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Quality Control of Skipjack Fish on Purse Seine Vessels at PPS Kutaraja

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ABSTRACT: The research aims to analyze the handling system for skipjack tuna since the fish are caught until sold at the Kutaraja Ocean Fisheries Port (PPS) fish auction site (TPI). The researcher used descriptive methods, organoleptic tests, scoring analysis, and np control charts as study methods. The research results show that the handling of skipjack tuna at the Kutaraja PPS has yet to be optimal, which has an impact on reducing the quality of the fish. The handling process that did not comply with the established procedures occurred from when the fish was put on the boat until it landed at PPS Kutaraja. The results of organoleptic tests, scoring analysis, and np control charts indicated a decrease in fish quality during the handling process. All ships based at PPS Kutaraja are not equipped with freezer cooling machines. The cooling process only relies on a very limited amount of ice blocks to maintain the quality of the fish during the fishing operation. Very limited use of ice cubes will trigger a decline in fish quality. Increasing hatch room temperatures also cause a significant decrease in organoleptic values and faster rigor mortis times for fish.

KEYWORDS: Fish Handling, Np Control Charts, Organoleptic Tests, Scoring Analysis, Skipjack Tuna

I. INTRODUCTION

Kutaraja Ocean Fisheries Port (PPS) is the center for capturing fisheries activities and supplies the largest marine fish in Aceh Province. According to UPTD PPS Kutaraja (UPTD PPS Kutaraja, 2022), the total production of marine fish landed in 2022 at PPS Kutaraja will reach 23,759 tons. Most of it was skipjack tuna (Katsuwonus pelamis), reaching 7,263 tons from purse seine catches (Putri, 2022). Referring to UPTD PPS Kutaraja data (UPTD PPS Kutaraja, 2022), the number of purse seine vessels at PPS Kutaraja reached 269 units, or around 53% of the total fishing vessels actively operating.

Skipjack tuna is classified as a highly perishable type of fish. Mahaliyana (Mahaliyana et al., 2015) informed that skipjack fish is rich in chemical compounds, such as iron (Fe), copper (Cu), and zinc (Zn). Nevertheless, Chen et al. (Chen et al., 2010) added that the histamine content in the body of skipjack tuna is higher than other pelagic fish, causing the quality of skipjack tuna to decline more quickly if left at room temperature. According to him, histamine compounds are formed from the decarboxylation of free histidine. Efforts to improve fish quality cannot be carried out. The only way to maintain the quality of skipjack tuna is through a good handling process (Huda et al., 2013).

The results of direct observations at TPI (fish auction place) PPS Kutaraja show that the quality of skipjack tuna is generally no longer fresh. The eyeballs are slightly concave in shape, the gills are slightly grayish, the mucus layer looks cloudy, the texture of the flesh is slightly soft, and the smell is sour. Referring to SNI 2729 (Organoleptic or Sensory Testing Instructions, 2013), fish is said to be fresh if the eyeballs are convex, the gills are dark red or reddish brown, the mucus layer is clear, the flesh is very bright in color, the texture of the flesh is dense, and smells fresh. Metusalach et al. (Metusalach et al., 2014) state that internal and external factors greatly influence fish quality. The type and biological condition of the fish influence internal factors. The external factors are caused by the method of death, duration of death, handling method, and fish handling facilities.

The problem of decreasing the quality of skipjack tuna in PPS Kutaraja is caused by the absence of a good handling strategy formulated from when the fish are caught until they are bought and sold at TPI. The direct observations showed that the handling of skipjack tuna was very poor, both when the fish were lifted onto the boat, stored in the cold room, unloaded from the cold room, and sold. Ignoring poor fish handling will harm fishermen and the management at PPS Kutaraja. Mallawa et al. (Mallawa et al., 2014) stated that skipjack tuna is a commodity caught for export. Therefore, good handling is very important and implemented. According to Sahubawa (Sahubawa, 2018), four stages of handling that must be considered to maintain good fish quality start from handling when the fish is caught and lifted onto the ship's deck, storage in the hold, duration of fishing operations, unloading, and transportation on land. Herawanty et al. (Herawanty et al., 2021) stated that the handling and treatment of fish on board and the ship's travel time from when the fish is caught until it is sold at TPI greatly influence the decline in fish quality.

First, the solution to maintaining good fish quality can be formulating a control strategy model. The method is to identify the quality handling system for skipjack tuna on purse seine ships from the time the fish is lifted onto the ship, before it is put into the cold room, before unloading, and before it is bought and sold at TPI PPS Kutaraja. Then, the consistency of the quality of skipjack tuna from when the fish is put on the boat until it lands at the Kutaraja PPS must also be analyzed.

