Fisheries Journal, 15 (6), 3596-3605 (2025)
http://doi.org/10.29303/jp.v15i6.1923

TUNA LOIN HANDLING PROCESS FLOW AT PT MARITIME TIMUR PERKASA KUPANG CITY

Alur Proses Penanganan Loin Ikan Tuna di PT Maritime Timur Perkasa Kota Kupang

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(Received October 23th 2025; Accepted December 29th 2025)

ABSTRACT

The handling of tuna loin, starting from the receiving process to the packaging stage (packing), is a critical series in maintaining the quality and safety of fishery products. This study aims to describe the process flow of tuna loin handling at PT Maritim Timur Perkasa, Kupang City, starting from the receipt of raw materials to the final packaging, the methods used in this study are direct observation of the production flow, interviews with operational staff, and recording the temperature conditions and handling time of each stage. The results of this study indicate that the tuna received is immediately checked for quality and trimming and retouching are carried out to separate good meat from unwanted meat. These loin pieces are then frozen in an Air Blast Freezer to a temperature of around -40 degrees Celsius, which is then packaged using food-grade materials with a quality label and production date and then stored in cold storage at a temperature of -20 degrees Celsius until the shipping process. Handling accompanied by quality control at every stage of processing and handling will provide good quality products.

Keyword: Tuna Loin Handling Flow, Quality Control

ABSTRAK

Penanganan loin ikan tuna yang dimulai dari proses penerimaan hingga tahap pengemasan (*packing*) merupakan rangkaian kritis dakam menjaga mutu dan keamanan pangan produk perikanan. Penelitian ini bertujuan untuk mendeskripsikan alur proses penanganan loin tuna di PT Maritim Timur Perkasa, Kota Kupang, mulai dari penerimaan bahan baku hingga pengemasan terakhir, metode yang digunakan dalam penelitian ini yaitu observasi langsung alur produksi, wawancara dengan staf operasional, dan pencatatan kondisi suhu serta waktu penanganan tiap tahapnya. Hasil penelitian ini menunjukkan bahwa ikan tuna yang diterima langsung diperiksa mutu seta dilakukannya trimming dan retouching untuk memisahkan daging yang bagus dan daging yang tidak diinginkan. Potongan loin ini kemudian dibekukan di dalam *Air Blast Freezer* (ABF) hingga suhu sekitar -40 derajat celcius, yang kemudian

dikemas menggunakan bahan food-grade dengan memberikan label mutu dan tanggal produksi lalu disimpan di dalam *cold storage* yang bersuhu -20 derajat celcius hingga proses pengiriman. Penanganan yang disertai dengan pengawasan mutu pada setiap tahapan pengolahan dan penanganan akan memberikan produk yang bermutu baik.

Kata kunci: Alur Penanganan Loin Tuna, Control Mutu

INTRODUCTION

Tuna is a crucial asset in the Indonesian fisheries industry, particularly in coastal areas like Kupang, East Nusa Tenggara. Tuna loins are highly sought after by the export market due to their superior quality, and physical attributes such as attractive color, fresh odor, cleanliness, and food safety are also key factors in determining product acceptance in the global market. Increasing market demand for high-quality tuna loin products can encourage processing companies to implement stringent handling practices and standards. Tuna, a fishery product that spoils quickly due to its high moisture content and sensitivity, can cause quality deterioration. Other factors that can contribute to quality deterioration include microbial activity within the tuna, exposure to sunlight, or poor handling by company workers.

PT Maritim Timur Perkasa, a fish processing company located in Kupang City, boasts comprehensive facilities to support product quality, including a chiller room to maintain fish temperatures, an Air Blast Freezer (ABF) capable of freezing fish products, and cold storage to maintain product quality and serve as storage for products prior to shipment. These facilities enable the company to maintain the physical and microbiological quality of tuna throughout the production process.

However, not only does it have comprehensive and sophisticated facilities, but the processing process must also meet high quality standards, from receiving whole fish, through temporary cooling, cutting and trimming, freezing, to final packaging and shipping. Critical factors such as temperature changes between rooms, time lags between stages, and poor sanitation can also be major causes of quality degradation, loss of competitiveness, or even product rejection. Therefore, through an evaluation of the processing process at PT Maritim Timur Perkasa, we can ensure that each stage complies with quality and food safety standards, such as HACCP.

