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MICROBIOLOGICAL QUALITY CASE STUDY OF YELLOWSTRIPE SCAD (*Selaroides leptolepis*) AT BINTAN CENTRE MARKET IN TANJUNGPINANG CITY

Studi Kasus Mutu Mikrobiologi Ikan Selar Kuning (*Selaroides leptolepis*) di Pasar Bintan *Centre* Kota Tanjungpinang

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ABSTRACT

Yellowstripe scad (Selaroides leptolepis) is a main commodity at Bintan Centre Market in Tanjungpinang City with sales volume reaching 2-3 tons per day. Fish handling conditions in this traditional market have problems such as simple storage, unclean equipment, and worker sanitation that does not meet standards which potentially increase pathogenic microorganism contamination. The high sales volume and suboptimal handling conditions can impact food safety of products consumed by the community; thus, a case study is needed to evaluate the microbiological quality of yellowstripe scad. This research aimed to analyze microbiological quality based on Total Plate Count (TPC), Escherichia coli, and Salmonella sp. parameters. The study employed a case study method with descriptive comparative analysis. Samples were collected from three vendors with highest sales volume (front, middle, back sections of market) on Monday, Wednesday, and Friday. Testing was conducted using SNI 2332.3:2015 for TPC, SNI 2332.1:2015 for E. coli, and SNI 01-2332.2-2006 for Salmonella sp. Results showed TPC values ranging from 2.5 x 10^3 to 2.9 x 10^4 cfu/g, still meeting the maximum limit of SNI (5.0 x 10^5 cfu/g). Tests for E. coli and Salmonella sp. showed negative results. There was a tendency for TPC values to increase toward weekend and in vendors located at back sections. In conclusion, yellowstripe scad marketed has good microbiological quality and is safe for consumption, but handling improvements are needed especially on weekends.

Keywords: Escherichia coli, Total Plate Count, Traditional Market, Salmonella sp., Yellowstripe Scad

ABSTRAK

Ikan selar kuning (*Selaroides leptolepis*) merupakan komoditas utama di Pasar Bintan *Centre* Kota Tanjungpinang dengan volume penjualan mencapai 2-3 ton per hari. Kondisi penanganan ikan di pasar tradisional ini memiliki permasalahan seperti penyimpanan sederhana, peralatan kurang bersih, dan sanitasi pekerja belum memenuhi standar yang berpotensi meningkatkan kontaminasi mikroorganisme patogen. Tingginya volume penjualan dan kondisi penanganan

yang kurang optimal dapat berdampak pada keamanan pangan produk yang dikonsumsi masyarakat, sehingga perlu dilakukan studi kasus untuk mengevaluasi mutu mikrobiologi ikan selar kuning. Penelitian ini bertujuan menganalisis mutu mikrobiologi berdasarkan parameter Angka Lempeng Total (ALT), *Escherichia coli*, dan *Salmonella* sp. Metode penelitian menggunakan studi kasus dengan analisis deskriptif komparatif. Sampel diambil dari tiga pedagang dengan volume penjualan tertinggi (bagian depan, tengah, belakang pasar) pada hari Senin, Rabu, dan Jumat. Pengujian dilakukan menggunakan SNI 2332.3:2015 untuk ALT, SNI 2332.1:2015 untuk *E. coli*, dan SNI 01-2332.2-2006 untuk *Salmonella* sp. Hasil menunjukkan nilai ALT berkisar 2,5 x 10^3 hingga 2,9 x 10^4 cfu/g, masih memenuhi batas maksimum SNI (5,0 x 10^5 cfu/g). Pengujian *E. coli* dan *Salmonella* sp. menunjukkan hasil negatif. Terdapat kecenderungan peningkatan nilai ALT menjelang akhir minggu dan pada pedagang di bagian belakang pasar. Kesimpulannya, ikan selar kuning yang dipasarkan memiliki mutu mikrobiologi baik dan aman dikonsumsi, namun diperlukan perbaikan penanganan terutama pada akhir minggu.

Kata Kunci: Angka Lempeng Total, *Escherichia coli*, Ikan Selar Kuning, Pasar Tradisional, *Salmonella* sp.

