

# IDENTIFICATION OF FRESHNESS LEVELS AND PHYSICAL DAMAGE OF SEVERAL FISH SPECIES AT CIROYOM FISH MARKET IN BANDUNG CITY, WEST JAVA

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## ABSTRACT

*The freshness and physical condition of fish are crucial indicators of quality and safety for consumption. This study aims to identify the freshness levels and physical damage of several fish species available at the Ciroyom Fish Market in Bandung City, West Java. Fish freshness was assessed based on sensory evaluation, including eye clarity, gill color, surface mucus, flesh, odor and body texture, while physical damage was examined through visual inspection of scales, fins, and overall body integrity. The results showed that fish observed in the morning had higher freshness levels ( $\geq 42$ ) and were classified as fresh, whereas those observed in the afternoon had lower freshness levels ( $\leq 42$ ) and were classified as not fresh. Additionally, a significant proportion of fish exhibited various forms of physical damage, likely due to handling, transportation, and storage conditions. These findings highlight the importance of proper handling practices to maintain fish quality and freshness.*

**Keywords:** *fish freshness, physical damage, Ciroyom Fish Market, sensory evaluation, fish quality*

## 1. INTRODUCTION

Fish is one of the most important sources of animal protein for human life (Yuliana, 2017). However, fish can easily lose freshness and deteriorate after being harvested. Freshness plays a crucial role in determining the quality of fish for consumption, but unfortunately, it cannot be improved—only preserved [1]. Therefore, to maintain the quality of fish and ensure it remains safe for consumption, prompt handling is necessary to preserve its freshness and prevent physical deterioration [2].

Fresh fish preserves its natural characteristics, such as appearance, odor, taste, and texture, which closely resemble its state when it was alive. The fish freshness can be assessed using organoleptic evaluation. To guarantee the quality and safety of fresh fish, both domestically and internationally, it must meet the requirements set by the Indonesian National Standard (SNI) Number 01-2729.1 of 2006, which outlines the specifications for fresh fish. This standard evaluates various parts of the fish, including: 1) eyes, 2) gills, 3) surface mucus, 4) flesh (colour and appearance), 5) odor, and 6) texture. Each of these indicators has specific criteria and weightings based on observed conditions. Fresh fish must score a minimum of 7 for each indicator, with a total score ranging from 42 to 54. Fish with a total score below 42 are considered not fresh [3].

In addition to freshness, physical damage to fish also affects its quality and market value. Improper handling, such as cuts or bruises, can soften the texture of fish. Physical damage can occur during the catching process, transportation, or even during sale at the market. Such damage can increase the activity of proteolytic enzymes, which negatively affect fish quality [4].

Previous research has identified several parameters for assessing fish freshness, including odor, flesh texture, skin color, and eye clarity [5]. Physical damage, such as wounds or injuries to the fish's body, often indicates improper handling during distribution and sale [6]. Such physical damage can lower the market value of

fish and reduce its shelf life, which can negatively impact consumer satisfaction and food safety [7] Therefore, it is important for fishermen, distributors, and retailers to monitor factors that cause physical damage to fish. Proper handling can reduce physical damage, preserve fish quality, and maintain its nutritional value.

The Ciroyom Fish Market in Bandung City plays a critical role in the fish trade, relying heavily on the quality of the fish sold. This market is one of the most visited by the public due to its affordable prices and diverse selection of fish. The Ciroyom Fish Market sells various types of fish, both freshwater and saltwater, including skipjack tuna, Spanish mackerel, and mackerel. Saltwater fish are typically more expensive than freshwater fish, which may impact how long they stay in the market and, consequently, their freshness. Time is a key external factor influencing fish freshness; improper handling can accelerate the deterioration of fish over time [8]. Fresh fish has a short shelf life due to its susceptibility to microbiological, enzymatic, and oxidative deterioration. Therefore, proper handling and storage are essential to slow down the spoilage process and ensure the safety and quality of the fish for consumption [9].

