faced difficult challenges in complying with standards and as result, the risks of food loss in international trade have increased. Meanwhile, based on RRR, Indonesian competitors, such as Australia, Brazil, Costa Rica, Ecuador, Spain, and Viet Nam are other countries showing improvement in compliance in the United States market.

Table 11: Relative rejection rate of Indonesia with trading partner: United States

Exporters	2014				2020				2014−2020			
	Rejection cases	Share import rejection (%)	Share import (%)	Relative rejection Rate	Rejection cases	Share import rejection (%)	Share import (%)	Relative rejection rate	Rejection Cases	Share import rejection (%)	Share import (%)	Relative rejection Rate
Japan	186	2	0.3	6.59	231	2.31	0.27	8.72	232	2.43	0.41	5.91
Costa Rica	32	0.34	0.86	0.4	5	0.05	1.27	0.04	17	0.18	1.1	0.16
Canada	318	3.41	1.8	1.9	399	4	1	4	303	3.15	1.67	1.88
Indonesia	68	0.73	9.61	0.08	202	2.02	13.45	0.15	216	2.26	11.97	0.19
Spain	129	1.38	1.55	0.89	32	0.32	1.03	0.31	100	1.03	1.57	0.65
Ecuador	31	0.33	9.97	0.03	13	0.13	8.27	0.02	30	0.3	10.18	0.03
Colombia	101	1.08	2.29	0.47	317	3.17	0.55	5.73	228	2.39	0.94	2.54
China	1,136	12.19	10.28	1.19	2,175	21.78	0.83	26.18	1,288	13.26	7.27	1.82
Mexico	614	6.59	2.96	2.22	1,064	10.65	3.97	2.68	908	9.36	3.08	3.04
Thailand	120	1.29	41.08	0.03	114	1.14	42.8	0.03	139	1.42	36.53	0.04
Viet Naam	120	1.29	12.96	0.1	69	0.69	15.85	0.04	110	1.15	14.97	0.08
Australia	77	0.83	0.24	3.52	81	0.81	0.33	2.42	64	0.66	0.58	1.14
Brazil	68	0.73	0.3	2.47	83	0.83	0.39	2.13	121	1.24	0.58	2.14
Republic of Korea	336	3.61	0.95	3.79	330	3.3	0.7	4.69	376	3.85	0.89	4.35
South Africa	2	0.02	0.18	0.12	8	0.08	0.43	0.19	22	0.22	0.28	0.79
Others	5,978	64.17	4.67	13.75	4,864	48.7	8.86	5.5	63,576	57.12	7.98	7.16
Total	9,316	100	100	1.00	9,987	100	100	1.00	67,731	100	100	1.00

Source: FDA (2021), calculation

The results from a focus group discussion and an in-depth interview support the findings from the secondary data related to tuna import rejections. The exporters stated that the rejections from Indonesia occur due to levels of histamine, carbon monoxide, temperature control issues, mercury, bad hygiene, and incomplete information labelling (e.g., no indication of the quantity of the contents in terms of weight). The common followed-up action of the refusals due to contamination with pathogenic bacteria or rotting is product discard, which in turn results in food loss and waste. In addition, the refusal can occur because of issues related to non-quality requirements. Under that scenario, tuna can be re-exported to other countries. For the past five years, it is estimated that approximately 1 to 3 tuna containers were returned per year due to import rejection. The main reasons of rejection were related to incomplete documents, quality deterioration, inaccurate product size, and poor handling process. To be specific, 20 to 30 percent of tuna: frozen the total Indonesian tuna exports per year are rejected. Accordingly, assuming tuna exports of 1,000 tons/year, approximately 200 to 300 tons are rejected. The tuna import refusals not only contribute to food loss but also are a nutrition waste. This is because tuna provides beneficial nutrition, as it is rich in rich in protein, omega-3, collagen and various vitamins and minerals such as natrium, kalium, calcium, magnesium, ferrous, vitamin D, vitamin B6, vitamin B12, and vitamin C. In addition, tuna food loss could also contribute to climate change. FAO (2021) points out that the rejected tuna, which is disposed of in landfills, may produce methane, a gas with 25 times more global warming potential than carbon dioxide (CO_2).