Literature that discusses handling the quality of fish, starting from capture to sale at TPI, has yet to be found. Several studies only discuss fish quality handling from TPI ports to marketing. Afiyah (Afiyah, 2019) studied the role of handling on fish quality at the Blanakan Beach Fishery Port (PPP). During the distribution chain to consumer areas, Sakina et al. (Sakina & Purwangka, 2021) examined the risk priorities for handling and transporting tuna at the Pondok Dadap coastal fishing port (PPP), Trilaksani (Trilaksani et al., 2011) reviewed the development of an integrated quality management system for export tuna products, Sari et al. (Sari, 2019) examined improvements in the handling of caught fish at the Palabuhanratu Indonesian fishing port (PPN), and Mustaruddin et al. (Mustaruddin, 2022) discussed the sanitation aspects of tuna landing at the Bungus ocean fishing port (PPS), West Sumatra. All literature is used as input in analyzing research results

II. MATERIALS AND METHODS

A. Time and Place

The research was conducted between 06-30 November 2023 at PPS Kutaraja, Banda Aceh City, Aceh Province. (figure1).

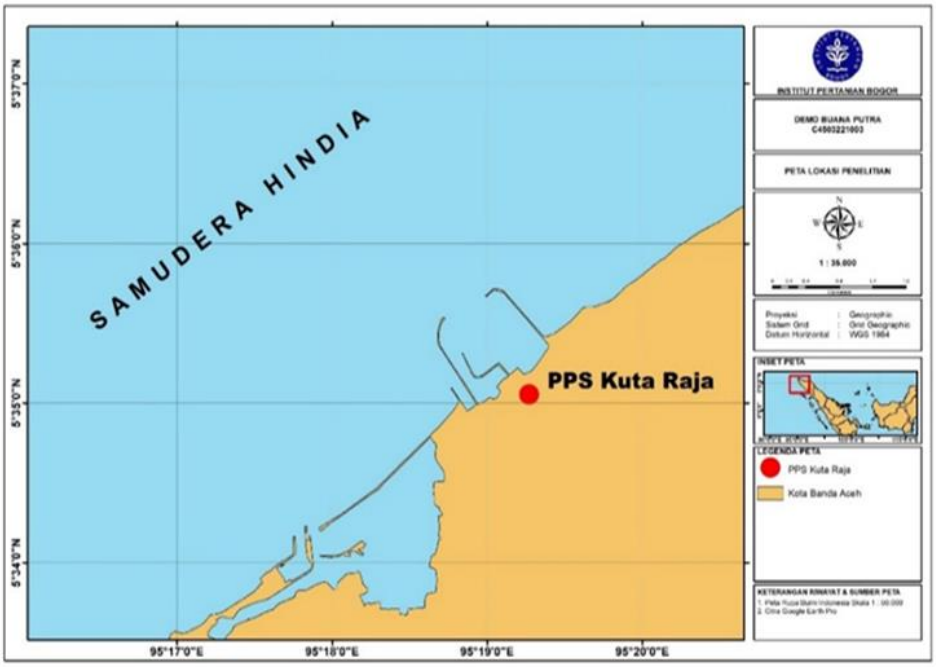

Figure 1. Map of the Research Location.

B. Tools and Materials

The research material only consisted of skipjack tuna. The tools used consist of a thermometer to measure the temperature of the cooling room, a camera, and an organoleptic questionnaire as a reference in carrying out the test.

C. Method of collecting data

Types and data collection using two methods, namely direct observation and literature study. Direct observation aimed to identify the handling system for skipjack tuna on purse seine vessels from when the fish were loaded onto the vessel, before being put into the cold room, before unloading, and before being bought and sold at TPI PPS Kutaraja. The samples were 25 skipjack tuna (Katsuwonus pelamis) for each stage. All fish samples were taken from 14 purse seine vessels using accidental sampling techniques.

D. Data analysis

All data was analyzed using four methods. Each is a descriptive method, organoleptic test, scoring analysis, and np control chart. Descriptive methods were used to analyze the handling system for skipjack tuna on purse seine vessels from when the fish were put on board until they were bought and sold at TPI PPS Kutaraja. Furthermore, the organoleptic test is aimed at analyzing the quality of the fish, scoring analysis to calculate the average value of the organoleptic test results and np control chart analysis to assess the consistency of the quality of skipjack tuna at each stage. Organoleptic assessment of fish samples refers to SNI 2729:2013 concerning instructions for organoleptic and sensory testing (Organoleptic or Sensory Testing Instructions, 2013).

