Quality control of small pelagic fish stocks in distribution line in Ambon and Kei Kecil, Maluku

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Abstract. Fish is very perishable, soon after caught and death, deterioration took place quickly especially in a high-temperature environment. Quality control is a necessity to keep the freshness of fish and the prime nutritional quality. In this study interview and observation were done on the focus group to investigate quality control activities carried out by the artisanal fisher community. In many places in Maluku, small pelagic fish caught by using purse seine net. The fishing ground is relatively close to the landing site at the coastal area and landed in 1-2 hours after death. Shortly after landed ice treating is applied on the fishes with the ratio of ice to fish roughly 1:2 and also a small amount of clean sea water added onto the fish-ice mixture in order to chilling fish and keep it fresh. Most fish are transported to the central market in town by using cars which takes one to two hours, and the rest taken by the small retailers and distribute to the closest markets in the village. If lots of fish harvested, some retailers will sell it on foot from house to house. The small-scale fishermen and retailers know very well the necessity of maintaining the freshness of fish, so it will be in good quality when delivered to the consumer hands and the high price.

1. Introduction
Small pelagic fish usually considered as low commercial value fishery but for many developing counties this fishery is the most important fisheries [1, 2]. Many small-scale fishing communities depend on small pelagic fisheries for food and source of employment and income [3, 4, 5].

The small pelagic fish commodity can be found abundantly throughout the year in Indonesia. Production of small pelagic fish in Maluku is predicted to be 58,156.7 ton year-1 [6]. The main small pelagic fish product come from the species of Decapterus spp, Selaroides leptoleptis, Rastreliger sp, Euthynus affinis, and Sardinella sp, caught mainly by purse-seine [7]. These commodities are the most fish consumed by the community, contributes both for the nutritional requirement as well as an important source of income especially for the coastal community [7, 8]. In a stringent fish quality standard, fresh fish with a good quality is a prime nutritional source and raise the price of the fish which in turn raise the income.

Fish is a high nutritional resource but a very perishable commodity. After caught and death the biochemical changes keep functioning but only catabolism processes. The digestive enzymes still active, instead of acting on food eaten, the enzyme begins to digest fish tissue components itself, break down (autolysis) the tissue component, lipids, carbohydrates, and proteins. The native bacteria present in the fish multiply rapidly and secrets various enzymes which catalyze the breakdown of fish tissues. Lipid oxidation causes rancidity of fish flesh and produces a foul smell. Autolysis also causes fading of fish pigments, reveals off flavor and browning. The rapid colonization and multiplication of bacteria
and several other autolytic eventually change the complete total breakdown of fish muscle [6]. Fish product treating with ice is applied to lowering the temperature the fish after death in order to reduce the growth of spoilage and pathogenic micro-organisms. Reducing the temperature also decrease the rate of enzymatic reactions which is linked to early postmortem changes. When icing the fish properly will extending the rigor mortis period. Quicker ice chills apply to reduce fish temperature is the most important thing in ice utilization [7].

The fishing ground of small pelagic fish in, in general, is close to the coastal area such as in Ambon Island and Kei Kecil Islands. The time spent from fishing ground to the landing fish site is about 1 to 2 hours. Once arrive at the landing site, the fish harvested will be transferred into a small bucket which can accommodate approximately 30-32 kg of fish (In Ambon) or 42-45 kg of fish (in Kei Kecil). All the fishes will be treated with ice and most of the fishes will then transported to central market in town. A small amount is taken by small retailers and sold at the local market in the village or around the village. Since the prime quality of the fish should be maintained until it reaches the consumers, this study was conducted to investigate the quality control activities carried out by the local fishermen and small retailer of small-scale pelagic fishery.

2. Materials and Method

Data on quality control was obtained through a focus group discussion with local small-scale fishermen and retailer from Ambon area and Kei Kecil area (Figure 1). Waai, Laha and Latuhalat village from Ambon Island were selected as a sampling station whilst Sathean and Selayer were selected as sampling station from Kei Kecil Island. Apart from focus group discussion, a questionnaire with a close question was distributed to the fishermen and retailer from the study site. Field observation was also conducted to examine quality control activities at the landing site, transportation to market and during market activities.

3. Result and Discussion

3.1 Distribution line of small pelagic fish stocks

The distribution line of small pelagic fish stock in Ambon and Kei Kecil are relative similar basically (Figure 2). Shortly after landed at the fish landing site, the fish will then transported to the central market in both places, however, the distribution line is more complex in Ambon compared to Kei Kecil. After landed, normally more than half of small pelagic fish stocks transported to the central market and the rest took by the small retailers and sell in the village. Sometimes fish harvested is transported from fishing ground directly to the central market and in another situation when the fish harvested is in a very low production, the fish landed was sell directly in the village only.
At the peak season where the production in Ambon is substantially abundant, the large amount of fish is transported to the cold storage (private and or government). This fish stock will be forwardly sent to regional market like Surabaya or Bali and utilized for tuna bait. This situation indicates small pelagic fish stocks under-utilized for food consumption in Ambon at that time.

