Catch handling evaluation of longtail tuna (*Thunnus tonggol*) by sensory evaluation and gap assessment in Pekalongan Archipelagic Fishing Port

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**Abstract.** As perishable food, fish require a proper handling from on-boarding, unloading, marketing and processing. This handling is closely related to the effect of fish product consumption on public health, such as seafood allergy by consuming degraded longtail tuna. This species is one of the dominant catches that landed at Pekalongan Archipelagic Fishing Port. This research aimed to evaluate longtail tuna handling to ensure the standard of quality assurance and safety of fisheries products. The fish quality was scored by scale of 1 – 9. Data were collected by sensory evaluation of fish quality during unloading process. The gap was assessed by comparing the actual process and the regulation in Minister of Marine Affairs Fisheries Decision - KEPMEN KP No. 52A/2013. The result showed that the quality of longtail tuna landed in Pekalongan AFP was acceptable by 7.85. The suitability to the handling standard was poor by 64.30%. The conclusion from sensory evaluation, the quality of longtail tuna landed at Pekalongan AFP is still in compliance with the quality of Indonesian National Standard (SNI) 2729:2013, but the level of suitability of handling longtail tuna has not complied with the regulation in Decision of Minister Marine Affairs Fisheries (MMAF) – KEPMEN KP No. 52A/2013.

**Keywords:** fisheries product, longtail tuna, standard, quality assurance

1. Introduction

Tuna (tuna, mackerel tuna and skipjack) is one of the superior fishery products with high economic value. In 2015, Thailand is the main country that exported tuna from Indonesia where the value reached 77.5 thousand tons of tuna products or equal to 148.3 million USD [1]. MMAF reported that around 109 out of 718 units of tuna processors are still active, amounting to 15.18 % of the total large scale processors.

Pekalongan Archipelagic Fishing Port (Pekalongan AFP) is one of the main landing sites of skipjack and known as the most productive port along the northern Java Sea. In 2017, around 12,847.93 tons of fish were landed in the port with the value equal to 211,834,156 billion IDR [1]. Large pelagic fish such as longtail tuna (*Thunnus tonggol*) is the major species that landed in this port [2]. As perishable food, fresh caught fish requires proper handling soon after it was caught on boat, distributed, marketed, and processed. The knowledge of proper handling techniques of such fish is essential to avoid prolonged
impacts when the fish product is consumed. For example, people might expose allergy reaction when they consumed a declined quality of fish product.

Longtail tuna becomes the main choice for alternative food of consumers since the fish meat contains high level of protein. It is estimated 23.87 grams of each 100 grams of skipjack meat consists of protein [3]. Since fish meat contains high protein, it requires suitable temperature for storing, proper pH and storing duration, and cleanliness of the tools that are used in processing. All of these are intended to avoid rapid growth of bacteria that could reduce the fish meat quality. A proper handling and quality control improvement of fresh fish that started from landing to on-boat handling should follow the minimum cold chain standard operation procedure. Following this rule is critical in producing better quality of the fish products.

The aims of the research are to defining the quality or freshness grade of longtail tuna based on organoleptic scoring/sensory test during the landing process of the fish in Pekalongan AFP. Mapping the gap among the good handling practice of longtail tuna over the applied standard procedure in handling the fish during the landing process at Pekalongan AFP.

2. Research Methods

2.1. Sampling location and data collecting methods
The field sampling was conducted at Pekalongan Archipelagic Fishing Port from July to August 2018. An interview method and direct observation of landed fish were used to collect information on fish handling. Another primary data is the sensory data that was taken directly when the fish was unloaded from the boat. The secondary data derived from literary study, the National Agency of Food and Drug of Indonesia (NAFDI), National Standardization Agency of Indonesia, Pekalongan AFP, the Marine and Fishery District Office and prior researches that are related with this research.

2.2. Data analysis
The sampled-vessels that caught skipjack were counted from vessels with less than 30 Gross Tonnage (GT) in size. There were 50 vessels landed in Tegal Port during the field sampling (July – August), of which 70 trips of vessel landed T. tonggol. It was reported that the accepted minimum requirement of sample that is required in descriptive research methodology is 10% of the total population [4]. Therefore, 7 vessel samples were counted for this research and it was assumed that they represented the total boat population during the survey.

