Comparative study of marine fish freshness based on the handling method in Puncak Permai modern market and Simo Gunung traditional market, Surabaya

M Sari¹, J Triastuti², H Pramono², and Sudarno³

¹Graduate of Aquaculture Study Program, Majoring in Fisheries Product Technology, Faculty of Fisheries and Marine, Universitas Airlangga, Mulyorejo, Surabaya, East Java 60115 Indonesia
²Department of Marine, Faculty of Fisheries and Marine, Universitas Airlangga, Mulyorejo, Surabaya, East Java 60115 Indonesia
³Department of Fish Health Management and Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, Mulyorejo, Surabaya, East Java 60115 Indonesia

*Corresponding author: juni.triastuti@fpk.unair.ac.id

Abstract. Fish handling conditions on the market nowadays mainly in the traditional market is less a principle handling with caution, fast, and clean, making the selling fish polluted with chemical, physical, and microbiological pollutants. The fish handling on the modern market is generally better than the traditional markets. Puncak Permai and Simo Gunung Market provide fresh fish more than any other market in Surabaya, making these markets become the main destination for consumers, therefore this study was conducted to observe the fish freshness in both markets. This research used a survey method that was conducted for seven times sampling with three days of interval sampling. This study took three types of marine fish. The main parameters observed were pH and organoleptic values, while the supporting parameters were interviewed data. The result showed that the handling method had a significant effect (p<0.05) on the organoleptic condition of all samples observed, but it had no significant effect (p>0.05) on the pH level.

1. Introduction
According to Ekasari et al. [1], fresh fish generally contains 65 – 80% water, 17 – 22% protein, 0,5 – 2% fat, and 1 – 2% ash. Marine fish contain Poly Unsaturated Fatty Acids (PUFA) such as EPA (Eicosapentaenoic Acid) and DHA (Docosahexaenoic Acid) [2]. Omega 3 level in marine fish is higher than freshwater fish [3]. Indonesian Ministry of Marine and Fisheries (KKP) [4] stated that fish consumption had increased from 33.89 kg/capita/year in 2012 to 46.49 kg/capita/year in 2017.

Fisheries commodities generally have an unstable chemical composition, perishable, and seasonal product [5]. Fish freshness is unable to be increased, but only able to be maintained therefore needed the right handling management to make them remain fresh for consumers [6]. The aim of fish handling is to maintain fish freshness after captured in a certain period before bought by consumers [7]. The current problem observed is the fish trader condition in the market who does not apply the caution, fast, and clean handling principles [8]. Fish sold by traders are often found polluted by chemical,
physical, and microbiological contamination before reaching the consumers as there is a lack of a secured fish handling method [9].

The fish handling on the modern market is generally better than the traditional markets. Traders in the modern market have been paying attention to sanitation and hygiene aspects such as wearing special cloth, head coverings, and gloves when selling [10]. One of the modern markets in Surabaya who applies those aspects is Puncak Permai Modern Market. Arianty [10] stated that the modern market was more organized condition compared to the traditional market, which was identical with dirty, crowded, inadequate infrastructure, poor vendor services with manipulative product quality, and low product quantity. One of the traditional market commonly visited by Surabaya citizen is Simo Gunung Traditional Market. This is due to Simo Gunung Traditional Market is a wholesale market with the consumer majority are retailed vegetable trader [11]. Puncak Permai modern market and Simo Gunung traditional market provides fresh fish more than any other market in Surabaya, making these markets become the main destination for consumers. Further comparative study about the fish freshness being sold on both markets was necessary to be done for providing preferences for consumers to choose the fresh fish product and presenting information about the way fish handling management was conducted. This condition was also the basic background of this study conducted.

2. Materials and methods

2.1. Research tools

This study was conducted at Puncak Permai Modern Market and Simo Gunung traditional market in Surabaya, Indonesia as well as the Faculty of Fisheries and Marine University Airlangga chemical laboratory in April – May 2018. Tools used in this study included analytical scale (Pioneer Ohauss 0 - 2100 G), petri dish, mortar, pH meter (EUTECH pH 700), beaker glass, measuring tube, spray bottle, organoleptic test sheets (BSNI 2729: 2013 ), tray, knife, plastic spoon, spatula, styrofoam box, jerry cans, camera, and stationery. Materials used in this study included Indian mackerel (Rastrelliger kanagurta), bluefin trevally (Caranx stellatus), red spine threadfin bream (Nemipterus nemurus), distilled water, ice cubes, tissue, and label paper.

2.2. Research method

The survey method was conducted to observe fish arrival to the market, the number of traders, location, market conditions, and fish handling process by traders in both markets. Sampling was conducted for seven times with three days of interval sampling. The fish sample was placed in a cooled container for fish freshness test material by measuring the pH level and determining sensory assessment. pH was measured using pH meters, while the sensory assessment was determined by organoleptic assessment. Based on the Indonesian National Standardization Agency (BSNI) [12], organoleptic criteria observation includes eyes and gills appearance, body surface mucus, odor, body-color, and texture.

2.3. Data analysis

pH level data was tested its normality to analyze the data distribution [13]. pH level data were also analyzed using an independent t-test to determine the significant difference in the two markets with a 95% degree of confidence, while organoleptic assessment data were analyzed using the Kruskal-Wallis test to observe each treatment rank [14].