Currently, there is no in-depth data or research regarding the freshness levels and physical damage of fish sold at the Ciroyom market. Therefore, research is needed to identify these conditions in order to improve the quality of fish trade at the market. This study aims to identify the freshness levels and physical damage of several types of fish sold at the Ciroyom Fish Market, with the hope of providing useful information for both traders and consumers and increasing awareness about the importance of proper fish management in fish trade.

## 2. Materials and Methods

This research was conducted at the Ciroyom Fish Market, Andir District, Bandung City, West Java, on October 5, 2023. The tools used in the research were writing instruments, trays, cutters (knives), and chopping boards.

The fish samples used in this study included *Euthynnus pelamial* (*Ikan Tongkol*), *Scomberomorus sommerson* (*Ikan Tenggiri*), *Rastrelliger sp.* (*Ikan Kembung*), *Caesio cuning* (*Ikan Ekor Kuning*), and *Lutjanus malabaricus* (*Ikan Kakap Merah*) which were purchased from the Ciroyom Market.

The method used in this research is a survey method. The sampling technique was determined using Purposive Sampling, which is a sampling method conducted intentionally to ensure that the research objectives are optimally achieved [10]. Sampling was done twice on the same day: in the morning around 07:00 AM when the fish arrived, and again at 12:00 PM in the afternoon, to observe any physical changes that occurred in the fish more accurately. The research samples will be analyzed physically (morphologically) to assess and describe the fish's freshness level based on SNI 01-2729.1-2006 regarding Fresh Fish Specifications, types of physical damage, and the factors causing them. The observed variables include: Fish Freshness, Fish Damage, and Factors Causing Fish Damage.

The identification of fish freshness levels was conducted using an organoleptic assessment sheet based on SNI 01-2729.1-2006 regarding Fresh Fish Specifications. This organoleptic assessment aimed to determine the freshness level of fish at Ciroyom Market in Bandung City, involving three trained panelists from Padjadjaran University. The observed parameters included eye color, gills, mucus, flesh, odor, and texture. The assessment results were recorded on a score sheet completed by the three panelists, using a scale of 1 to 9. Fish were categorized as fresh if they received a minimum score of 7 for each parameter. Observations were conducted at two different times: 07:00 AM and 12:00 PM. Meanwhile, the identification of physical damage to fish was carried out by recording data on a monitoring sheet, which included information about the fish species and types of physical damage. The collected data were analyzed using a qualitative inductive method, which involves describing information from general to specific [10].

## 3. Results and Discussion









Fish Freshness Levels at the Ciroyom Fish Market, Bandung City. The results of the observations on the fish freshness levels based on SNI 01-2729.1-2006 regarding Fresh Fish Specifications, conducted by 3 (three) panelists on the five types of saltwater fish purchased at the Ciroyom Fish Market, Bandung City, can be seen in Table 1.

Table 1. Average Freshness Levels of Fish at the Ciroyom Fish Market in Bandung City.

Fish species	Average Freshness Levels	
	Morning (07.00)	Afternoon (12.00)
<i>Euthynnus pelamial</i> ( <i>Ikan Tongkol</i> )	48.33	33.66 3
<i>Scomberomorus sommerson</i> ( <i>Ikan Tenggiri</i> )	47.66	30.33 1
<i>Rastrelliger sp.</i> ( <i>Ikan Kembung</i> )	48.66	36.33 5
<i>Caesio cuning</i> ( <i>Ikan Ekor Kuning</i> )	47.33	34.66 4
<i>Lutjanus malabaricus</i> ( <i>Ikan Kakap Merah</i> )	42.33	33.33 2