7. Analysis of the main drivers of food loss in the tuna global value chain: behind and across the borders

There is various literature on the drivers of food loss in the fisheries' global value chains. Based on previous chapters, it has been discussed that the food loss driven could be at micro and macro levels. Micro-level is related to the food loss incidents along the domestic value chain that are also caused by a lack of investment in the postharvest infrastructure, technologies, and human capital. The macro or global level is related to the international trade and NTMs imposed by other countries such as import regulations and food safety standards. When the exported tuna do not meet the standards and qualifications set by other countries, it will be rejected and cause food loss.

The majority of the literature has reported that food loss occurs along the value chains of fish products. Several studies of fish product losses in Indonesia have been carried out, but they tend to be limited to the value of the losses and have focused very much on nutritional loss. At post-harvest, fish losses can consist of physical losses, namely weight wasted or lost fish; quality loss, which is the difference in the value of fresh fish compared to the quality in the hands of consumers; price reduction/loss, price comparison while still fresh compared to the price when there has been a decline in quality for consumers; nutritional loss, decreasing nutritional components as quality decreases; and functional loss.

Chege and Carson (2017) report that fish loss in Africa was estimated at 75,000 to 125,000 tons/year (25 percent), equivalent to approximately 16,500 to 27,500 tons of fish protein/year. This protein loss was followed by a loss of essential nutrients because tuna is the main source of unsaturated fatty acids omega-3, which plays a very important role in the development of intelligence and cognitive abilities.

Trilaksani and others (2020) highlight micro-level causes of food loss and waste of fisheries products in Indonesia at each stage of the value chain from the production to consumption stages. First, factors associated with pre-harvest include product damage due to biological factors (predators, pests, and microorganism contamination), chemicals (such as poor water quality due to sewage contamination and pesticides.), and physical (handling or treatment during pre-harvest). Food loss and waste occurring at this stage affect the quality and quantity of harvest/catch yields. Second, at the harvesting and early handling levels, the schedules of catching are very important to prevent excessive supply. Third, infrastructure and facilities, namely electricity and water as well as cold logistics are still considered to be impediments, particularly in remote areas.

Post-harvest losses after fish are brought ashore are very likely to occur due to significant deterioration in quality. Damage in quality and quantity can occur during transportation, storage, and processing, as well as on the way to the market and consumers. Cold chains on tuna can be used to optimize the temperature and quality of freshness through real-time temperature tracking of the products.

Fourth, contamination can occur due to improper sanitation and hygiene in the processing unit. This problem is related to the availability of facilities, food safety quality standards, and the ability of the workforce to master and apply quality standards. Infrastructure and facilities regarding water installation is important in processing unit due to food safety concern. It is required to install portable water treatment in the processing unit to mitigate cross contamination (Sugandhi 2022). Contamination for one product prevents products produced in the same batch to be sold, resulting in a significant loss. Packaging is also an important factor because it determines the shelf life of the product and prevents contamination or product damage during transportation. Fifth, temperature, adequate product displays facilities, humidity, and cleanliness.

These macro -level and trade-related causes of food loss and waste can be explained by more systemic problems. Identifications of the main drivers of fisheries' global value chains are essential for policymakers, fishermen, processors, exporters, export quality infrastructure (laboratories), and other stakeholders. The first driver is the emergence of NTMs in the fisheries trade. NTMs are being used increasingly as substitutes for the declining ordinary tariffs. This is also evident in the fisheries trade. Fugazza (2017) has estimated the prevalence of NTMs in the fisheries sector. Some of the results of the study stress fisheries products are significantly more affected by NTMs in comparison to non-fisheries products. To be more specific, technical regulations, particularly SPS measures are the most common. It is estimated that fisheries imports are affected by SPS measures, technical barriers to trade measures, and pre-shipment related measures by 93 percent, 82 percent, and 41 percent, respectively. Among non-technical regulations, price-control measures are the most frequently applied.

