Effect of Differences in Temperature and Storage Time on The Number of Microbes in Fresh Lemuru Fish (*Sardinella lemuru*)

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***Abstract*— lemuru fish is a pelagic fish that is widely found in Indonesian waters that have an economical selling price. Fish is a food that is easily damaged so it requires good and correct handling. The purpose of this study was to determine the effect of temperature and storage time on the number of microbes in fresh lemuru fish. This study uses a quantitative research design. The treatment in this study was carried out with 2 treatments of differences in temperature and time. The number of microbes obtained at 0^0C at storage time for 0 hours (10,1 x 104 colonies / ml), 24 hours (8,8 x 10^4 colonies / ml), and 48 hours (6,3 x 10^4 colonies/ml). At 5^0C at storage time for 0 hours (10,2 x 10^4 colonies/ml), 24 hours (9,8 x 10^4 colonies/ml), and 48 hours (9,0 x 10^4 colonies/ml). At 27^0C at storage time for 0 hours (10,4 x 10^4 colonies/ml), 24 hours (23,3 x 10^4 colonies/ml), and 48 hours (29,8 x 10^4 colonies/ml). In conclusion, the longer the storage time of lemuru fish with low temperatures, the number of microbes that grow is small.**

Keywords— lemuru fish, storage temperature, storage time, number of microbes

I. INTRODUCTION

Indonesia is a country with islands and is surrounded by oceans. This is what makes Indonesia has abundant fishery products. The fishery is in the form of marine life and one of them is fish [1]. Fish is said to be a very easily damaged food source whose handling process must be done quickly and appropriately. Using a poor handling method will lead to poor quality of fish products if a good handling method leads to good quality fish products. Lemuru fish is a fish that is widely found in Banyuwangi water. This fish is one of the pelagic fish that swim only on the surface of the waters so many fishermen in Banyuwangi water catch a lot. Many people catch pelagic fish for their consumption or are sold to the market and processed into products that have a high selling value. Fish, in general, have a high protein content, as well as lemuru fish. [2]. In addition, lemuru fish also contain unsaturated fatty acids namely omega 3 consisting of EPA (Eicosa Pentaenoic Acid), DHA (Docosa Hexaenoic acid), and Linoleic [3].

Fish is a commodity that is easy and quickly decomposes so it requires handling in maintaining its quality [4]. Fish is a food that is easily damaged (perishable food). Many types of microbes can grow and cause foul odors and carnations that can decompose the nutritional components of these foods. Then it takes good handling somewhat the fish does not suffer damage [5].

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Fish contains many organic and inorganic compounds that are good for the human body. However, fish is also a food that is quickly damaged. With good fish handling, the fish can be maintained in quality until the fish is ready to be consumed. Various methods have been done to maintain the freshness of fish quality, one of which is by methods such as cooling and freezing [2].

The level of freshness and speed of quality decline in fish can be affected by several internal and external factors. Internal factors consist of the type and biological condition of the fish. External factors consist of the process of death, time, handling methods, and infrastructure in handling the fish. Good fish handling procedures can maintain the quality of fish ranging from capture to consumption by consumers by inhibiting spoilage, minimizing contamination, and no physical damage to fish. In general, each type of fish has a pattern and speed of decline in quality that is different from other types of fish. The speed of decline in the quality of fish that experience cuts or bruises are faster than fish with intact physical condition [6].

Supporting factors that can cause microbial growth and foul odor are environmental factors. Environmental factors such as temperature, oxygen, pH, shelf time, and cleanliness of facilities and infrastructure [7]. Handling fish that can maintain the level of freshness of fish or the quality of fish by using low temperatures. The use of low temperatures can slow down biochemical processes that occur in the body of fish and can maintain the quality of fish. The biochemical process of the fish can also be seen in the pH level of the fish's body. So the pH in the body of the fish also affects the quality of fish [8]. Therefore, the goal of this study was to find out the effect of differences in temperature and storage time on the number of microbes in fresh lemuru fish (*Sardinella lemuru*).

II. METHODS

This study uses a quantitative research design. The research conducted by testing the number of microbes in lemuru fish (Sardinella lemuru) was conducted at the Faperta Laboratory of PGRI Banyuwangi University. The treatment in this study was carried out with 2 treatments of differences in temperature and time. The treatment of temperature differences is using temperatures of 0^0C, 5^0C, and 27^0C. The time difference between treatment is 0 hours, 24 hours, and 48 hours.

III. RESULTS AND DISCUSSION

Freshness is a detector to distinguish fish with good and bad quality. Fish can be said to be still fresh if biochemical, microbiological, and physical changes that occur have not caused damage to the fish's body. While fish are not fresh then there have been changes biochemically, microbiologically, and physically in the body of the fish [9]. Temperature treatment in fish can maintain the quality or level of freshness of fish. The lower the temperature of the fish can be lowered and the more stable the temperature maintained during handling then the quality of the fish or quality, the better the fish [10]. Temperature treatment of 0^0C, 5^0C, and 27^0C with storage time of 0 hours 24 hours, and 48 hours in lemuru fish (*Sardinella lemuru*) can be seen in table 1.