HACCP is a concept that aims to prevent things that can endanger consumer safety, either in the form of damage and/or contamination of food ingredients by microorganisms that can cause diseases such as salmonella, Escherichia coli, and coliform. Microorganism contamination can occur from the initial stage, namely from the receipt of raw materials, handling, storage, to distribution. This occurs due to the lack of good sanitation and hygiene. Damage or contamination is caused by employee attributes used, conditions or storage or processing, carelessness at work, as well as facilities and infrastructure that no longer meet standards and cleanliness of the work environment that is not considered so that in principle it does not meet the requirements of good and correct production methods (Hamisi, 2007) (Abdullah & Tangke, n.d.) This study is directed to identify in detail the process flow of tuna loin handling at PT Maritim Timur Perkasa, uncover potential critical points in the process, and evaluate the suitability of facilities and operational practices with international quality standards. Thus, it is expected to provide specific improvement recommendations to improve the quality and reliability of tuna loin products from this company.

METHODS

This research was conducted using a descriptive method with a mixed approach (qualitative and quantitative) implemented at PT Maritim Timur Perkasa Kupang for 1 month, starting from August 26 to September 26. This method was used to collect, review, and analyze

the process flow of tuna loin handling in accordance with the specified standards. Data were collected through direct observation of the tuna loin handling process flow from receipt to packaging, as well as measuring the temperature between rooms and the time required between stages. Interviews were conducted with production and quality staff to obtain information on operational practices and obstacles in the field. Facility data was obtained from official company documentation, including specifications for the chiller room (temperature −4 °C, with a capacity of ~3 tons), Air Blast Freezer (up to −40 °C, total capacity ~12 tons), and cold storage (−20 °C, capacity ~200 tons). The results of the analysis were carried out by comparing field data with quality and food safety standards such as HACCP to assess the extent to which company practices are appropriate and where there are still critical points that need to be improved.

RESULT

The fundamental goal of fisheries resource management is to increase production and optimize sustainable utilization, while maintaining resource and environmental sustainability. These goals must align with the national fisheries development agenda. Within the context of capture fisheries, tuna is a marine commodity with high economic value and makes a significant contribution to national fisheries activities. However, tuna is also susceptible to spoilage due to its highwater content. Deterioration in quality can also be triggered by microbial activity within the fish, direct exposure to sunlight, or improper handling. This situation requires a more standardized and hygienic handling system to ensure the safety and quality of tuna.

Quality control in tuna handling has not fully guaranteed safety and contamination. Therefore, a strategy is needed to prevent potential hazards or cross-contamination. One widely implemented system is the Hazard Analysis and Critical Control Point (HACCP). This system ensures quality by focusing on food safety aspects by identifying and controlling critical points in the production process (FDA, 1998) (Abdullah, 2020). The implementation of HACCP in the fisheries industry is crucial because fresh fishery products, including tuna, go through a long distribution chain to markets or supermarkets. If the product is damaged before reaching consumers, the company and marketing parties will lose trust. The HACCP system has long been implemented in various developed countries such as Japan and the United States as an effort to prevent contamination by dangerous microorganisms such as Salmonella, Escherichia coli, and califorms. This type of contamination usually occurs due to inadequate sanitation and hygiene practices during the raw material receipt, handling, storage, and distribution stages. Factors causing quality damage can originate from the use of inappropriate cleaning agents or preservatives, unhygienic storage containers, employee work attributes, uncontrolled storage temperatures, and infrastructure that does not meet standards. Therefore, the principles of Good Manufacturing Practices (GMP) are an important foundation for ensuring that all production processes meet quality and food safety requirements (Hamisi, 2007) (Abdullah, 2020). PT Maritim Timur Perkasa is a company located in Kupang Regency, East Nusa Tenggara, engaged in tuna processing. To maintain competitiveness in the global market, this company implements a good quality management system to ensure the quality of its products. Considering that quality is a major determinant factor in the trade of fishery products, the implementation of HACCP in all fish processing units in Indonesia is a strategic step to ensure the safety and quality of tuna products.

1. Products and Raw Materials Handling

PT Maritim Timur Perkasa's main product is tuna loin, using yellowfin tuna, albacore tuna, and bigeye tuna as raw materials, depending on consumer demand. The frozen tuna loin

is exported nationally. PT Maritim Timur Perkasa receives fresh, whole loins, which have been gutted, finned, and gill-deboned, and then filleted.