INTRODUCTION

Tanjungpinang City as the center of capture fisheries in the Riau Islands Province with a total production reaching 15,480 tons in 2023. Small pelagic fish dominate the catch with a contribution of 60% or around 9,288 tons. Yellowstripe scad (*Selaroides leptolepis*) is one of the leading commodities with a production of 548 tons or 5.9% of the total production of small pelagic fish (KKP, 2024). The high production makes the price of yellowstripe scad affordable so that the consumption rate is high. In addition, this fish has a nutritional content per 100 g, such as 27% protein; 3.3% fat; 138 kcal energy; and 100 mg phosphorus, so it is widely used in various processed products such as salted fish, pindang, and fish crackers (Sharfina et al., 2014). The high nutritional value and diverse uses encourage the importance of maintaining the quality of yellowstripe scad.

Proper post-harvest handling is key to maintaining the quality of yellowstripe scad. Several factors that affect the quality of fresh fish include catching methods, handling methods, infrastructure, worker hygiene, and environmental conditions of the sales location (Lokollo & Mailoa, 2020). Handling that is not in accordance with standards can accelerate the decay process and the growth of microorganisms that have the potential to endanger consumer health.

Bintan Center Market is the largest traditional market in Tanjungpinang City with an area of 2,500 m^2 and a daily transaction volume of IDR 500 million. The total number of traders operating in this market is 238 traders, 72 of whom are fresh fish traders, the majority of whom make yellowstripe scad their main commodity with demand reaching 2-3 tons per day (Antoni, 2022). However, the handling conditions of fish in this market face various problems such as simple fish storage methods, equipment that is not cleaned routinely, workers not using standard work equipment, and poor drainage conditions. This condition has the potential to increase contamination of pathogenic microorganisms such as *Escherichia coli* and *Salmonella* sp. which can cause digestive disorders and poisoning in consumers.

Previous studies have shown variations in the microbiological quality of fish in various traditional markets. Saud et al. (2024), reported that yellowstripe scad at Manado Boulevard Market had an TPC value of 5.65 x 10^3 cfu/g. In contrast, Maftuhah et al. (2024), found E. coli contamination in yellowstripe scad at Pandeglang traditional market reaching >1100 APM/g. Wibisono (2016), also identified 47.6% of fish samples positive for Salmonella sp. at Sidoarjo Market. These findings indicate the importance of evaluating microbiological quality to ensure the safety of fishery products.

The high sales volume of yellowstripe scad as the main commodity in this market is an aspect that needs to be considered. In addition, handling conditions that still require improvement can have an impact on the food safety of products consumed by the public. Therefore, research on the microbiological quality of yellowstripe scad at Bintan Center Market is important to conduct.

METHODS

This research was conducted from December 2024 to January 2025. Microbiological testing was carried out at the Laboratory of the Fish Quarantine Center for Quality Control and Safety of Fishery Products (BKIPM) Tanjungpinang City.

The method used was a case study analyzed descriptively comparatively. According to Creswell (2015), a case study is a type of approach that attempts to examine as much data as possible regarding the subject being studied through various methods such as interviews, observations, document reviews, survey results, and any data to describe a case in detail. The comparative descriptive approach is used to describe and compare the results of microbiological tests from the samples taken so that the microbiological quality of yellowstripe scad marketed at the Bintan Center Market can be determined (Sugiyono, 2013).

Sampling in this study was carried out using the purposive sampling method. This method was chosen because the sample was determined based on certain criteria in accordance with the research objectives (Subhaktiyasa, 2024). Sample selection criteria include:
1) Yellowstripe scad in fresh condition (bright eyes, red gills, chewy meat, and a distinctive smell of fresh fish).
2) The size of the fish is relatively uniform (length 15-20 cm and weight 100-150 g/tail).
3) Obtained from three traders with the highest volume and sales.

The materials used in this study were yellowstripe scad, Plate Count Agar (PCA), Lauryl Tryptose Broth (LTB), Brilliant Green Lactose Broth (BGLB), EC Broth, Eosin Methylene Blue Agar (EMBA), Lactose Broth (LB), Rappapport Vassiliadis (RV), Salmonella Shigella Agar (SSA), Xylose Lysine Deoxycholate (XLD), Hektoen Enteric (HE), Triple Sugar Iron Agar (TSIA), Lysine Iron Agar (LIA), Kovac's reagent, Methyl Red, Voges-Proskauer, and Butterfield's Phosphate Buffer (BFP).