Table 1 shows the average freshness levels of fish at the Ciroyom Fish Market in Bandung City during the morning and afternoon. In the morning (7:00 AM), *L. malabaricus* had the lowest average score of 42.33 (fresh), *C. cuning* had an average score of 47.33 (fresh), *S. sommerson* had an average score of 47.66 (fresh), *E. pelamial* had an average score of 48.33 (fresh), and *Rastrelliger sp.* had the highest average score of 48.66 (fresh). In the afternoon (12:00 PM), *S. sommerson* had the lowest average score of 30.33 (not fresh), *L. malabaricus* had an average score of 33.33 (not fresh), *E. pelamial* had an average score of 33.66 (not fresh), *C. cuning* had an average score of 34.66 (not fresh), and *Rastrelliger sp.* had an average score of 36.33 (not fresh). Overall, it can be concluded that all the fish observed in the morning had high freshness levels ( $\geq 42$ ) and were classified as fresh, while all the fish observed in the afternoon had freshness levels  $\leq 42$  and were classified as not fresh.

To observe the differences in the appearance of the four research indicators (excluding odor and texture) on the five types of fish sold at the Ciroyom fish market in Bandung City, refer to images 1

Fish species	Observation Time	
	Morning (07.00)	Afternoon (12.00)
<i>Euthynnus pelamial</i> (Ikan Tongkol)	 	 
<i>Scomberomorus sommerson</i> (Ikan Tenggiri)	 	 