It has been found that NTMs produce *conflicting* results. On one hand, NTMs can contribute to improving the overall quality of the products as they protect consumer health and well-being. Moreover, the implementation of NTMs has been potentially linked to increased economic benefits for exporters by improving consumer-specific attributes and hence raising demand for imports. Another benefit is related to enhancing the competitiveness in fisheries trade and creating a sound enabling environment in the long run (Cato and Subasinge, 2003; Fugazza, 2013; Henson and Jaffee, 2008). NTMs can also directly contribute to sustainable development as policy instruments, or they can indirectly affect sustainable development through their impact on trade and investment. The existing condition demonstrates that the distribution of NTMs in Asia and the Pacific has been strongly linked to Sustainable Development Goal 3 − ensuring healthy lives and promoting well-being for all at all ages and SDG12 - responsible consumption and production (Duval, 2021).

On the other hand, NTMs have the potential to transform into NTBs and hence increase trade costs. These issues have also been found in the fisheries sector and create a more challenging environment for exporters. Nazir (2021) states that common issues of NTMs are the following.

First, they are often badly designed and incoherent as the measures have failed to target the problem, are too broad, and consist of cumbersome compliance verification mechanisms. To date, there has been limited research, justification, and scientific basis, and inadequate consultations process, and limited improvements in domestic regulations. NTMs compliance cost is not economical and potentially hinders trade. Henson and others (2000) state that to upgrade the landing site and laboratory test on chemical and microbiological analysis, a laboratory needs to increase its investment cost by $1.2 million and $1.1 million, respectively. Lord, Oktaviani, and Ruehe (2010) also argue that Indonesian fisheries processors face further standards requirements on top of public standards and regulations. For instance, several system certifications, such as ISO 22000, Food Safety, Quality and Food Defense Audit (NSF international), BRC Global Standard for Food Safety (BRC), and Marine Stewardship Counsel (MSC) audit on the sustainability of sea catch are commonly required by European buyers. The range of annual additional expenses ranged from several thousand to 100.000 euros ($113,000).

Second, varying and relatively strict food safety standards of tuna amongst importing countries are also problematic for Indonesian tuna exporters. Food safety standards are set by importing countries with the main objective being to protect consumers in their respective countries. Fugazza (2017) also suggests that smallholders face serious impediments to fully complying with technical regulations, including homogeneous quality of products, sound transportation facilities, and adequate packaging due to insufficient human, financial and technical resources (Doherty, 2010), as well as institutional capacity (Mayeda, 2004).

Each country has its level of standards and usually developed countries apply more stringent standards than developing countries. It is worth noted that compliance with the established standards is closely monitored in developed countries (Kareem, 2016). For example, the regulations about histamine in European Union are stricter than in the United States. The tolerance limit in the European Union is 50 ppm than that of the United States by 100 ppm. In addition, the temperature limit is 1.2 degrees Celsius which is lower than the limit in the United States. This causes a refusal charge of Indonesian tuna mainly due to histamine level. In the United States, mostly imported tuna is in the form of frozen tuna and rejected due to filthy. Indonesia has different calibration and measurement methods on filth tests compared to the United States. Inspection agent in the United States perform the non-sensory tests to assess filth and decomposition which are relatively subjective (Sugandhi, 2022).

Table 12: Reasons for refusal cases in the European Union, Japanese and United States markets

Partner countries	Cases of refusal	Most of the refusal charges
European Union	13	Histamine and carbon monoxide
Japan	10	Bacteria and salmonella
United States	605	Filthy and salmonella

Source: Calculated from EU RASFF, Ministry of Health, Labour and Welfare Japan, and US FDA (2021)

Third, non-transparent communication of new regulations also constituted as driver of tuna rejections in destination markets. The rejection could be because the exporter/domestic company does not know about the other countries' import regulations and food safety standards, or because the regulations have been changing. These factors from the global level will surely create challenges for the main actors along the domestic value chain (micro-level) to produce qualified tuna products.