The tools used in this study were 35°C and 45°C incubators, autoclaves, stomachers, colony counters, petri dishes, test tubes, micropipettes, vortexes, water baths, hotplate stirrers, magnetic stirrers, analytical scales, laminary air flow, bunsen burners, and surgical instruments.

The research procedure began with sample handling using a coolbox filled with ice, followed by preparation in the laboratory by taking 25 g of fish meat, storing it in a refrigerator at a temperature of -10°C, then testing for TPC, *E. coli*, and *Salmonella* sp. using the appropriate SNI reference method.

The test result data were analyzed descriptively comparatively by comparing the test result values between traders and the day of sampling. The results were compared with the maximum limit of microbial contamination: TPC maximum 5.0 x 10^5 cfu/g (SNI 2332.3:2015), *E. coli* maximum 3 APM/g (SNI 2332.1:2015), and *Salmonella* sp. negative in 25 g sample (SNI 01-2332.2-2006).

RESULTS

Total Bacteria Count of Yellowstripe Scad

The total number of bacteria in yellowstripe scad (*Selaroides leptolepis*) was analyzed using the TPC test. Total Plate Count (TPC) is a number that indicates the number of mesophilic bacteria in each 1 mL or 1 g of food sample examined.

The results of the TPC test on yellowstripe scad from three different traders at the Bintan Center Market using the SNI 2332.3:2015 reference method are presented in Table 1, Table 2,

and Table 3. The test was carried out with two different incubation temperatures, namely 35°C and 45°C to identify the presence of microbes.

Table 1. Results of TPC Testing of Yellowstripe Scad on Monday

No.	Trader Location	TPC Temperature	Results (cfu/g)	Quality Requirements (cfu/g)
1	Trader 1 (Front)	TPC 35°C	2.5×10^3	5.0×10^5
		TPC 45°C	<2500	
2	Trader 2 (Middle)	TPC 35°C	2.7×10^3	
		TPC 45°C	<2500	
3	Trader 3 (Back)	TPC 35°C	2.8×10^3	
		TPC 45°C	<2500	

Table 2. Results of TPC Testing of Yellowstripe Scad on Wednesday

No.	Trader Location	TPC Temperature	Results (cfu/g)	Quality Requirements (cfu/g)
1	Trader 1 (Front)	TPC 35°C	2.7×10^3	5.0×10^5
		TPC 45°C	<2500	
2	Trader 2 (Middle)	TPC 35°C	2.8×10^3	
		TPC 45°C	<2500	
3	Trader 3 (Back)	TPC 35°C	2.9×10^3	
		TPC 45°C	<2500	

Table 3. Results of TPC Testing of Yellowstripe Scad on Friday

No.	Trader Location	TPC Temperature	Results (cfu/g)	Quality Requirements (cfu/g)
1	Trader 1 (Front)	TPC 35°C	3.1×10^3	5.0×10^5
		TPC 45°C	<2500	
2	Trader 2 (Middle)	TPC 35°C	2.9×10^3	
		TPC 45°C	<2500	
3	Trader 3 (Back)	TPC 35°C	2.9×10^4	
		TPC 45°C	<2500	

The TPC test results showed variations in values between traders and sampling days. On Monday's test, the TPC values ranged from 2.5×10^3 to 2.8×10^3 cfu/g. The highest value was found in trader 3 at the back of the market (2.8×10^3 cfu/g), while the lowest value was found in trader 1 at the front of the market (2.5×10^3 cfu/g).

On Wednesday's test, there was an overall increase in TPC values, ranging from 2.7×10^3 to 2.9×10^3 cfu/g. Trader 3 again showed the highest value (2.9×10^3 cfu/g). On Friday, there was a significant increase, especially in trader 3, which reached 2.9×10^4 cfu/g, a 10-fold increase compared to the previous test results.

Escherichia coli Content in Yellowstripe Scad

Testing of *Escherichia coli* bacteria content in yellowstripe scad was conducted on 2 traders, namely those located in the middle of the market and those with the highest sales volume at Bintan Center Market. Testing was conducted on Monday using the SNI 2332.1:2015 reference method. The test results are presented in Table 4.