2. Process Flow for Handling Frozen Tuna Loin

The handling process at PT Maritim Timur Perkasa has implemented GMP (Good Manufacturing Practice) and SSOP (Sanitation Standard Operating Procedure). The frozen tuna loin handling process at PT Maritim Timur Perkasa is constantly monitored using a recording sheet, with the process stages shown in the figure.

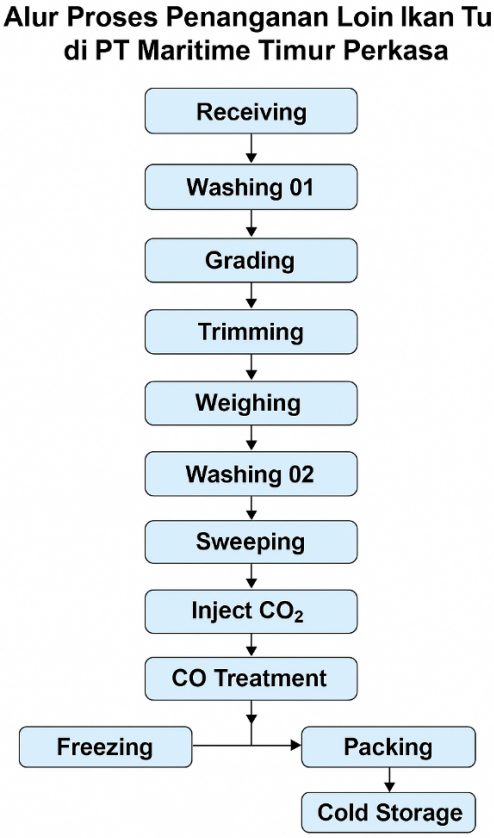

Figure 1. Tuna loin handling process flow
Source: author, 2025

a) Receiving

The crucial initial stage in the tuna loin handling process at PT Maritim Timur Perkasa is receiving. This process is crucial to ensure product quality before it proceeds to further processing. At this stage, fish arriving from the ship or supplier are placed in a receiving room where temperatures are maintained at a low level to maintain freshness. This receiving process requires temperature checking of the fish.

b) Washing 01

After the tuna loins are received and pass the initial inspection process, the first washing (Washing 01) is performed. This process uses clean, sanitized water mixed with chlorine and ice cubes. The goal is to remove dirt, mucus, blood residue, and any microbes still attached to the fish before it enters the production room. This washing stage also serves as a hygiene step before the fish enter the production room. By washing properly and in accordance with established standards, cross-contamination can be prevented, thus maintaining meat quality. In this process, the chlorine mixture used is 100 ppm.

c) Grading

Tuna loin grading at PT Maritim Timur Perkasa is a crucial step in ensuring the quality of tuna loin before it enters the processing stage. During this process, the physical condition and texture of the fish are carefully examined to differentiate between high-quality and low-quality fish. The grading process yields two types of fish: local fish and good fish. Local fish are characterized by a decline in quality and certain characteristics, such as sasi or azuki disease, which indicates holes in the fish flesh, causing it to become soft. Yake meat, which is whitened due to increased body temperature during fishing, and broken, easily detached fibers and flesh, are also found. Tumors or wounds from impacts or sharp objects can appear on the fish's body, and tinea versicolor can spread throughout the flesh. These conditions result in the fish not meeting quality standards and having a low selling value.

Conversely, fish classified as good are high-quality, characterized by freshness, even, bright red flesh, a dense texture, intact fibers, and freedom from dirt and disease. These high-quality fish are prioritized for export processing because they meet quality standards and have a high selling value. Through this grading process, companies can easily distinguish between high-quality and low-quality fish.

d) Trimming

The next stage after grading is trimming. This process separates the Tuan Loin fish based on quality, then cleans and trims the meat. Trimming removes unwanted parts, such as blood, black muscle tissue, excess fat, small bones, and any deformed or damaged meat. This process is crucial because it can affect the appearance, nutritional value, and quality of the fish. The trimming process requires highly skilled and experienced workers, as each cut must be precise without damaging the meat fibers.