Fourth, complicated trading procedures, such as the length of time required to process export documents and loading and unloading/dwelling time increases the time required for the delivery of goods, which can reduce the quality of exported goods. To support exports, it is imperative to monitor trade-related policies implemented. Export facilitating measures are being put in place through the digitalization of NTM-related procedures and sector-specific trade facilitation measures and increasing transparency with the national trade portal.

Fifth, the existence of institutions that facilitate and supervise exporters to meet the standards set by partner countries is very crucial in terms of conformity regarding competent authorities and laboratory facilities. The difference in the level of technology between developed and developing countries in export and import activities has the potential to increase rejection cases. For example, the difference in sampling and microbial test results between Indonesian laboratories and the destination country resulting from differences in testing technology and laboratory infrastructure (methods, tools, and human resources) causes test results to be different, which leads to the rejection of exported products. Laboratories in developed countries have sophisticated equipment and high precision (Rahmawaty, Rahayu Kusumaningrum, 2014). Lord, Oktaviani, and Ruehe (2010) have identified that competence in supporting Indonesia Export Quality Infrastructure (EQI) varies significantly regarding the analytical measurement of heavy metals, histamine, and antibiotics. There has been some indication as well that method for examining histamine was not suitable for European Union requirements. Moreover, the calibration of tools and equipment is also not satisfactory. In addition, it is also imperative to ensure the development of the quality infrastructure supported by mutual recognition of standards and accreditation.

The results from an in depth interview on the stakeholder perception on the ranking of drivers of food loss showed that micro level drivers related to the tuna value chains are key drivers of Indonesian tuna rejections in destination markets. Handling tuna on the fishing vessels, technology in fishing, as well as improving infrastructure and facilities consisting electricity and water along cold chain management are considered as the most important drivers to avoid rejections. Hygiene in tuna handling is central to avoid cross contamination. In addition, the installment of monitor automatic recording temperature and improvement of cold chain management for storage and distribution is critical to mitigate the temperature abuse that may lead to higher probability of biological, chemical and physical risks.

Amongst the macro level drivers consisting technical and procedural NTMs, the stakeholder viewed that procedure to obtain get document export in Indonesia and procedure to obtain export certification also need to be considered. Challenge faced by exporters related to the submission process that has not been fully paperless because it requires a recommendation from the related Ministries. It is also important to increase availability and the capacity of laboratory testing in areas that are relatively close to the center of tuna exporters (Sugandhi, 2022).

Inspection and clearance procedures in European Union, United States and Japan are perceived to not closely link to rejection rates. The inspection is conducted by random sampling and usually focus on the inspection of temperature to assess histamine levels. Mitigating the risk of rejections are crucial due to the reputation effect. Sugandhi (2022) stated that high level of rejections may lead to systematic control inspection where all of exported tuna subject to inspection. This takes a relatively long time and burdensome for the affected exporters and decrease the reputation of the exporting country. On the worse scenario, export rejections may also lead to moratorium.

Table 13: Stakeholder perception on the ranking of drivers of food loss

No	Drivers of Export Rejections Leading to Food Loss	Importance Ranking
A	**Macro level drivers: Technical and Procedural NTMs**	
1	Strict regulations (NTMs) on food safety in the European Union, United States and Japan	**11**
2	Transparency in the implementation of NTMs related to food safety in the European Union, the United States, and Japan	**12**
3	Mechanism of consultation and socialization of NTMs related to food safety in the European Union, United States of America, and Japan	**13**
4	Procedure to obtain document of export in Indonesia	**9**
5	Procedure to obtain export certification	**8**
6	Inspection and clearance procedures in European Union, United States and Japan	**10**