Table 4. *Escherichia coli* Calculation Results

No.	Parameter	Test Stages	Results	Quality Requirements
1	*Escherichia coli*	Presumptive Test (Lauryl Tryptose Broth)	Negative	Maximum 3 APM/g
		Confirmatory Test (EC Broth)	Negative	
		Complementary Test (L-EMB/EMBA)	Negative	

Escherichia coli testing on trader 2 (with the highest sales volume) showed negative results at all stages of testing. This indicates the absence of pathogenic bacteria in yellowstripe scad.

Salmonella sp. Content in Yellowstripe Scad

Testing for the presence of *Salmonella* sp. bacteria in yellowstripe scad was conducted on trader 2 who had the highest sales volume at Bintan Centre Market. Testing was conducted on Monday using the SNI 01-2332.2-2006 reference method. The test results are presented in Table 5.

Table 5. Results of *Salmonella* sp. Testing on Yellowstripe Scad Trader 2

No.	Parameter	Test Stages	Results	Quality Requirements
1	*Salmonella* sp.	Pre-enrichment (Lactose Broth)	Negative	Negative/25 g
		Selective enrichment (RV Broth)	Negative	
		Isolation on selective media (TTB, RV, SCB)	Negative	

The results of *Salmonella* sp. testing on yellowstripe scad from trader 2 (with the highest sales volume) at Bintan Center Market showed negative results at all stages of testing. This indicates the absence of pathogenic bacteria in yellowstripe scad.

DISCUSSION

Total Number of Yellowstripe Scad Bacteria

Based on Tables 1, 2, and 3, the results of TPC testing on yellowstripe scad from three traders at Bintan Center Market showed varying results but were still within safe limits for consumption in accordance with quality requirements according to SNI 2332.3: 2015, which is a maximum of 5.0 x 10^5 cfu/g. According to Martoyo et al. (2014), variations in TPC values can be influenced by various factors such as handling, storage conditions, temperature, trader sanitation, and sampling time.

In Monday's test (Table 1), TPC at an incubation temperature of 35 °C ranged from 2.5 x 10^3 to 2.8 x 10^3 cfu/g. The highest value was found in samples from trader 3 located at the back of the market (2.8 x 10^3 cfu/g), while the lowest value was found in samples from trader 2 located in the middle of the market (2.5 x 10^3 cfu/g). According to research conducted by Kusumaningsih (2020), the high TPC value in trader 3 can be associated with the location at the back of the market which generally has poor air circulation and is closer to the disposal site which can be a source of cross-contamination. This is in accordance with what was explained by Soukotta & Sukardi (2021), that the back of the market building experiences reduced air, causing poor air circulation. Based on observations, it was found that there was a waste disposal site located near trader 3, namely at the back of the market. Meanwhile, all samples at an

incubation temperature of 45°C showed TPC results of less than 2500 cfu/g, indicating a low number of thermophilic bacteria that can grow at high temperatures.

The test results on Wednesday (Table 2) showed an increased TPC value compared to Monday ranging from 2.7 x 10^3 to 2.9 x 10^3. Based on observations, the increase in TPC values was due to the high number of buyers in the middle of the week compared to the beginning of the week. This is in accordance with what was stated by Safitri & Hardi (2023), that traditional markets have busy days for buyers, namely in the middle of the week. In addition, trader 3 again showed the highest TPC value (2.9 x 10^3 cfu/g) and trader 1 located at the front of the market showed the lowest value (2.7 x 10^3 cfu/g). The results of Kusumaningsih's (2020) study also stated that the location of traders at the front of the market usually has better air circulation and lower humidity levels, which can inhibit the growth of microorganisms. In addition, traders at the front of the market generally receive stricter supervision from market managers so that they tend to pay more attention to sanitation and hygiene.

In the Friday test (Table 3), there was a significant increase in TPC values in all traders. The highest TPC value was found in trader 3 located at the back of the market, reaching 2.9 x 10^4 cfu/g at an incubation temperature of 35°C. This value increased 10 times compared to the test results on Monday (2.8 x 10^3 cfu/g) and Wednesday (2.9 x 10^3 cfu/g). This condition can be caused by increased buying and selling activity towards the end of the week. Safitri & Hardi (2023), stated that the weekend is the busiest day for buyers in traditional markets. Based on observations made, the number of buyers at the end of the week increased compared to the beginning and middle of the week. Martoyo et al. (2014), explained that the high density of buyers at the end of the week causes fish to be exposed to room temperature more often due to the frequency of removal and return to the cooler container which is more frequent, causing traders to pay less attention to handling and storing fish.