Furthermore, trimming also aims to shape the loin to the desired size and shape standards for both export and local markets. The trimmed loin will appear cleaner, fresher, and visually appealing, increasing its market value and competitiveness. This trimming process maintains the quality and aesthetics of PT Maritim Timur Perkasa.

e) Weighing

After the trimming process, the tuna loins are then weighed. This weighing determines the net weight of each trimmed loin and serves as the basis for production records and quality control. The weighing process uses a highly accurate digital scale to ensure the results meet standards. The weight data obtained is then carefully recorded for company administration purposes and to meet sales requirements. This weighing also aims to align the loin size with market demand. This weighing process ensures that each fish has a clear, uniform, and consistent weight standard, facilitating packaging and distribution, and increasing consumer confidence in the fish's quality.

f) Washing 02

After weighing, the next step is washing 02. This process is carried out to ensure cleanliness and maintain the quality of the fish. This washing process uses clean water mixed with a chlorine solution with a concentration of 10-25 ppm. The purpose of this process is to reduce the number of microorganisms attached to the surface of the fish meat. This process is also important because tuna is one of the fish that is easily degraded or very sensitive to microbial contamination or unhygienic processing. This washing process can reduce the potential for the emergence of bacteria that cause spoilage, so that the fish remains fresh and maintains its quality. This washing process also aims to help remove residual blood, mucus, and dirt that may still be attached after the trimming process. By implementing a washing process in accordance with procedures and standards, it can meet international food safety requirements.

g) Sweeping

Sweeping is the process of drying the fish after washing, ensuring that the tuna loin is completely free of dirt and debris. Sweeping is typically done by wiping or rubbing the surface of the loin with a clean sponge moistened with 70% alcohol. This process not only removes any remaining mucus, blood, or tissue debris, but also helps improve the visual appearance of the loin, making it look neater and more hygienic.

Furthermore, sweeping is a key step in maintaining food quality and safety standards, as it reduces the possibility of cross-contamination from the surface of the meat. This process also ensures the loin appears fresher and ready for further processing. Sweeping also ensures that the fish's quality meets established standards.

h) Injection (*Inject CO2*)

The CO2 injection process is one of the steps taken to maintain the quality, freshness, and quality of fish before the packaging process. This injection aims to quickly lower the core temperature of the meat, thereby inhibiting or slowing the activity of microbes and enzymes that cause quality deterioration. With a stable and low temperature, the meat texture will remain firm, bright red, and retain a fishy odor. The CO2 injection process is carried out using special equipment that allows the gas to penetrate evenly into the fish. This process also aims to extend the shelf life of fish. This injection is one of the standard procedures that must be carried out to maintain and maintain the quality of fish.

i) CO Intake

After the CO2 injection process, the tuna loin is then transported to be packed into a plastic bag and undergoes further processing. This process is carried out by placing the tuna into a transparent plastic bag, then inserting a CO2 gas tube into the transparent bag. Through this tube, CO2 gas is flowed into the bag until the required volume is reached. After that, the bag is immediately sealed to keep the gas trapped inside. The CO2 gas entering the packaging will react with the myoglobin pigment in the tuna muscle tissue, forming a bright red carboxymyglobin compound. This chemical bond is stable, allowing the tuna loin to maintain its fresh appearance even when stored for longer periods in cold storage.

j) Chilling

The chilling process is one of the stages in tuna loin handling that aims to maintain the quality and freshness of the fish. Chilling is done by lowering the temperature of the fish to near freezing point, usually between 0 and 4 degrees Celsius, without completely freezing the meat. Chilling aims to slow enzyme activity and microbial growth that can cause quality deterioration, so that the texture, color, and aroma of the meat are maintained. In the chiller, tuna loins are usually arranged neatly on racks or special containers to allow cold air to circulate evenly throughout the fish. This process also helps re-solidify the texture of the meat after going through a series of previous treatments. By consistently controlling the temperature in the chiller, all fish will be maintained in accordance with established standards. In the chiller, fish are usually kept for 48 hours.

k) Retouching

The retouching process involves several steps. The initial step involves tidying up all equipment used for the retouching process and ensuring all items remain hygienic. Next, the loin is removed from the chilling room. This removal process is carried out using a vacuum system to maintain cleanliness and maintain a stable temperature. This is crucial to prevent temperature fluctuations that could degrade the fish's quality. After the CO2 removal process, the fish is removed, removing any remaining carbon monoxide previously used to maintain the color of the fish. This CO2 removal ensures the fish is safe for consumption and meets food standards.

The fish will then enter the trimming room. Trimming involves cutting and removing any unsuitable parts, such as black tissue, excess fat, or uneven meat. Trimming also ensures the meat maintains a neat appearance. After trimming, the fish will be graded, a process of grouping loins based on quality. Low-quality fish, characterized by sasi, yake, or spots, will be separated from high-quality loins. High-quality fish are characterized by a dense texture and bright red color. This process distinguishes between grades A, B, C, and local.