III. RESULTS AND DISCUSSION

Post-Catch Fish Handling

The initial handling process for skipjack tuna carried out by Kutaraja fishermen is divided into two stages: lifting from the sea and releasing the fish from the net. Removing the fish usually takes time between 40-50 minutes. The time to release the fish depends on the number of fish caught. All the fish caught were thrown onto the ship's deck and left to flounder until they died in direct sunlight.

Handling skipjack tuna is not quick and exposed to direct sunlight. It is best to handle fish quickly and without exposure to sunlight, starting from the time the fish is lifted from the sea until it is put on board. The aim is to maintain the quality of fish in accordance with the desired standards (Ismanto et al., 2013). Sahubawa (Sahubawa, 2018) stated that handling time greatly influences the decay process. The process of handling fish must be carried out as quickly as possible to avoid deterioration in fish quality (Deni, 2015). Rahmatang et al. (Rahmatang et al., 2019) stated that fish bodies contain very high levels of water and nutrients, so fish easily experience deterioration in quality. Fish will rot quickly if the handling process takes too long.

Fishermen's negligence and mistakes in handling fish will result in physical damage. For example, skin peels and bruises due to squeezing (Soepardi et al., 2022). The boat deck and equipment that will be used in the fish handling process should be cleaned first to reduce bacterial contamination of the fish's body (Adawyah, 2007).

Handling Fish in the Refrigerated Room

Handling of skipjack tuna while in the refrigerator is carried out by Kutaraja fishermen using the ice method. The ice used is in the form of large blocks that have been crushed. The cooling room is also not equipped with a room temperature measuring device. The results of the observations by measuring the hatch's temperature were found to be between 18-21°C. As a result, the fish are not controlled properly while they are in the refrigerator.

The caught fish must be put in a refrigerated room with a very low temperature so that the quality of the fish remains good. Sulistijowati et al. (Sulistijowati et al., 2011) revealed that a good temperature for skipjack tuna is around 0–6 °C. Rossari et al. (Rossarie et al., 2019) said that unstable temperatures can result in a decrease in fish quality. Gram and Dalgaard (Gram & Dalgaard, 2002) added that microbial growth in fish can be hampered by the use of low temperatures. Meanwhile, if you use ice, the best method for using ice for skipjack tuna should be a ratio of 1:1, which is better than ice with a ratio of 1:2 based on pH value, sensory analysis, and temperature (Litaay et al., 2017).

Handling Fish Before Unloading

Handling skipjack tuna before unloading it in the harbor pond is divided into two stages: at night and in the morning. Unloading activities at night are usually carried out on small vessels. Demolition activities took place between 19.00-20.30 WIB. The unloading in the morning is only carried out by large ships that arrive at the port in the evening. The demolition time takes place between 07.00-09.00 WIB. Usually, large ships arrive at night to carry out their unloading activities in the morning around 07.00-09.00 WIB. The unloading process begins with taking the fish from the cold room. Next, the fish are transported using rattan baskets and placed directly on the TPI floor with a tarp. Rattan baskets are used repeatedly without first going through a sterilization process.

Handling caught fish also requires paying attention to the container used. Clean and sterile containers are highly recommended for transporting fish because they greatly affect the quality of the fish. Pane (Pane, 2008) stated that using unhygienic baskets will have a negative effect on fish because the fish will easily be contaminated by bacteria. Fish quality According to Irinato and Giyatmi (Irinato & Giyani, 2009), fish quality is influenced by how it is handled and the sanitation and hygiene of the facilities used during handling.

Handling Fish Before Buying and Selling at TPI

Handling skipjack tuna at TPI involves two methods: fishermen put the fish in a basket and place it on the TPI floor with a tarp. The condition of the tarpaulin used is usually not sterile because the surface of the tarp is only cleaned using plain water. Fish handling at TPI is made worse by poor basket placement. The basket is dropped directly onto the floor, causing physical damage to the fish. Fishermen generally need to pay more attention to the cleanliness of TPI. Fish handling at the fish landing center needs to comply with established procedures. The fishermen focus on quickly unloading the fish from the cold room so that the fish will immediately enter the buyer's bag or basket.

Handling fish at fish landing centers is actually a very important process to pay attention to in order to ensure that the quality of the fish is guaranteed. Unhygienic baskets and mats, as well as poor working conditions, can accelerate the growth of mold on fresh fish meat (Palawe et al., 2016).

Organoleptic Test of Skipjack Fish on Purse Seine Vessels

Poor handling methods can affect the freshness quality of skipjack tuna. The quality of fish can generally be determined by analyzing it through organoleptic tests. The test is carried out in four stages, namely, from when the fish is lifted onto the ship, before it is put into the cold room, before unloading, and before buying and selling at TPI PPS Kutaraja. The test focused on the eyes, gills, body surface mucus, meat, smell, and texture based on SNI 2729:2013. The organoleptic test results are presented in Figures 2-7.