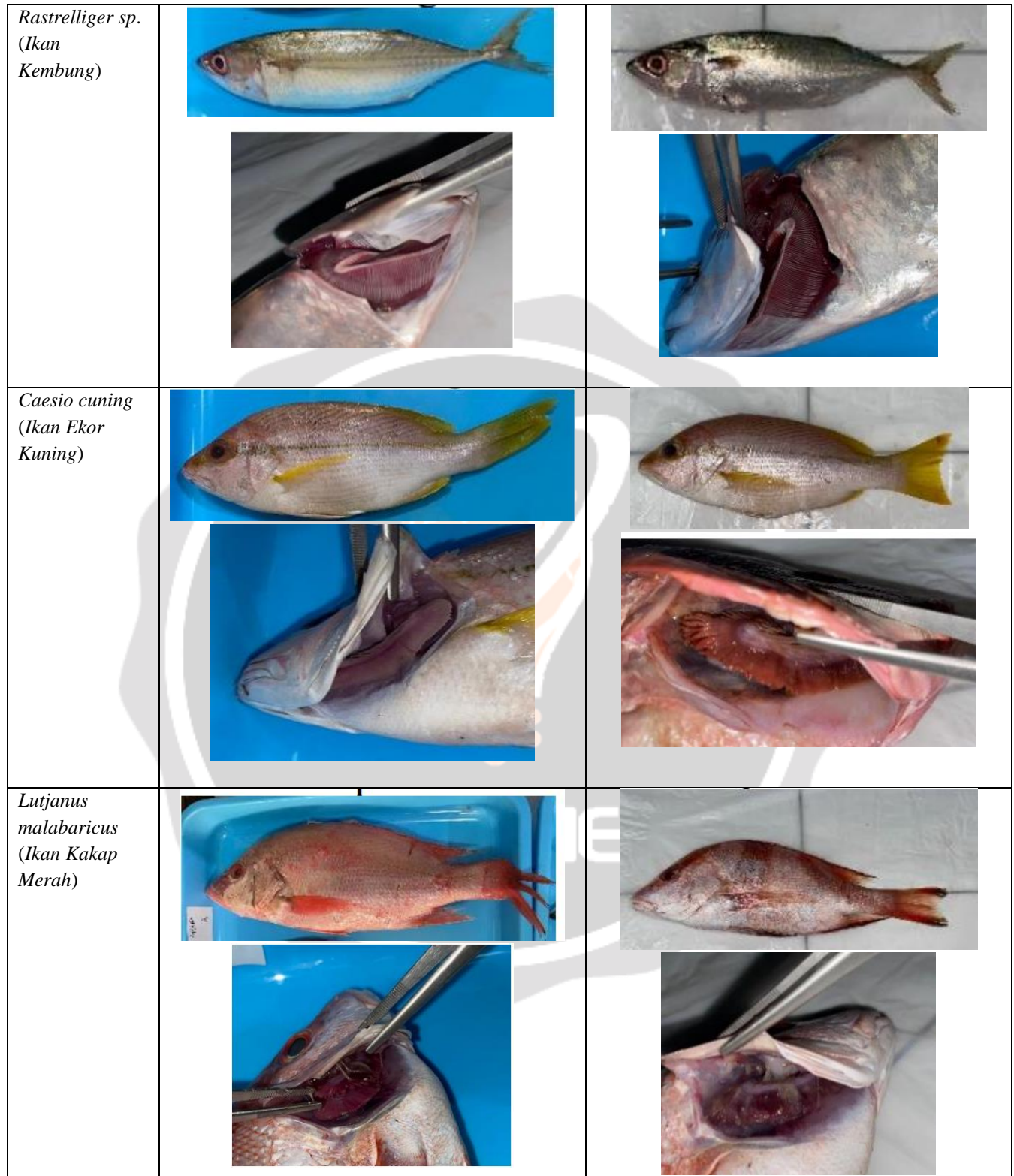


Image 1. The differences in appearance among the five types of fish sold at the Ciroyom Fish Market in Bandung City. Note: fish morphology (top); gills (bottom)

The fish collected in the morning still appeared fresh, characterized by bright eyes, protruding (convex) eyeballs, a clear cornea, and a shiny, bright black pupil. This is due to the absence of biochemical changes, allowing the metabolism within the fish's body to function properly [11]. The appearance of the eyes in fish serves as an easily identifiable indicator of freshness [12]. For the gill indicator, fish collected in the morning had bright red gills without being covered in mucus, while the mucus layer on the body surface was clear, transparent, and shiny [13]. The flesh incision appeared very bright in colour, with no discoloration along the backbone, and the abdominal wall remained intact. The fish did not emit any ammonia, hydrogen sulfide (H<sub>2</sub>S), acidic, or rotten odors. The texture of the fish's body was firm and elastic when pressed with a finger, and the flesh near the backbone was difficult to tear. The fish's flesh was quite flexible when bent and would immediately return to its original shape when released. This flexibility is due to the connective tissue in the flesh remaining intact [14].

Fish collected in the afternoon are classified as not fresh, with physical characteristics such as milky white eyes, sunken eyeballs, cloudy corneas, grayish pupils, and a lack of shine. The gills appear dark brown and are covered with a thick, somewhat cloudy mucus layer. Gills are particularly susceptible to becoming a source of bacterial decay. After death, the blood circulation stops, and oxidation may occur, which changes the gill color to dark brown [11]. Gills contain the highest concentration of blood, creating conditions favorable for the growth of spoilage bacteria. Fish spoilage can occur due to an excessive number of bacteria in the gills, which can lead to decomposition [12]. The thick, yellowish-brown mucus also covers the entire body surface. This is a natural response of fish when confronted with unpleasant situations or threats. A large amount of mucus released can range from 1 to 2.5% of the fish's body weight. In this condition, the fish is in a hypererynia stage, where the mucus is excreted from glands located in the skin, forming a thick, transparent, cloudy layer. The mucus appears somewhat cloudy, dull, and even whitish. This physical change in the mucus indicates the pre-rigor phase, meaning the fish is starting to decay.

In terms of flesh incision, the cut appears very dull, with contrasting red color along the backbone, and the abdominal wall is very soft. The fish emits a strong ammonia smell, the presence of H<sub>2</sub>S (hydrogen sulfide), and acidic and rotten odors. The texture is soft, with visible finger marks when pressed, and the flesh can be easily torn away from the backbone. Fish flesh that is not fresh (decayed) becomes rigid, and when bent, it does not return to its original shape. This rigidity is due to damage to the connective tissue and the rupture of many cell walls, causing the fish's flesh to lose its flexibility (autolysis). Autolysis is the process of self-degradation, in which the fish's tissues break down by enzymes originating from the fish itself [15]. Autolysis occurs when the fish enters the post rigor mortis phase.