After the fish are graded according to their quality, they are then weighed, a process known as weighting. The neatly trimmed loins are weighed using a digital scale to determine their net weight. This data will be used for production records and to ensure that the fish meet the weight specifications requested by the buyer. After being weighed, the fish are cleaned through the 03 washing process. This washing process uses clean water mixed with a chlorine solution of 10-25 ppm and ice cubes. This aims to maintain the fish's hygiene and prevent contamination. The final stage of the retouching process is swiping, which is the process of wiping the fish with a sponge mixed with 70% alcohol. Swiping is done to protect the fish from microbial contamination and ensure that the fish are completely clean before being packaged. Once confirmed dry or free of water, the fish are placed in plastic bags to maintain hygiene and quality before being vacuum-packed.

Next, a vacuum seal is performed, a crucial step before the fish is placed in cold storage. At this stage, the loin, wrapped in plastic, is placed in a vacuum sealer to remove all air from the packaging. The vacuum sealer is held for approximately 75 seconds until the entire cavity in the plastic is completely sealed and airtight. This oxygen-free environment suppresses microbial growth, prevents fat oxidation, and preserves the color of the meat for longer. Furthermore, the vacuum sealer extends the shelf life of the fish and ensures its safety and hygiene. After the vacuum sealer, a final check is performed. This process ensures uniformity and neatness, checking for leaks or skin, and smoothing the loin.

l) Freezing

The freezing process is a crucial step in maintaining the quality and freshness of tuna loin before it is marketed. After several packaging stages, the tuna loin is placed in a freezing chamber at very low temperatures, typically reaching -35 to -40 degrees Celsius. This process is carried out for approximately 15-24 hours until all parts of the meat are frozen evenly. Rapid freezing at extreme temperatures aims to stop enzyme activity and the growth of microorganisms that cause spoilage, so that the texture, color, and nutritional content of the fish are maintained. Furthermore, the freezing process also aims to maintain the quality of the fish in the long term. With proper freezing, the fish will remain fresh without experiencing any changes.

m) Packing

The tuna loin packing process begins with the fish being removed from the frozen tuna storage room (ABF). After the fish are removed, the loins are then taken to the sorting stage. At this stage, the tuna are grouped by size, grade, supplier, and production date. This sorting process ensures that each fish meets the required category and facilitates the packaging process.

The sorted tuna loins are then placed into master cartons, large cartons that hold multiple packages of fish for neatness, ease of organization, and safety during storage and shipping. Labels are then attached with important information such as product type, size, weight, grade, supplier, and production date. The packaged tuna loins are then weighed before being transferred to the storage room.

The next step is the sampling process, which involves taking product samples for quality testing. Sampling is conducted periodically to ensure that packaged products meet food safety standards and export quality requirements. The sampling results form the basis for the final assessment of the product's suitability for marketing. As a final step, the tuna loin product, which has undergone all these processes, is then stored in Cold Storage (CS). Storage at low temperatures aims to maintain the stability of the product's quality, freshness, and texture until it is distributed to domestic and international markets. With this procedure, the company can ensure that the product continues to meet applicable quality standards.

DISCUSSION

The results of the study indicate that the tuna loin handling process at PT Maritim Timur Perkasa has been carried out systematically and in accordance with the principles of Good Manufacturing Practices (GMP) and Sanitation Standard Operating Procedure (SSOP). Each stage, from raw material receipt to packaging, has implemented a quality control system that complies with standards, thereby maintaining the physical quality and food safety of the product. These results show strong agreement with previous studies conducted by Nento (2015) and Abdullah & Tangke (2021), both in terms of procedure implementation and the HACCP-based quality control approach. In general, the process flow implemented at PT Maritim Timur Perkasa is similar to the results of Nento's (2015) study examining yellowtail tuna packaging at CV Cahaya Mandiri Gorontalo.

In the study, the tuna processing stages include receiving raw materials, washing, weighing, cutting, trimming, freezing with an Air Blast Freezer (ABF), packaging, and storage. Similarly, at PT. Maritim Timur Perkasa, the processing stages begin with receiving, washing, grading, trimming, chilling, retouching, CO2 injection, freezing, and packing. This similarity indicates that the company has adopted tuna processing industry standards commonly applied to export-oriented companies. Furthermore, temperature control is a major concern, with PT Maritim Timur Perkasa maintaining strict production room temperatures, such as at -4°C in the chiller, -40°C in the freezing room, and -20°C in the cold storage. This temperature control aligns with the research findings of Nento (2015) which emphasizes the importance of a cold chain system to maintain the quality of tuna meat.