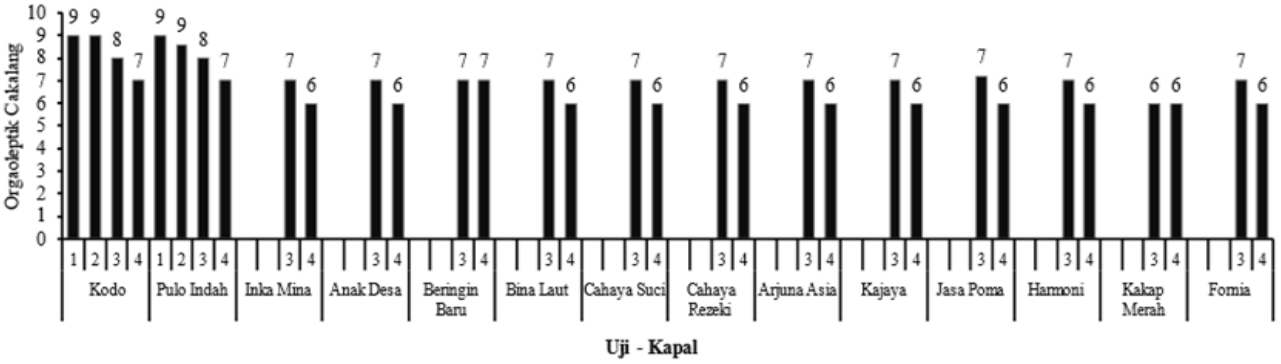

Figure 2. Organoleptic test values for skipjack tuna eyes

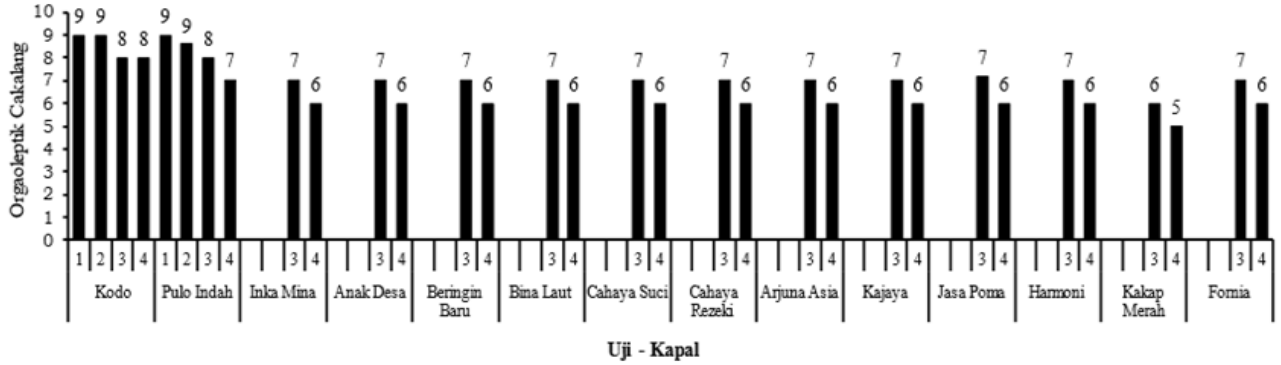

Figure 3. Organoleptic test values of skipjack tuna gills

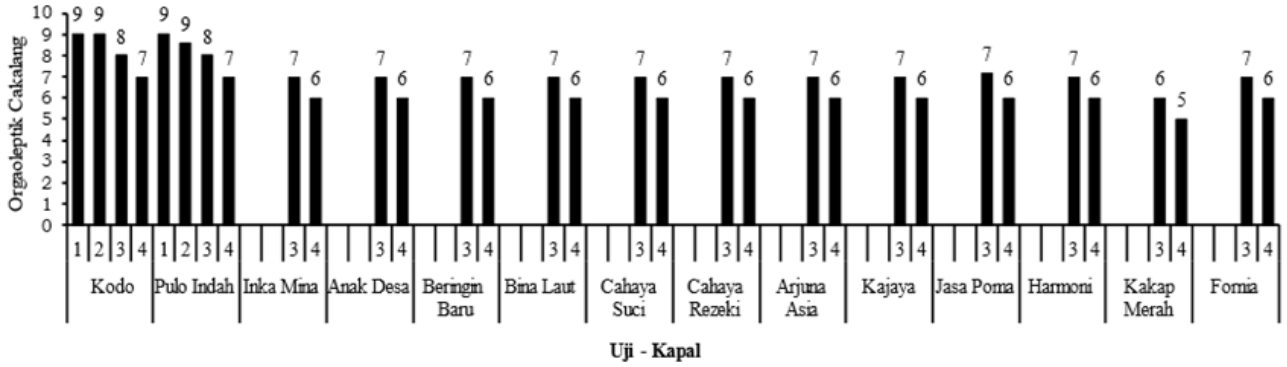

Figure 4. Organoleptic test values of body surface mucus of skipjack tuna

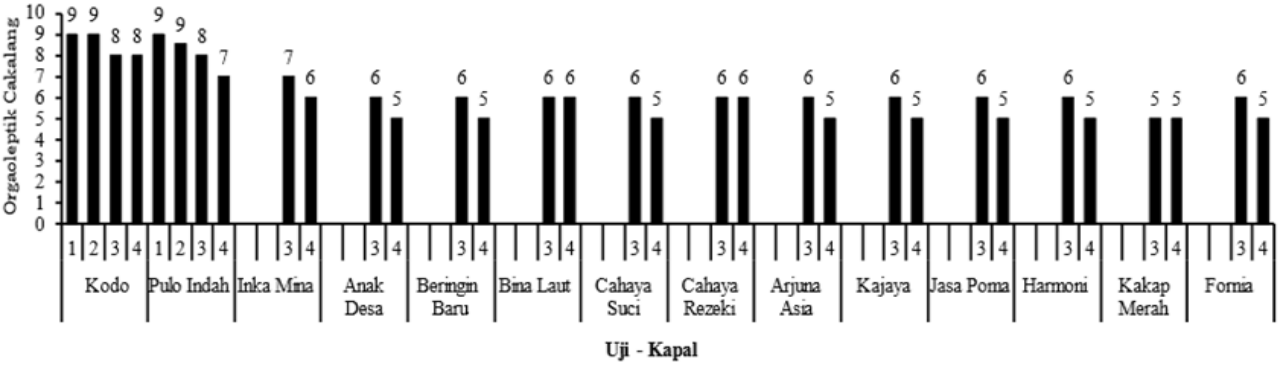

Figure 5. Organoleptic test values of skipjack tuna meat

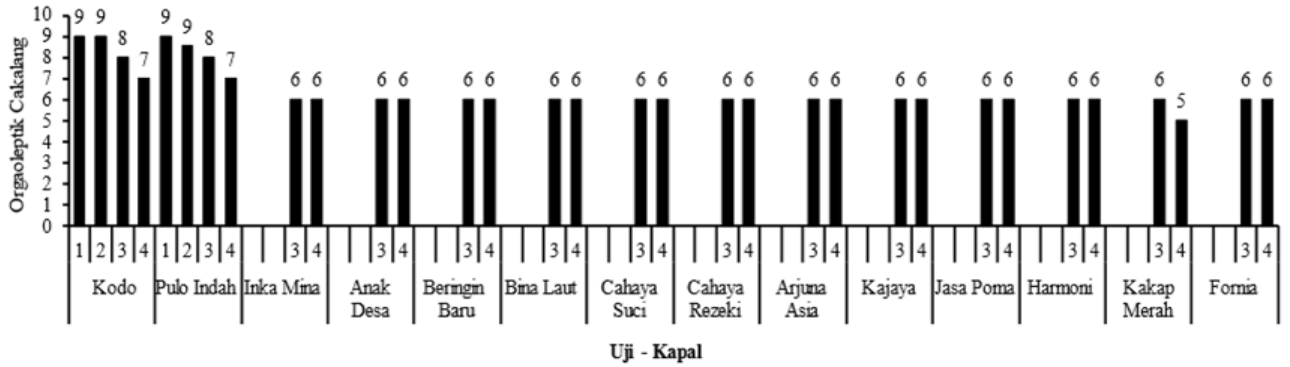

Figure 6. Organoleptic test value of skipjack tuna odor

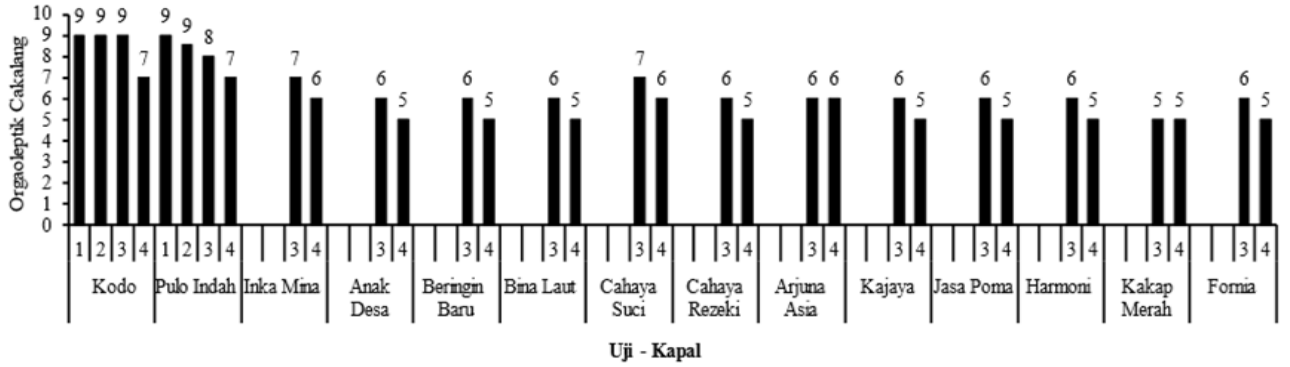

Figure 7. Organoleptic test values for the texture of skipjack tuna

Based on Figures 2-7, the organoleptic test results of the fish obtained by vessels 1, 2, 3, and 14 were in poor condition. The main cause is that all purse seine vessels based at PPS Kutaraja are not equipped with freezer cooling machines. The cooling process only relies on a very limited amount of ice blocks to maintain the quality of the fish during the fishing operation. Very limited use of ice cubes will trigger a decline in fish quality. The increasing temperature of the hold causes a significant decrease in organoleptic values and a faster rigor mortis time. The rapid process of autolysis and fish decay by bacteria will also increase. However, skipjack tuna caught by vessels 1 and 2 showed much better organoleptic values than vessels 3-14. The fishing operation time for vessels 1 and 2 is only 1 – 2 days, or shorter than vessels 3-14, which is 5-20 days, so the fish is not stored in the refrigerator for too long, or the spoilage process does not last long.