The low TPC value at an incubation temperature of 45°C (all samples showed results <2500 cfu/g) indicated that the microorganisms that dominate in yellowstripe scad are mesophilic bacteria that grow optimally at temperatures of 20-40°C. This is in accordance with the statement of Ghaly et al. (2010), that the natural microflora in tropical marine fish are generally dominated by mesophilic bacteria such as Pseudomonas, Moraxella, and Acinetobacter which are less able to grow at temperatures above 40°C.

Overall, the TPC test results showed that yellowstripe scad from the three traders at the Bintan Center Market had good microbiological quality. There were indications of an increase in the number of bacteria at the end of the week and at traders located at the back of the market, with trader 3 showing the highest TPC T value consistently on all three sampling days. The peak value of 2.9 x 10^4 cfu/g in trader 3 on Friday indicates the importance of implementing good handling practices, especially during periods with high market activity levels, as well as improving sanitation facilities, especially at the back of the market, to maintain the microbiological quality of fish within safe limits.

Escherichia coli Content in Yellowstripe Scad

The absence of *E. coli* bacteria in the yellowstripe scad sample indicates that sanitation and hygiene practices in handling fish at the Bintan Centre Market, especially by trader 2, have been implemented properly. *E. coli* contamination of fishery products generally comes from several main sources such as the use of contaminated water to wash fish, poor personal hygiene practices by workers, and cross-contamination from unclean equipment (Tansania, 2023).

The low level of microbial contamination in yellowstripe scad from trader 2 can be attributed to several handling factors applied by the trader. Based on observations during sampling, trader 2 implemented relatively good handling practices such as the use of clean water to wash fish, handling fish with clean hands, and using sufficient ice to maintain the cold chain. According to Litaay et al. (2017), the use of sufficient ice can suppress the growth of

bacteria including *E. coli* because most enteric bacteria cannot grow optimally at temperatures below 10°C.

Negative results for *E. coli* in traders with the highest sales volume show an interesting phenomenon. Although trader 2 has a high level of buyer crowds, he managed to maintain the microbiological quality of the fish well. According to Budiati et al. (2015), traders with high stock turnover actually have the advantage of minimizing fish storage time, thereby reducing the risk of microbial growth including *E. coli*.

Salmonella sp. Content in Yellowstripe Scad

The absence of *Salmonella* sp. bacteria in yellowstripe scad samples indicates good food safety aspects. According to Suharni et al. (2008), *Salmonella* sp. is a pathogenic bacterium whose presence in food products can cause gastroenteritis infections in humans with symptoms such as diarrhea, fever, and abdominal pain. Therefore, this negative result indicates that yellowstripe scad sold at the Bintan Center Market is safe for consumption in terms of *Salmonella* sp. contamination.

Several factors can contribute to the absence of *Salmonella* sp. in yellowstripe scad sold by trader 2. Based on observations, the trader applies relatively good handling practices such as using clean water to wash fish, handling with clean hands, and using enough ice to maintain the cold chain. According to Zalukhu et al. (2023), *Salmonella* sp. cannot grow optimally at temperatures below 7°C, so the implementation of a good cold chain can effectively inhibit the growth of these bacteria.

Another factor that contributes to the negative results of *Salmonella* sp. is the process of catching and handling fish before reaching the market. According to Suryanto & Sipahutar (2021), *Salmonella* sp. contamination in fresh fish generally comes from aquatic environments contaminated with domestic or livestock waste, unhygienic handling after catching, and cross-contamination during distribution. The low level of *Salmonella* sp. contamination in yellowstripe scad indicates that the waters where the fish are caught are relatively clean and the post-catch handling process has been carried out properly.

CONCLUSION

The TPC value of yellowstripe scad from the three traders at Bintan Center Market ranged from 2.5 x 10^3 to 2.9 x 10^4 cfu/g and still met the maximum limit of SNI 2332.3:2015 (5.0 x 10^5 cfu/g). *Escherichia coli* testing showed negative results and met the quality requirements of SNI 2332.1:2015 (maximum 3 APM/g). The results of *Salmonella* sp. testing were also negative, and met the requirements of SNI 01-2332.2-2006 (negative/25 g). There was a tendency for an increase in the number of bacteria towards the end of the week and among traders at the back of the market.

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