Furthermore, the results of this study also demonstrate consistency with the findings of Abdullah & Tangke (2021) regarding the implementation of the HACCP (Hazard Analysis and Critical Control Point) system in the tuna processing industry. Abdullah & Tangke emphasized that HACCP implementation plays a crucial role in identifying and controlling critical points during the production process to prevent biological, chemical, and physical contamination. At PT Maritim Timur Perkasa, this principle is implemented through a series of quality control procedures such as checking the temperature and freshness of the fish at the receiving stage, using chlorinated water (100 ppm during the first wash and 10–25 ppm during subsequent washes), and spraying 70% alcohol during the sweeping process to suppress microbial activity. Furthermore, the temperature of the production and storage rooms is recorded and monitored daily to ensure the stability of the handling process. This demonstrates that the company has implemented a HACCP-based quality control system consistently and comprehensively.

In addition to its consistency with previous research, this study also demonstrates a technological innovation not found in previous studies, namely the application of CO2 and CO_2 gas injection during the pre-packaging stage. This process is carried out to maintain the bright red color of tuna meat by forming the compound carboxymyoglobin, which can maintain a fresh appearance and prevent fat oxidation. This technology is an improvement on the modified atmosphere packaging (MAP) system, which can extend the shelf life of products without changing the physical and sensory characteristics of the meat. This innovation is a significant

differentiator from the results of research by Nento (2015) and Abdullah & Tangke (2021), both of which did not discuss the application of modified atmosphere technology to tuna loin handling.

Furthermore, the quality assessment (grading) system implemented at PT Maritim Timur Perkasa also demonstrates strict export standards. Tuna loin products are classified based on meat quality, color, texture, and cleanliness into grades A, B, C, and local. Only grade A meets export criteria due to its uniform bright red color, dense texture, and freedom from defects or blemishes. This grading system aligns with research by Nento (2015), which emphasized the importance of quality sorting as a determining factor in the success of fishery product exports. Furthermore, the company routinely samples frozen products to ensure quality compliance with international food safety standards as recommended in the HACCP system (Abdullah & Tangke, 2021).

The implementation of GMP and SSOP at PT. Maritim Timur Perkasa has also demonstrated consistency in maintaining sanitation and cleanliness of the work environment. Every worker is required to wear hygienic attributes, the production area is cleaned regularly, and all equipment is sterilized after use. This procedure supports the principles of Good Handling Practices (GHP) recommended by the FAO (1998) and reinforced by Abdullah & Tangke (2021), which state that clean and hygienic processing practices are key to maintaining fish quality and preventing cross-contamination. Overall, the results of the study indicate that PT. Maritim Timur Perkasa has successfully integrated the quality system from previous research with new, more modern and efficient innovations. While Nento's (2015) research focused on packaging and refrigeration, and Abdullah & Tangke's (2021) on HACCP critical point control, this study combines both into a single, comprehensive and measurable production system. Consistent cold chain implementation, strict sanitation, and the use of CO2/CO_2 gas injection technology make PT Maritim Timur Perkasa's tuna loin handling process superior in terms of efficiency, shelf life, and product quality. This demonstrates that the company's processing system meets international standards and is capable of supporting the competitiveness of Indonesian tuna products in the export market.

CONCLUSION

The tuna loin handling process carried out at PT Maritim Timur Perkasa has been carried out systematically and in accordance with the standards of the fishery product processing industry. The stages include receiving raw materials, sorting, weighing, washing with chlorinated water, trimming, freezing, packaging, and storage in cold storage. The application of the principles of Good Handling Practices (GHP) and Good Manufacturing Practices (GMP) can guarantee the quality, hygiene, and safety of the product. In addition, the discipline of the workforce in implementing cleanliness procedures and continuous quality control also supports the company's success in producing tuna loin products that meet quality standards. Consistent temperature control and sanitation have been proven to maintain the physical and organoleptic quality of tuna loin, so that the resulting product meets export standards.

ACKNOWLEDGEMENT

The author would like to thank all parties involved in the preparation of this journal. Special thanks are extended to the supervisor for his guidance and direction, and to those who provided references and literature sources that served as the basis for the writing and analysis of this journal. Hopefully, this journal will be beneficial and serve as a useful reference for the development of science in the field of fisheries.

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