No	Drivers of Export Rejections Leading to Food Loss	Importance Ranking
B	**Micro level drivers across the tuna value chain**	
7	Technology in fishing	**2**
8	Handling tuna on the fishing vessels	**1**
9	Infrastructure and facilities, namely electricity and water along cold chain management	**3**
10	Storage risk due to biological, chemical and physical factors	**7**
11	Sanitation and cleanliness in the processing unit.	**4**
12	Risk damage on cargo	**14**
13	Human resources quality	**5**
14	Role Export Quality Infrastructure e.g., certification, laboratory, and etc.	**6**

8. Conclusion and recommendation

Conclusion

Based on the discussion, there are several import regulations imposed on tuna by the European Union, the United States, Japan, and Indonesia. The regulations generally aim to ensure the safety and quality of imported seafood (in this case tuna). However, from the discussion above, the standard in the import regulations among the partner countries at some levels are different, particularly in the European Union that has the highest strictness level that some of them also stricter than in Codex standard. With the limitations and lack of micro level readiness in the tuna's value chain in developing countries, this different level of strictness import regulation could lead to higher possibility of tuna rejection. In other words, this brings a failure to comply with the regulations results in the rejection of the exported tuna to the destination countries, which, in turn, leads to food loss. The results show that food loss is evident in the cross-border tuna trade and that over the past five years some 20 to 30 percent of the exported Indonesian total tuna was refused annually. The refusals are attributed to compliance problems in product specifications, product quality, and food safety requirements.

In addition to food loss and waste in the cross-border tuna trade, the rejections exacerbate nutrition waste and increase the risks of climate change. Moreover, the level of compliance for tuna exports is decreasing, which in part can be attributed to tighter and more numerous NTMs regulations. Micro-level drivers associated with food loss of fisheries products are (a) post-harvest damages due to biological, chemical, and physical factors; (b) poor handling and catching scheduling; (c) lack of infrastructure and facilities, namely electricity and water as well as cold chain logistics; (d) improper sanitation and hygiene in the processing unit; (e) inability to fulfill the food safety standards from the export markets, and (f) insufficient of socialization about the food safety standard and import regulation of partner countries and of international standards (Codex) on each stage and on each actors of tuna’s value chain.

Additionally, macro level drivers of food loss of fisheries products consist of (a) increasing use of NTMs that have the potential to transform to NTBs and hence increase trade costs; (b varying and relatively strict food safety standards of tuna amongst importing countries are also problematic for Indonesian tuna exporters; (c) non-transparent communication of new regulations also constituted as driver of tuna rejections in destination markets; (d) complicated trading procedures, such as the length of time required to process export documents and loading and unloading/dwelling time; and (e) the existence of institutions that facilitate and supervise exporters to meet the standards set by partner countries is very crucial in terms of conformity regarding competent authorities and laboratory facilities.

The stakeholder perception on the ranking of drivers of food loss supported the notion that micro level drivers related to the tuna value chains are the main drivers of Indonesian tuna rejections in destination markets, consisting of handling tuna on the fishing vessels, technology in fishing, and infrastructure and facilities, namely electricity and water along cold chain management.

Recommendation

As outlined previously, food loss of tuna products occurs because of micro and macro level levels drivers. To reduce food loss in tuna products in international trade, proposed strategies should focus on the two issues.

At the micro-level, it is important that exporter countries (in this case Indonesia) increase the performance of quality control and food safety handling for tuna and its processed products by strengthening tuna export quality infrastructure including landing facilities, cold chain management system, laboratories, and boost the capacity of actors within the tuna value chains to implement best practices, such as Good Handling Practices (GHP) and Good Manufacturing Practices (GMP). Accordingly, the exporters of tuna from Indonesia to the European Union, the United States, and Japan would be able to more easily comply with the regulations, which, in the future, are expected to reduce the rate of tuna food loss. Moreover, increasing the socialization about the food safety standard and import regulation of trade partners and of international standards (Codex) is needed. This socialization can be done on each stage and on each actors of tuna’s value chain. From the import side, the improvement of tuna import regulations to Indonesia, particularly the technical requirements of food materials criteria, is needed because of the strict level that is still relatively below the rules set by the European Union and the United States. For example, the recommendations of temperature limit for histamine is varied, namely 4.4 degrees Celsius by the FDA of the United States and 1.2 degrees Celsius by the European Commission. In addition, the maximum tolerance of histamine limit also differs. FDA has put stated the safe limit is 50 ppm and the Indonesian standard body has set is 100 ppm. This is also to ensure that tuna and its products distributed to the population are safe to consume.