In connection with organoleptic testing, Green-Petersen and Hyldig (Green-Petersen & Hyldig, 2010) stated that duration and temperature are determining factors for fish freshness, which can be determined from organoleptic value. The results of the study by Herawanty et al. (Herawanty et al., 2021) proved that the ice-free cooling method with a storage time of 12 hours resulted in the organoleptic value of the eyes and gills of skipjack tuna decreasing as the storage time increased. Therefore, it is better to use a freezer in the cold room compared to a storage room with ice. Freezer-cooled ships, according to Setiawati et al. (Setiawati et al., 2016), usually have much greater storage capacity than ice-cooled purse seine vessels.

Fishermen's negligence and mistakes in handling fish also play a major role in reducing the quality of skipjack tuna. The solution is to provide fishermen with awareness about the importance of maintaining the quality of fish so that the selling price remains high. Fishermen's skills in handling fish must also be further improved. According to Beverly (Beverly, 2011), the three keys to maintaining fish quality are handling fish properly, cooling fish quickly and maintaining the cold chain, and maintaining good sanitation. Zulfikar (Zulfikar, 2016) added that good and appropriate handling methods will produce products that are high quality, not easily damaged, and safe for consumption.

Scoring Analysis of Skipjack Fish on Purse Seine Vessels

The results of the scoring analysis for skipjack tuna at PPS Kutaraja were obtained from the average value of the organoleptic test. Scoring values were applied to 14 purse seine vessels with different treatments. The two ships were subjected to 4 stages of testing, starting when the fish were loaded onto the ship, put into the cold room, dismantled, and traded at TPI PPS Kutaraja. The other 12 ships were subjected to 2 stages of testing, namely before dismantling and before being traded at TPI PPS Kutaraja. The scoring analysis is based on SNI 2729:2013, which focuses on the eyes, gills, body surface mucus, meat, smell, and texture. The results of organoleptic testing are presented in Figure 8. Skipjack tuna is considered good quality if it gets a score above 7. The quality of fish catches can be assessed through scoring. Scoring shows the quality of the fish when it is caught, put on board the ship, and before it is put into the cold room. Sogn-

Grundvag et al. (Sogn-Grundvåg et al., 2022) argue that catches using purse seine fishing gear tend to be better compared to several other types of fishing gear because the fishing process is fast.