TABLE 1.
DATA FROM OBSERVATION OF THE NUMBER OF MICROBES

Temperature Treatment	Storage Time	Total TPC Σ colonies / ml
Temperature 0^0C	0 hour	10,1 x 10^4
	24 hours	8,8 x 10^4
	48 hours	6,3 x 10^4
Temperature 5^0C	0 hour	10,2 x 10^4
	24 hours	9,8 x 10^4
	48 hours	9,0 x 10^4
Temperature 27^0C	0 hour	10,4 x 10^4
	24 hours	23,3 x 10^4
	48 hours	29,8 x 10^4

Can be seen in table 1, at the treatment of temperature 0^0C at storage time for 0 hours obtained a total TPC of 10,1 x 10^4 colonies/ml. At 24-hour storage, time obtained a total TPC of 8,8 x 10^4 colonies/ml. At 48 hours of storage time, a total TPC of 6,3 x 10^4 colonies/ ml was obtained. From these results, the number of microbes is getting less and less along with the longer storage time with a temperature treatment of 0^0C. If the storage temperature is lowered then microbial growth will be inhibited, characterized by enzymatic reactions that take place in the cell. Decreased inhibition of microbial growth in low-temperature storage results in changes in membrane structure and reduced supply of nutrients to enzymes in cells. This can be demonstrated by the number of microbial responses that are decreasing in growth due to low-temperature storage treatment [11]. The rate and pattern of decrease in the quality of fish are greatly influenced by temperature, where the higher the temperature the faster the decrease in the quality of freshness of fish [12]. The use of low temperatures of 0^0C in fresh fish can slow the rigormortic phase in fish and suppress microbial activity, suppressing chemical reactions and organoleptic changes [13]. If food is not stored at low temperatures, many pathogenic bacteria will grow and cause disease in humans. Pathogenic bacteria that are often detected in fish include Achromobacter, Pseudomonas, Micrococcus, Bacillus, Clostridium, Shigella, Salmonella, and Vibrio. These bacteria can cause damage to the body of fish and if consumed by humans can cause disease in humans [14].

At the temperature treatment of 5^0C obtained the total result of TPC at storage time for 0 hours amounting to 10,2 x 10^4 colonies/ml. At 24 hours of storage time, a total TPC of 9,8 x 10^4colonies/ ml was obtained. At 48 hours of storage time, a total TPC of 9,0 x 10^4 colonies/ ml was obtained. At 5^0C storage temperature treatment, there was a decrease in the number of microbes growing, but the decrease was not very significant compared to the storage temperature of 0^0C. At a storage temperature of 0^0-5^0C in the fish, the preservation process can slow the growth of bacteria and some bacteria die and some songs remain slow-growing by forming spores. The use of low temperatures also resulted in a decrease in chemical processes and the number of bacteria associated with the decay process [7]. Fish contains many organic and inorganic compounds that are good for the human body. However, fish is also a food that is quickly damaged. With good fish handling, the fish can be maintained in quality until the fish is ready to be consumed. Various methods have been done to maintain the freshness of fish quality, one of which is by methods such as cooling and freezing. Handling with cooling and freezing to prevent damage or decay. This handling can also extend the shelf life. Refrigeration can only extend the storage life of fish within a few days. While freezing can extend the storage life of fish within a few months. Storage with low temperatures can not kill all microorganisms, but only inhibits the growth of microorganisms. [2].

At the temperature treatment of 27^0C obtained the total result of TPC at storage time for 0 hours amounting to 10,4 x 10^4 colonies/ml. At 24 hours of storage time, a

total TPC of 23,3 x 10^4 colonies/ ml was obtained. At 48 hours of storage time, a total TPC of 29,8 x 10^4 colonies/ ml was obtained. At a storage temperature of 27^0C obtained result of the longer the storage time, the increasing the number of microbes in fish. This is due to the absence of low temperature treatment that can inhibit enzymatic reactions in the microbial body so that the amount of microbial growth also increases. At room temperature 25^0-28^0C, the bacteria that can grow are bacteria belonging to the mesophil group, bacteria that can survive at an optimum temperature of 37^0C [14]. Cooling is the handling commonly used in fish to slow down damage to fishing products. In addition to good handling as well uses a cold chain system and prioritizes sanitation and hygiene [12].

IV. CONCLUSION

In this study, the number of microbes obtained at a temperature treatment of 0^0C at storage time for 0 hours (10,1 x 10^4 colonies / ml), 24 hours (8,8 x 10^4 colonies / ml), and 48 hours (6,3 x 10^4 colonies / ml). At 5^0C at storage time for 0 hours (10,2 x 10^4 colony/ ml), 24 hours (9,8 x 10^4 colony / ml), and 48 hours (9,0 x 10^4 colonies / ml). At 27^0C at storage time for 0 hours (10,4 x 10^4 colonies/ ml), 24 hours (23,3 x 10^4 colony / ml), and 48 hours (29,8 x 10^4 colonies / ml). The results concluded that the longer the storage time with low temperatures, the number of microbes that grow is hampered. While the longer the storage time with the room temperature, the number of microbes that grow increases.

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