Fish that die after being caught undergo three sequential phases: pre-rigor, rigor mortis, and post rigor mortis. The pre-rigor phase is when the fish's quality and freshness are similar to when it was alive. The rigor mortis phase is when the fish retains its freshness and quality but gradually becomes stiff. The post rigor mortis phase is when the fish starts to decompose [15]. Fish that undergo autolysis have an unelastic body texture, so when pressed, it takes relatively longer for the flesh to return to its original state. If the autolysis process has progressed further, the flesh will never return to its original position when pressed [16]. The autolytic process causes the flesh to become softer and easier to separate from the bones [17]. Additionally, the decline in the freshness of fish flesh can be attributed to the presence of cathepsin enzymes in the fish [18]. Referring to the fresh fish quality standard according to SNI 01-2346-2006, the fish samples collected in the afternoon do not meet the organoleptic assessment qualifications.

After fish are caught, changes in the chemical and physical composition of the fish can be delayed with low-temperature treatment, allowing the texture to remain similar to when the fish was alive [19]. This aligns with [20] who found that as the fish's quality declines, the texture of the flesh undergoes significant changes. This is due to the breakdown of muscle tissue through enzymatic processes that stop blood circulation and allow oxygen for metabolism. Over time, the fish's muscles become firmer and more tender. At the final stage of decomposition, uncontrolled enzymatic activity and bacteria cause the fish's muscles to relax and lose elasticity (post-rigid stage), leading to muscle protein breakdown. Fish also start to emit less fresh odors. The texture of the fish becomes soft and less elastic. The change in texture is caused by the breakdown of muscle tissue through

enzymatic processes. During rigor mortis, the fish's muscles become stiff, and when entering the decomposition phase, the muscles loosen and lose elasticity due to bacteria and enzymes [1].

A visible decline in fish freshness can be observed physically. Fish will emit unpleasant odors, and changes in texture, color, mucus, and appearance will occur [21]. The deterioration of fish quality begins from the moment it is caught and continues until it reaches the end consumer. Two important factors in the decline of freshness are time and temperature. Fish freshness decreases over time if not handled properly [22]. The water temperature when the fish is caught significantly affects the fish quality, especially in warm water, and the longer the fish stays in the water before being lifted, the faster the quality will degrade [14]. Fish temperature plays the most significant role in determining the time needed for fish to enter, begin, and pass through rigor. The lower the temperature at the time of handling after capture, the slower the fish will enter the rigor phase, and the longer the rigor phase will last [14].

In addition to temperature and time factors, the deterioration of fish freshness can also occur due to improper handling. Injuries or bruises on the fish can make its texture soft and reduce its freshness [23]. Other factors that contribute to physical damage to fish in markets include dropping, excessive stacking in storage containers before sale, improper packing during transportation and distribution, as well as excessive stacking in storage containers when the fish is sold at the market [23]. If fish in rigor are stacked too high, dropped, stepped on, hit, folded, bent, exposed to chemicals, and so on, the decay will occur more rapidly. However, the decomposition process can be slowed down if the fish is stored at low temperatures [14].

#### 4. CONCLUSIONS

The freshness level of fish at the Ciroyom Fish Market in Bandung City, based on Indonesian National Standard Number SNI 2729:2013 on Fresh Fish Specifications, indicates that fish samples in the morning are still fresh and suitable for consumer consumption. However, by the afternoon, there is a decline in fish freshness, which affects consumer acceptance. Further research is recommended to explore effective preservation methods to enhance the shelf life of fish sold in traditional markets, so that the results of this study can serve as a reference for making further policy decisions.

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