Data analysis was based on score sheet of SNI 2729:2013 for fresh fish then continued with SNI 2346:2011 of Sensory or Organoleptic Test Guidance for fish products. Data obtained from the score sheet was tabulated and summarized to define the quality grade of fish by defining the scores average in 95% confidence level [5].

To calculate the average of interval grade quality of the samples, the formula below was used:

\[
P(\bar{x} - (1.96.s/\sqrt{n})) \leq \mu \leq (\bar{x} + (1.96.s/\sqrt{n})) = 95%
\]

\[
\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}
\]

\[
s^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}
\]
Notes:
\[ s = \sqrt{s^2} \]  \hspace{1cm} (4)

\[ n = \text{numbers of panelist} \]
\[ s^2 = \text{variance of quality scores} \]
\[ 1.96 = \text{deviation standard coefficient at 95\% confidential level} \]
\[ \bar{x} = \text{an average of quality scores} \]
\[ x_i = \text{quality scores that given by panelist } i, \text{ where } i = 1,2,3,\ldots n \]
\[ s = \text{standard deviation} \]

The next method is analyzing the gap among the applied handling procedures in Pekalongan AFP over the standard handling procedures stipulated in MMAF decision No. 52A/KEPMEN-KP/2013 regarding the minimum quality and security requirements of fishery products in production, processing, and distribution process. The higher the gap value, the lower the adjustment score that represents the low suitability of handling.

Scoring on each element then counted in a cumulative way to get the recent suitability handling score. The gap and the suitability handling score could be calculated based on formula (5) [6].

\[ \text{Suitability handling} = (\bar{x} \times CL_h) / (\bar{x} \times CL_r) \times 100\% \]

Notes:
\[ CL_r = \text{Maximum score that possible to get (which is 5)} \]
\[ CL_h = \text{Present handling score} \]
(The score is obtained from scoring each element of handling score)

While the final score to decide the gap status of the handling process is based on these criteria:

- 0\% - ≤ 34\% : The handling process is most unlikely with the standard
- 34\% - ≤ 50\% : The handling process is unlikely with the standard
- 50\% - ≤ 65\% : The handling process is fairly unlikely with the standard
- 65\% - ≤ 80\% : The handling process is almost likely with the standard
- 80\% - ≤ 100\% : The handling process is very likely with the standard

3. Results and Discussion

Primary data shows that tuna production that landed in Pekalongan AFP during January to August 2018 reached 1,256.5 tons and it dominated by 47\% of \textit{T. tonggol}, 27\% of kawa-kawa, 21\% of skipjack and around 5\% yellowfin tuna. It was recorded around 790.56 kg of \textit{T. tonggol} landed per boat in average during the observation. The freshness of fish samples have been reduced after they landed from vessel since the fish was caught on different day. During the observation, the fish was not exposed to ice from loading process on boat to the auction spot. This situation might increase the temperature during the handling process and eventually decrease the quality while triggering the decay of the fish rapidly. The bacteria that triggering the decaying process can exist at 0-30 degree Celsius and dropping the temperature rapidly may help postponing the decaying process [7]. Fresh fish will lose its freshness gradually since it dies before entering the decay process. Adding ice is the most effective way to delay the decaying process since ice can drop the temperature and pertain the proper cold chain. The lower the temperature, the better freshness of the fish. Warm temperature will speed up enzymatic reaction and microorganism activity [8].

The longtail tuna in Pekalongan AFP was sold through auction method where each kind of fish was sorted and priced based on the quality grade. The fish then laid off on the special basket which is about
15-40 kg per basket. Fish with good quality grade was sold 900,000 per basket with average weight of 23 kg/basket or 23,000 IDR per kilogram. The price can be higher in the consumer price gate.