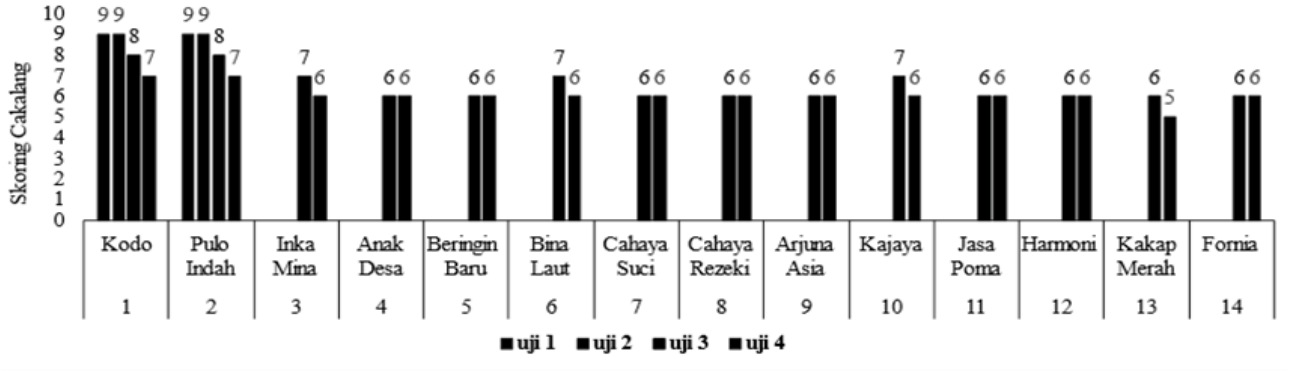

Figure 8. Results of scoring analysis for skipjack tuna

Based on Figure 8, ship 1 shows the results of test 1 with a value of 9, test 2 (8), test 3 (8), and test 4 (7). Ship 2 received test 1 results worth 9, test 2 (9), test 3 (8), and test 4 (7). The tests on ships 3-12 and 14 concluded that the results of tests 1 and 2 got the same value, namely 6. A different value occurred on ship 13, with the value of test 1 being six and test 2 (5) experiencing a decrease. In general, the quality of skipjack tuna caught by all vessels decreased in value in the third and fourth tests. In general, the quality of skipjack tuna caught by all vessels decreased in value in the third and fourth tests. Afiyah et al. (Afiyah, 2019) stated that fish quality decreases with increasing fishing areas and fishing time. According to him, Indonesia is in a tropical area with high and fluctuating temperatures, so microbial growth occurs quickly during cold chain handling of fish. Dityanawarman et al. (Dityanawarman et al., 2015) concluded that temperature affects growth rate and histamine production. Lehane and Olley (Lehane & Olley, 2000) added that increased histamine production in fish is caused by improper handling temperatures, so compounds producing histidine decarboxylase (HDC) bacteria or histamine-producing bacteria (HPB) grow abundantly. The solution, according to Wibowo et al. (Wibowo et al., 2017), is to provide good fish storage facilities so that the quality of the fish is maintained.

np Control Map of Skipjack Fish Quality on Purse Seine Vessels

Controlling the quality of caught fish is not aimed at improving the quality but at maintaining the quality so that it approached its fresh condition when it was just caught. The way to do this is to prevent damage to the fish's body. The observed quality deterioration can be seen from several types of quality defects, which can be detected sensory by looking, feeling, and pressing the fish based on SNI 2729:2013. The results of the types of quality defects in skipjack tuna at PPS Kutaraja can be seen in Figure 9-10.

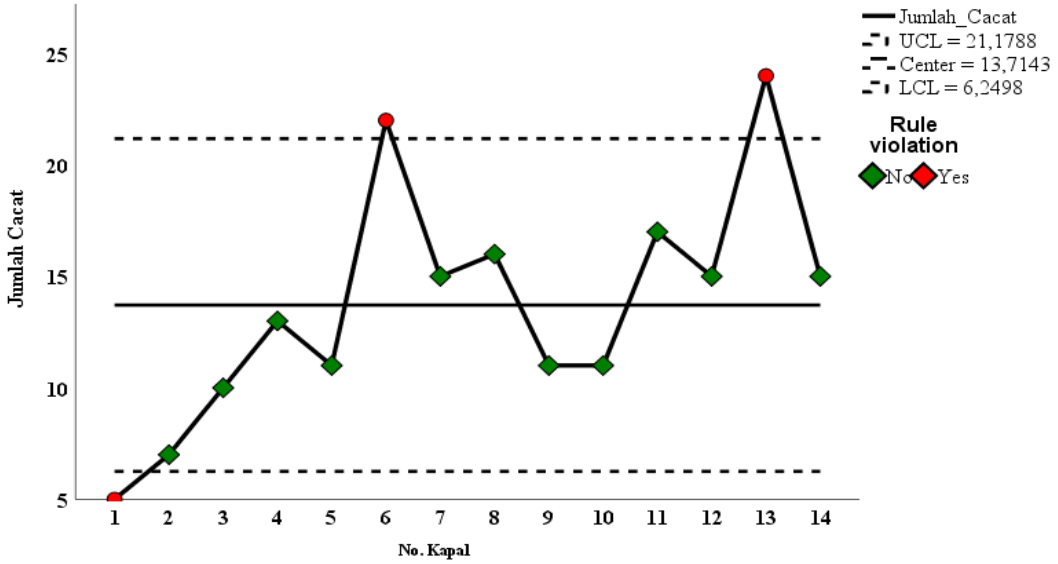

Figure 9. NP control chart for handling skipjack tuna before dismantling

Figure 9 shows the center line np or CL has a value of 13.17143. The upper limit of the np control chart is 21.1788, and the lower limit of the np control chart is (6.2498). The value of the number of defects in each process in the np

control chart must not exceed the upper limit value and the lower limit value in order to be categorized as controlled. Based on Figure 8, the number of disabled fish caught by three purse seine vessels is beyond control. Ship 1 is below the LCL, while Ship 6 and Ship 13 are above the UCL.