At the macro level, the risk of refusals of tuna in the European Union, the United States, and Japan can be mitigated by harmonizing and streamlining the NTMs, which is related to the food safety standard and import regulation, among trade partners. Moreover, this can also be done by putting forward export facilitating measures via digitalization of NTM-related procedures and increasing transparency with national trade portals and the establishment by governments of help desk services in exporting and importing countries. In this case, the term “help desk” refers to the institutions that facilitate the smooth operation of international trade flow among trade partners, particularly through information exchanges. As outlined previously, every country has its own set of regulations, and the standards to fulfil the regulations vary among the countries. In this regard, the information exchange activities among trade partner countries related to these issues are important to provide preventive actions for the refusals of tuna in the international trades. From the government side, help desk institutions can be organized by the ministry of trade or representatives of countries abroad under the embassy or consulate general of the countries. From the private sector side, currently, several private institutions provide commercial “help desk” services[19]. These operations institutions can facilitate international trade among trade partners by providing information related to the regulations in the exporting countries that should be fulfilled by the exporters.

[19] Example of private Help Desk: (1) https://trade.ec.europa.eu/tradehelp/ hosted by the European Union and (2) http://www.eximtutor.com/exim-help-desk/ hosted by an Indian company.

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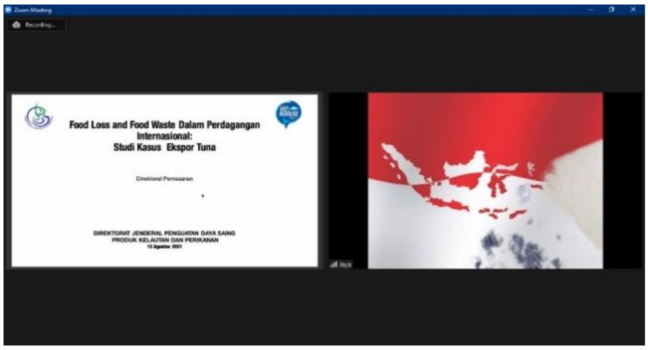
Appendices