3. Results and discussion

3.1. pH analysis

The pH level measurement result of fish samples sold on Puncak Permai Modern Market and Simo Gunung Traditional Market is shown in Table 1. The result of the t-test showed that the pH levels of all types of samples in both markets were not significantly different (p>0.05).
Table 1. Fish pH level at Puncak Permai and Simo Gunung Market

| Species                  | Puncak Permai Modern Market | Simo Gunung Traditional Market |
|--------------------------|-----------------------------|--------------------------------|
| Indian mackerel          | 6.30±0.40                   | 6.32±0.25                      |
| Bluefin trevally         | 5.97±0.06                   | 6.33±0.31                      |
| Red spine threadfin bream| 6.62±0.24                   | 6.71±0.27                      |
| **Average of All Samples** | **6.39±0.38**               | **6.52±0.32**                  |

*) Notation indicated by different superscript letters in the table shows significant differences (p<0.05).

The pH level of all types of samples on both markets was still under a pH range of fresh fish (Table 1). According to Rehbein and Jorg [15], the standard pH level for fresh fish should be 6.8 – 7. The average of pH levels in Puncak Permai Modern Market was more acidic than Simo Gunung Traditional Market. This was presumably because the fish transit period in the Puncak Permai Market was longer than the Simo Gunung Market, based on Kasmiati et al. [16] who stated that longer transition periods would decrease the fish freshness level. The fish transit period in Puncak Permai Modern Market was approximately 13 hours starting from fish arrival until sold in the market, while the transition period in Simo Gunung Traditional Market only lasted about an hour. The fish storage period in Puncak Permai Modern Market was also longer than Simo Gunung Traditional Market. Longer fish storage period increased the lactic acid accumulation [17], resulting in a more acidic pH level on all types of marine fish observed from Puncak Permai Modern Market compared to Simo Gunung Traditional Market.

3.2. Fish organoleptic
The organoleptic test results of the three fish species in both markets are seen in Table 2. The Kruskal-Wallis test results showed that the organoleptic values of all types of samples in both markets were significantly different (p<0.05).

Table 2. Fish Organoleptic Test at Puncak Permai and Simo Gunung Market

| Species                  | Market  | Average ± SD |
|--------------------------|---------|--------------|
|                          |         | Eyes   | Gills   | Mucus   | Meat   | Smell  | Texture |
| Indian mackerel          | Puncak  | 7.90±0.9 | 6.93±1.3 | 7.79±1.0 | 7.46±1.1 | 7.68±1.1 | 7.52±1.2 |
|                          | Permai  | 9       | 9       | 9       | 8       | 9       | 0        |
|                          | Simo    | 6.65±1.4 | 5.91±1.8 | 6.80±1.2 | 6.40±1.4 | 6.50±1.5 | 6.50±1.3 |
|                          | Gunung  | 8       | 6       | 7       | 6       | 6       | 4        |
| Bluefin trevally         | Puncak  | 7.66±0.8 | 7.72±0.9 | 7.90±0.9 | 7.87±0.9 | 7.92±1.0 | 7.89±0.9 |
|                          | Permai  | 8       | 8       | 4       | 5       | 1       | 7        |
|                          | Simo    | 6.75±1.4 | 6.65±1.5 | 6.93±1.3 | 6.87±1.1 | 6.69±1.3 | 6.80±1.2 |
|                          | Gunung  | 6       | 5       | 0       | 6       | 4       | 1        |
| Redspine threadfin bream | Puncak  | 7.66±1.3 | 7.80±1.1 | 8.10±1.0 | 7.89±1.0 | 7.88±1.2 | 7.95±1.2 |
|                          | Permai  | 5       | 4       | 9       | 4       | 6       | 2        |
|                          | Simo    | 6.28±2.0 | 6.74±1.9 | 6.84±1.5 | 6.77±1.6 | 6.53±1.8 | 6.47±1.8 |

*) Notation indicated by different superscript letters in the table shows significant differences (p<0.05).
The organoleptic values of all types of marine fish at the Puncak Permai Modern Market is higher than the Simo Gunung Traditional Market. This is because the organoleptic test is subjective [18]. According to BSNI [19], fish is said to be fresh if they have organoleptic values 7 – 9, rather fresh with 4 – 6 organoleptic values, and not fresh between 1 – 3. Based on Table 2, the organoleptic value of all types of samples in Puncak Permai Modern Market is eight (fresh), while the organoleptic value at Simo Gunung Traditional Market is seven (fresh). These results indicate that the level of freshness of marine fish in both markets is the same, namely the condition of good freshness (advanced).

3.3. Fish handling in Puncak Permai and Simo Gunung market

The fish handling process by traders from Puncak Permai Modern Market was different from Simo Gunung Traditional Market based on the transit period, trader's hygienic condition, selling period, and the amount of cooling material used. Traders at Puncak Permai Modern Market paid more attention to hygienic factors compared to the Simo Gunung Traditional Market, besides providing more ice cubes as cooling material than Simo Gunung traditional market. The fish display period in the Simo Gunung Traditional Market was also longer than the Puncak Permai Modern Market. According to Nurqaderianie et al. [20], the long fish display period would decline the fish freshness because of increased bacterial proliferation. However this study showed no significant difference on the fish pH level obtained from both markets. This was presumably because the traders on both markets added some ice cubes regularly for maintaining the cooling temperature [21]. The fish handling in both markets had already implemented a cold chain system, thus the freshness was in an advanced condition observed from organoleptic assessment results and pH levels. This showed that the fish handling with a good cooling method would maintain the fish freshness level for the consumers [22].

4. Conclusion

The freshness of marine fish at the Puncak Permai Modern Market and Simo Gunung Traditional Market were on the same good freshness level (advanced level). Fish handling by Puncak Permai Modern Market traders was better than Simo Gunung Traditional Market traders based on trader's hygiene, selling period, and the number of cooling materials used aspects.

5. References

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