3.2. Quality control activities carried out by the community.

The fishing activity of small pelagic fish in Ambon and Kei Kecil always took place in the early morning before sunrise, since this enables the caught not to be exposed to the hot temperature arise during the daytime. On the arrival at the landing site, the caught fish are transferred into the big plastic buckets with the holding capacity of 30-45 kg. Some people cover their buckets but some others did not. This probably depends on the awareness of the quality attains and financial condition. Bucket with a cover on the top is better since it keeps the fish in good quality.

Activity on landing sites and central market is presented in Figure 3.

The cold chain is not applied during fishing activity since the fishing ground is close to the landing site. Time consumed from fishing ground to landing site is around 1 hour to 2 hours or sometimes less than 1 hour, hence the fish still in the stage of rigor mortis with the prime quality when landed. The rigor mortis stage of fish occurs within 1 to 7 hours after death [8]. It was also reported that fish applied with the cold chain of 0–20°C, for example in Tilapia sp, the onset rigor time from death will reach will have rigor mortis stage within 2–9 hours and time from death to end of rigor is 26.5 hours [9].

Shortly after landed, ice treatment is applied towards the caught with the ratio of ice to fish roughly 1:2 by weight. A small amount of clean sea water was also added into the fish-iced in the bucket to spread the cool temperature evenly throughout the bucket in order to decrease the fish body temperature faster. The lower fish body temperature, the longest stage of rigor mortis will achieve and will keep the freshness of the fish well. When the chilling process is done quickly, handled carefully and hygienically will effectively reducing spoilage in fish. The ratio of ice to fish is roughly 1:1 by weight. If the store was insulated, this ratio could be as low as 1:5. The colder the fish will greatly reduce bacterial and enzyme activities [9].

Ice is an important thing in order to keep fish in fresh condition, but some people do not use ice during market activities. Time take for the fish product to reach the consumer varies according to the distance from the fishing ground, landing site and to the customer. When the fish product is sold in the village, it commonly takes 1 to 3 hours to reach the consumer, therefore time-consuming from the fishing ground to the consumer is about 4 to 5 hours after death. This time consuming is still in the time set on rigor mortis in which the fish is still in good quality.

At the central market, more time is spent on market activities. To keep the fish product in good quality, therefore, more ice is added to the ratio of ice to fish is 1:3 roughly. There is also a need to add...
a small amount of seawater to maintain a chilling temperature which can maintain the fish product in a good quality.

Total bacteria found from a random sampling at 2 markets in Ambon area was $1.7 \times 10^4$ CFU g$^{-1}$ at morning time, increased to $18.8 \times 10^4$ CFU g$^{-1}$ at afternoon time [10]. The maximum total bacteria found in fish should not exceed $5 \times 10^5$ CFU g$^{-1}$ [11], this means that fish product found in the central market in Ambon is still in the good condition. When the fish is not sold out on that day, the fish should be stored in ice overnight and sell again the next morning. The box of a broken freezer/refrigerator is usually used to keep chilling fish store overnight.

**Figure 3.** The process of fish landing in the coastal area (A), distributed to the market (B) and sell in central market (C)

### 3.3. Facilities in quality control activities

The facilities needed to sufficiently support fish quality is an important thing in fisheries activity. In Ambon case and Kei Kecil, the landing site if is insufficient to support quality control activities. The landing site took place at the coastal area in an open air. During the day with high sun intensity, the fish will directly expose to the hot temperature and will have a bad effect to fish product quality. No clean water facility available, instead seawater was used to add to iced fish in the bucket.

There is no clean water facility available at the central market in Ambon. Since the central market was built on top of seawater, the retailer will draw seawater directly from a hole drilled at the market floor to clean the fish and added to iced-fish inside the bucket. The capacity of the central market in
Ambon is insufficient to accommodate all retailers or fish traders. Many of fish retailer/trader sell their fish on the floor by putting them on the wood plate placed on top of the bucket, not on the table bench.

The central market in Kei Kecil, on the other hand, is smaller than the central market in Ambon but have a relatively better facility. Clean water facility is available, the layout is neat and fish is selling on the table bench, and this will enhance fish quality compared to Ambon central market. Figure 4 shows market activities at the central market in Kei Kecil (A) and Ambon (B).

**Figure 4.** The central market facility in Kei Kecil (A), in Ambon (B), and seawater withdraw from the market floor in Ambon (C).
4. Conclusion

- With insufficient facilities available, the small pelagic fish stocks in Kei Kecil and Ambon still have a good quality
- Factors which contribute to good quality of fish delivered to the consumer are the knowledge of fish retailer on handling fish harvested and the distance of fishing ground to fish landing site which is close.
- Consider the need for good quality of fish product, good quality control facility in central market need to be improved especially in Ambon central market.

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