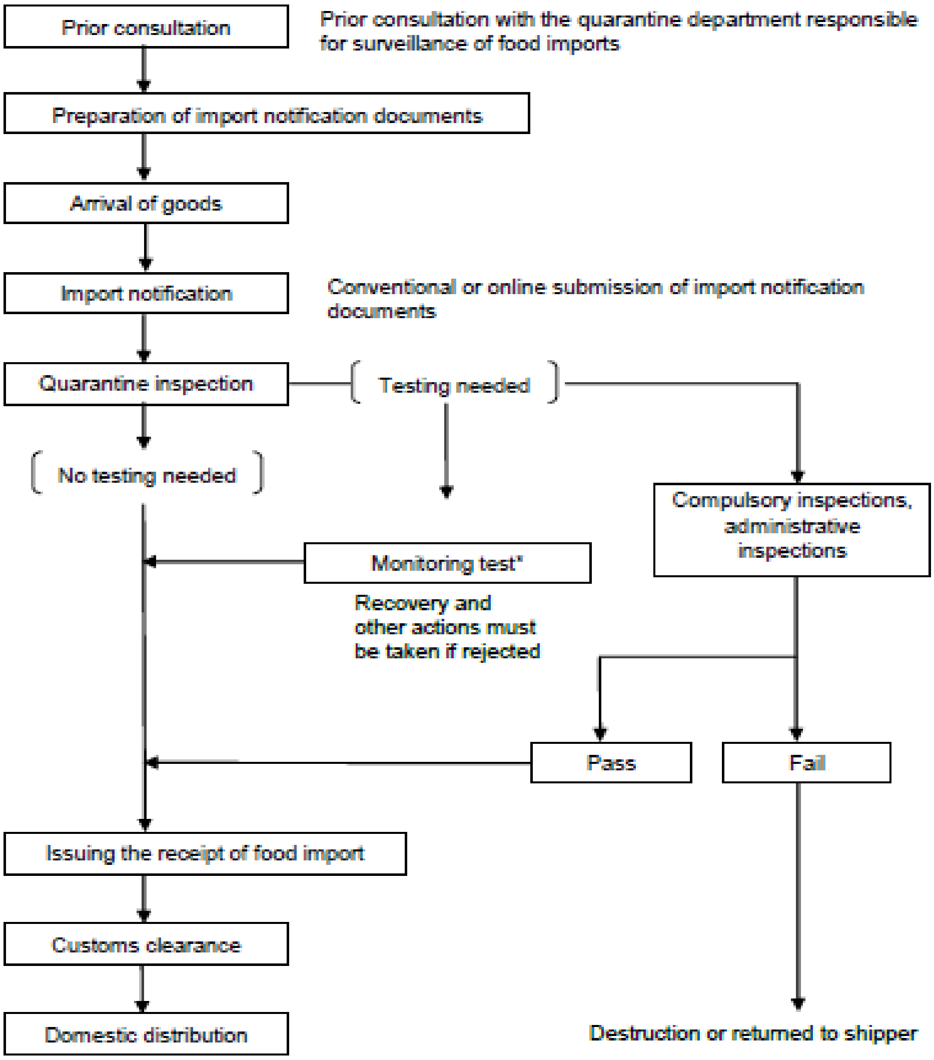
Appendix 1: List of participants “FGD food loss and food waste in international trade: case studies of Indonesian tuna exports to the European Union, United States, and Japan”, 12 August 2021

No.	Name	Institution
1	Bambang Parwanto	Direktorat Jenderal Bea Cukai (Directorate General of Customs and Excise)
2	Farah Ramadhiani	Badan Standarisasi Nasional – BSN (National Standardization Agency of Indonesia)
3	Pri Sandi Padang Sumunar	Direktorat Jenderal Bea Cukai (Directorate General of Customs and Excise)
4	Kastana Sapanli	IPB University
5	Risna Yusuf	Balai Besar Riset Sosial Ekonomi Kelautan dan Perikanan - BBRSEKP (Research Centre for Marine and Fisheries Socio-Economic)
6	Zulva Azijah	IPB University
7	Budi Wardono	Balai Besar Riset Sosial Ekonomi Kelautan dan Perikanan - BBRSEKP (Research Centre for Marine and Fisheries Socio-Economic)
8	Ima Kusumanti	Sekolah Vokasi IPB (IPB Vocational School)
9	Hendra Sugandhi	Asosiasi Pengusaha Indonesia – APINDO (Indonesian Employers Association)
10	Freshty Yulia Arthatiani	Balai Besar Riset Sosial Ekonomi Kelautan dan Perikanan - BBRSEKP (Research Centre for Marine and Fisheries Socio-Economic)
11	Estu Sri Luhur	Kementerian Kelautan dan Perikanan (Indonesia Ministry of Marine Affairs and Fisheries)
12	Benny Osta Nababan	Pusat Kajian Sumberdaya Pesisir dan Lautan - PKSPL IPB (Center for Coastal and Marine Resources Studies, IPB University)
13	Wiyoto	Program Studi Teknologi Produksi dan Manajemen Perikanan Budidaya, Sekolah Vokasi IPB (Aquaculture Production and Management Technology Study Program, IPB Vocational School)

Appendix 2: Event documentations "FGD food loss and food waste in international trade: case studies of Indonesian tuna exports to the European Union, United States, and Japan", 12 August 2021