Table 1. Tuna production (Jan – Aug 2018).

| No | Species                              | Volume (Kg) | Production value (Rp) | Average price (Rp) |
|----|--------------------------------------|-------------|-----------------------|--------------------|
| 1  | Bigeye tuna                          | 64,994      | 2,453,523,500.00      | 37,750.00          |
| 2  | skipjack tuna                         | 268,741     | 4,305,454,770.83      | 16,020.83          |
| 3  | Kawa-kawa; eastern little tuna        | 334,823     | 5,334,216,211.61      | 15,931.45          |
| 4  | longtail tuna; Northern bluefin tuna  | 587,978     | 11,939,157,880.10     | 20,305.45          |
|    | Total                                 | 1,256,536   |                       |                    |

Source: PIPP, 2018 (processed)

3.1. Quality (freshness) of fresh T. tonggol

Organoleptic or sensory test is a method that uses sense of organs to define the quality of the tested products [5]. This scoring method uses sensing organs that observe visual appearance of eyes, gills, mucus on the surface of fish skin, meat texture, smell, and other factors that required to define the quality. Meanwhile, the definition of fresh fish is that the fish still has the same physical characteristic to live fish, including the meat texture, the smell or even the physical appearance. It can also be defined as a fish that has not yet processed or preserved by chemical substances and still has the same appearance when they are caught. Sensory scoring standard for fresh fish is referred to SNI 2797:2013 regarding the Indonesian National Standard (SNI) of fresh fish, while the quality test guidance is based on SNI 2346:2011 about sensory testing guidance for fishery products. Some criteria of fresh fish based on organoleptic method are the skin and eyes are still bright, the smell is fresh with elastic texture of the meat and looks compact, and the fish should come from unpolluted waters with minimum scores is 7 (score is ranged from 1 to 9) [9]. Sensory method was used to observe the longtail quality appearance. Samples were obtained from 7 sampled-vessels that landed the mackerel tuna during July and August. The organoleptic results are described on table 2. The quality scoring of the longtail tuna in Pekalongan AFP has a score of 7.85 with the range score of 7.3-8.1. This score fell on the normal score based on score guidance of SNI 2729:2013 where the minimum score is 7. Therefore, the longtail tuna that caught by gillnet vessels from Pekalongan AFP has complied with the SNI 2729:2013 for standard requirement of fresh fish quality measurement. Sensory test plays an important role as preliminary detector in defining the deviations and changes of the quality of the products [5].

Table 2. Sensory score of fresh longtail tuna.

| Object   | \( \bar{x} \) | \( s^2 \) | \( s \) | P1   | P2   | sensory score          |
|----------|----------------|-----------|--------|------|------|------------------------|
| vessel 1 | 7.92           | 0.0139    | 0.118  | 7.79 | 8.05 | \( P (7.79 \leq \mu \leq 8.05) \) |
| vessel 2 | 7.67           | 0.0972    | 0.312  | 7.32 | 8.02 | \( P (7.32 \leq \mu \leq 8.02) \) |
| vessel 3 | 7.92           | 0.0139    | 0.118  | 7.79 | 8.05 | \( P (7.79 \leq \mu \leq 8.05) \) |
| vessel 4 | 7.83           | 0.0139    | 0.118  | 7.7  | 7.96 | \( P (7.7 \leq \mu \leq 7.96) \) |
| vessel 5 | 7.83           | 0.0139    | 0.118  | 7.7  | 7.96 | \( P (7.7 \leq \mu \leq 7.96) \) |
| vessel 6 | 7.92           | 0.0139    | 0.118  | 7.79 | 8.05 | \( P (7.79 \leq \mu \leq 8.05) \) |
| vessel 7 | 7.83           | 0.0556    | 0.236  | 7.56 | 8.1  | \( P (7.56 \leq \mu \leq 8.1) \) |
| average  | 7.85           |           |        |      |      | \( P (7.32 \leq \mu \leq 8.1) \) |

Source: Primary data processing, 2018
3.2. Handling evaluation of longtail tuna by GAP assessment in the Pekalongan AFP