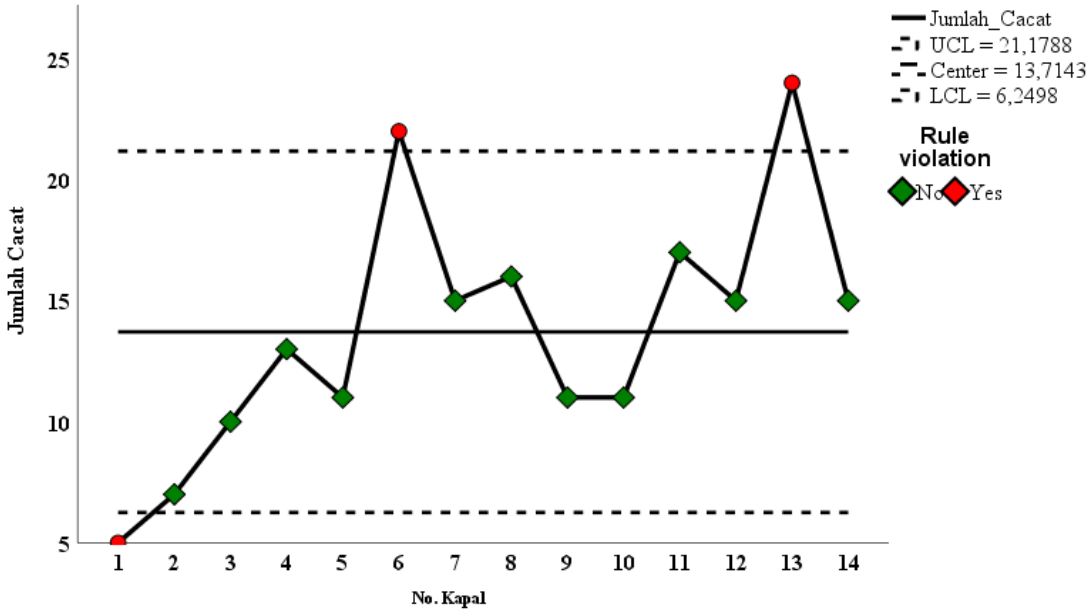

Figure 10. NP control map for handling skipjack tuna before being traded at TPI

Based on Figure 10, 4 vessels produced fish with a number of defects beyond control; respectively, vessels 1 and 2 were below the LCL, and vessels 6 and 14 were above the UCL. The research results showed that as many as four vessels produced fish with defects beyond control. Defects due to physical impact can occur starting from capture and during transportation (Lestari et al., 2015). According to Tolstorebrov et al. (Tolstorebrov et al., 2016) and Hastrini et al. (Hastrini et al., 2013), the types of defects that commonly occur in caught fish include scratched skin, less chewy flesh, pale flesh color, faded eyes, and cloudy mucus. Litaay et al. (Litaay et al., 2017) stated that eye damage was caused by a lack of ice in the hold during the storage process, which increased the rate of bacterial growth in fish. Therefore, the application of ice during the handling of fish on board must be carried out continuously. Kusumah et al. (Kusumah et al., 2015) prove that melting ice occurs due to inadequate handling and provision of ice so that cold temperatures cannot be maintained and actually accelerate the melting.

CONCLUSIONS

The handling of skipjack tuna at the Kutaraja Ocean Fisheries Port (PPS) has not met the expected standards, so the quality of skipjack tuna has decreased. The main cause is fishermen's negligence and errors in handling since the fish is lifted onto the boat before being put into the cold room, before unloading, and before being bought and sold at TPI PPS Kutaraja, which results in physical damage. The results of organoleptic tests, scoring analysis, and np control charts showed a decrease in fish quality during the handling process. All purse seine vessels based at PPS Kutaraja are not equipped with freezer cooling machines. The cooling process only relies on a very limited amount of ice blocks to maintain the quality of the fish during the fishing operation. Very limited use of ice cubes will trigger a decline in fish quality. The increasing hold temperature causes a significant decrease in organoleptic values and a faster rigor mortis time for fish.

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