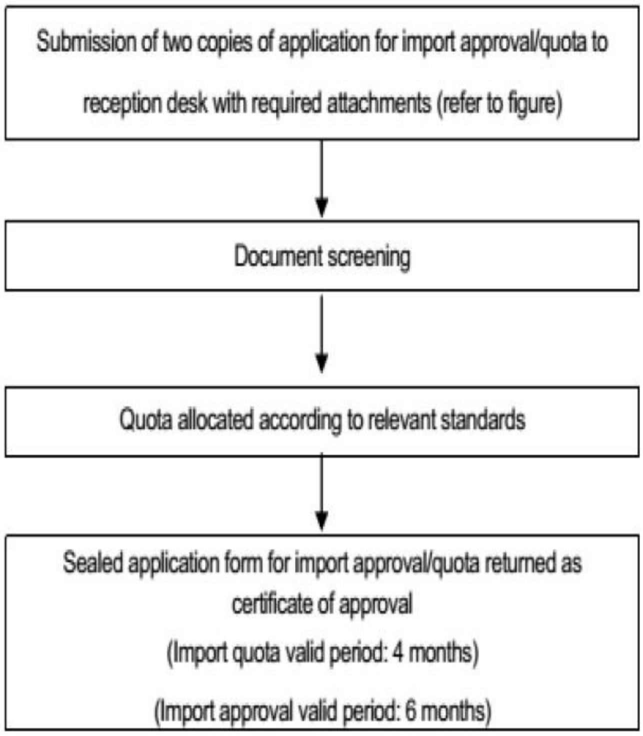


Appendix 3: Flowchart of import procedures in Japan



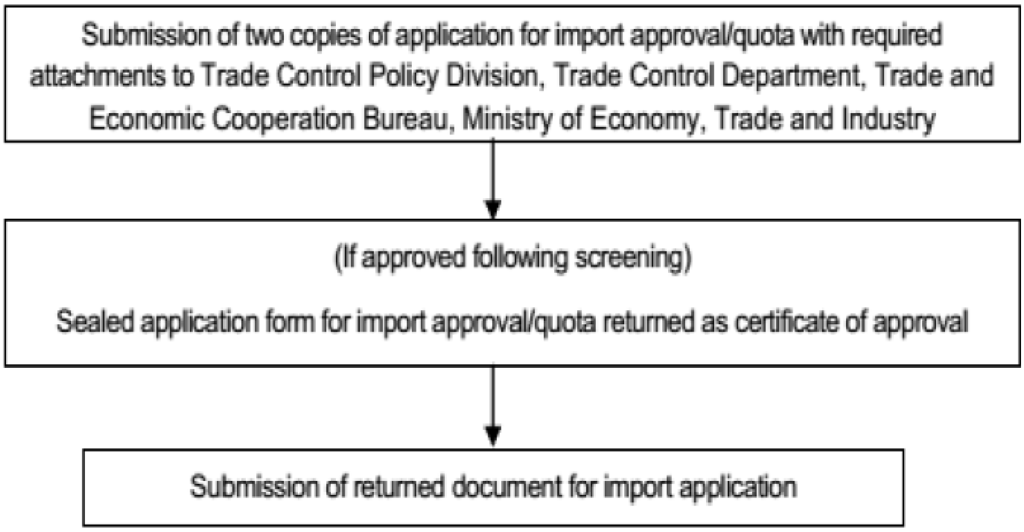
Source: JETRO (2011)

Appendix 4: Procedures of import quota application in Japan



Source: JETRO in ITPC Osaka (2020)

Appendix 5: Procedures of import approval application in Japan



Source: JETRO in ITPC Osaka (2020)

Appendix 6: Specific materials related to allergy labelling in Japan

Specific materials requiring allergy labeling	Egg, milk, wheat, shrimp, crab, buckwheat noodle, groundnuts
Specific materials for which allergy labeling is recommended	Bearded clam, squid, salmon roe, orange, kiwi fruit, beef, walnut, salmon, mackerel, soy bean, chicken, banana, pork, matsutake, peach, yam, apple, gelatin

Source: JETRO (2011

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