The current compliance of the handling of longtail tuna with the applicable standards in Pekalongan AFP was assessed by MMAF decision Number 52A/KEPMEN-KP/2013 concerning Requirements for Fishery Product Quality and Security Guarantee in the Process of Production, Processing and Distribution [10]. The gap value for each element is determined by each suitability criterion by giving a score of 1 to 5 (not appropriate until the criteria is very suitable). Elements in handling fish in actual conditions were juxtaposed with appropriate standard elements KEPMEN 52A/2013. Scores were given to the sample vessels, so the value given is in accordance with the actual situation. The data obtained was then analyzed using gap analysis. Gap analysis was carried out since the demolition of fish on board until the fish was landed on the fish auction place and carried out using an assessment check sheet. Gap analysis was carried out on 7 sample vessels, with the gillnet ship carrying fresh longtail tuna as the dominant catch. Fresh fish with good quality is handled in accordance with the provisions of the handling or applicable standards so that the fish produced is safe for consumption. If the handling is not right, then microorganisms will breed and will reduce the quality of fresh fish. If the quality of fish decreases, the selling price of fish also decreases. Based on the gap analysis carried out on gillnet vessels with longtail tuna catches in Pekalongan AFP, it is shown that there is a gap between the handling carried out and the applicable standards (Minister Decision). The results showed that there was a gap of 1.79 (table 3) with a suitability level of 64.30%, which means that the handling of longtail tuna in Pekalongan AFP is currently not in accordance with the standards.

| Object  | Gap value | Level of conformity (%) |
|---------|-----------|-------------------------|
| Vessel 1| 1.82±0.05 | 63.70±1.05              |
| Vessel 2| 1.85±0.16 | 62.97±3.15              |
| Vessel 3| 1.60±0.05 | 68.15±1.05              |
| Vessel 4| 1.71±0.11 | 65.93±2.10              |
| Vessel 5| 1.78±0.05 | 64.45±1.05              |
| Vessel 6| 1.83±0.03 | 63.33±0.52              |
| Vessel 7| 1.94±0.01 | 61.58±0.14              |
| Average | 1.79±0.06 | 64.30±1.29              |

The greater the gap value, the lower the level of suitability as well as the smaller the gap value, the higher the suitability value. Based on the results of interviews and general observation, the facilities available at Pekalongan AFP and fishing vessels operating are quite decent and in good condition. But there are several things from the element of conformity based on Minister Decision Number 52A/KEPMEN-KP/2013 which has not been fully applied into the operational handling of fish, especially on fish produced at Pekalongan AFP.

There are several conditions for fish handling that are not in accordance with the standards, including:

- The fish caught is not maintained at the time of dismantling up to the fish landing site. Based on KEPMEN KP 52A/2013 regarding the cold chain, it is explained that the fish caught must be protected from sunlight or other heat sources. Fishery products that are not stored in a living condition must be immediately cooled after boarding a fishing vessel and/or fish carrier. Storage and transportation activities of fishery products are carried out by applying cold chain systems in accordance with applicable regulations.

- Hygiene sanitation and fish storage layout do not prevent the fish from contamination from external factors (oil, grease, wood paint), and some materials that come into contact with the product still allow cross-contamination. As explained in KEPMEN KP 52A/2013 that parts of the vessel or container for storing catches must be kept clean and always in good condition, thus avoiding contamination of fuel and dirty water.

- There are also crew members who smoked when handling catches both on board and at fish landing sites. According to Minister Decision Number 52A/KEPMEN-KP/2013, person in charge and crews wear clean work clothes and headgear so that they cover their hair perfectly, wash their hands before
starting work and are not allowed to smoke, spit, eat and drink in the area of handling and storing products and are committed to apply and document how to handle fish the good one.

4. Conclusion

The organoleptic/sensory scoring of the longtail tuna in Pekalongan AFP has score 7.85 with the range is 7.3-8.1. This score felt on the normal score based on score guidance of SNI 2729:2013, where the minimum score is 7. Therefore, the longtail tuna that caught by gillnet vessel from Pekalongan AFP has complied with the SNI 2729:2013 for standard requirement of fresh fish quality measurement. The gap score of the longtail tuna in Pekalongan is 64.30%. This result reflects the handling process of mackerel tuna caught in Pekalongan AFP is less complied with Minister Marine Affairs and Fisheries Decision Number 52A/KEPMEN-KP/2013.

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