Microbial quality and diversity of Caesio cunning and Scolopsis taenioptera harvested by using trap and trawl fishing techniques

M Suhaimi and N U Karim

1Faculty of Fisheries and Food Science, Universiti Malaysia Terengganu, 21030, Kuala Nerus, Terengganu, Malaysia
2Institute of Tropical Aquaculture and Fisheries, Universiti Malaysia Terengganu, 21030, Kuala Nerus, Terengganu, Malaysia.

*Corresponding author: ulfah@umt.edu.my

Abstract. The degradation of fish quality and quantity along the supply chain contributes to the postharvest losses. Lack of hygienic practices, non-preprocessing fish and rough handling are the main factors of lowering the catch qualities. This study aims to investigate the microbiology quality and their diversity on coral fishes harvested from two different fishing techniques; trap and trawl. Two fish species; Caesio cunning and Scolopsis taenioptera were subjected to total bacteria, total coliform, Enterobacteriaceae sp., Pseudomonas sp., and yeast and mould analysis. The bacteria identification were further studied using Biomerieux Vitex identification system. The total bacteria count of Caesio cunning and Scolopsis taenioptera harvested by using trap showed a significant (p<0.05) lower amount compared similar species harvested using trawl technique. Furthermore, the pathogenic bacteria and yeast and moulds of Caesio cunning harvested from trap were significantly (p<0.05) lower compared to similar species harvested from trawl techniques. However, there is no significant difference of total coliform, Enterobacteriaceae, Pseudomonas sp. and yeast and moulds found in Scolopsis taenioptera caught from either trap or trawl. The microflora found in both fish species was dominated by Aeromonas sp. Aeromonas sp. is a Gram-negative bacteria, facultatively anaerobic, rod-shaped

1. Introduction
Fish is an important source of protein for human consumption. According to the Food and Agriculture Organization, fish composed 88% over 151 million tonnes of the 171 million tonnes of total fish production consumed by the world’s population in 2016 [1]. However, due to the infection of spoilage bacteria and intoxication, consumption of fish may cause diseases and food poisoning to the consumer [2]. Some of these diseases that present on the external surfaces of fish including slime, gills and gut are caused by microorganisms that naturally present in the fish habitat [3]. In dead fish, spoilage bacteria such as Flavobacterium sp., Psychrobacter sp., Chryseobacter sp., Acinetobacter sp. and Pseudoalteromonas sp. start to spread and grow into the tissues causing undesirable odour and appearance which may contribute to food safety problems [4]. All of the spoilage bacteria could enter the seafood processing chain due to poor standards of hygiene and sanitation during incorrect handling or storage [5]. There is an urgent need to develop microbial control strategies since diseases epidemics are recognized as a limitation to fish production.

Trap-nets are passive fishing gears that have evolved from simple barriers to modern-day netting enclosures with herding and retaining devices. They are usually set on traditional sites in the path of
migrating fish in coastal waters. Trap-net fisheries can be energy-efficient, selective and habitat-friendly providing catches of high quality since the catch is usually alive when brought abroad the vessel [6]. The trawl is flexible gear that can be used on many types of areas and grounds in shallow and deep waters and by small and large vessel for a wide range of target species. These characteristics have made trawling the preferred fishing method for many fisheries [6]. The trawl net provides a pliable grid when pulled from the water the net reel wound tightly [7]. The most widespread of physical disturbance for the seabed is bottom trawling according to the research provide that trawl gears removed 6-14% of fauna biomass per pass and reduce the coral reef fishes [8]. This study was conducted to determine the microbial quality and diversity of Caesio cunning and Scolopsis taenioptera harvested by using trap and trawl fishing techniques.

2. Materials and methods

2.1 Samples collection

Two coral reef fishes species; Caesio cunning (species 1) and Scolopsis taenioptera (species 2) were collected from the fishing port, Pulau Kambing, Terengganu. All samples were transported in polystyrene box with fish to ice ratio at 1:1.

2.2 Microbiology analysis

Microbiology analysis was carried out using a method by [9]. All instruments were sterile with 70% ethanol before used. 10 ± 0.1 g of fish muscle were weighted and aseptically transferred to a sterile stomacher bag. All samples were homogenized in 90 ml of Maximum Recovery Diluent (MRD) (MERCK, Germany). The appropriate dilution was spread accordingly on the selective agar at instructed incubation hours. Total bacteria count were determined on plate count agar after incubated at 30°C after 48 hours. For total coliform determination, the samples were spread plated on MacConkey agar and incubated at 35°C for 18 until 24 hours. Yeast and mould count was determined on Rose Bengal agar base after incubated at 30°C in the dark for 5 days. Meanwhile, Enterobacteriacea and Pseudomonas sp. count were determined using violet red bile glucose agar and cetrimide agar, respectively after incubated at 35°C for 18-24 hours. All analysis were done in triplicate. Microbiology counts were expressed as log colony forming units per gram of samples (log_{10} CFU g^{-1}).

2.3 Identification of bacteria

Bacteria colonies were selected at random using a Harrison Disc [10]. The isolates were streaked onto PCA and incubated at 30°C. After 18-24 h incubation, the size and colour of the colonies were recorded and the following tests carried out: Gram reaction, motility (using the hanging drop method) [11] catalase activity and oxidase activity [10]. The bacteria were identified by using the VITEK 2 Compact System (BioMérieux).

2.4 Statistical analysis

The software package IBM SPSS Statistics software (Version 20) was used for statistical analysis. All experiments were replicated 3 times with different samples. The data were analyzed using one-way analysis of variance (ANOVA) and the mean value were compared by Tukey’s multiple range test. P values less than 0.05 were considered statistically significant. The results were reported as mean values ± standard deviation (S.D).

3. Result and discussion

The total bacteria count of Caesio cunning and Scolopsis taenioptera harvested by using trap showed a significant (p<0.05) lower amount compared similar species harvested using trawl technique (Table 1). Total bacteria count of Caesio cunning harvested from the trap (4.81±0.12 log_{10} CFU g^{-1}) were lower compared to the bacteria counts from the trawl (5.34±0.04 log_{10} CFU g^{-1}). Total bacteria count of Scolopsis taenioptera from the trap was recorded at 4.24±0.08 log_{10} CFU g^{-1} and showed a significantly lower amount compared to the bacteria counts from the trawl (5.51±0.04 log_{10} CFU g^{-1}). Furthermore,
the pathogenic bacteria and yeasts and moulds of *Caesio cunning* harvested from trap were significantly (p<0.05) lower compared to similar species harvested from trawl techniques. However, there is no significant difference of total coliform, *Enterobacteriaceae, Pseudomonas* sp. and yeasts and moulds found in *Scolopsis taenioptera* caught from either trap or trawl. The fish trap showed a significantly reduced amount of bacteria accumulation might due to low of destruction and no penetration of bacteria into the fish skin. However, the bacteria count found at fish skin from the fish trawl were increased because the fish tissue and cause injuries from the trawl and also influenced by the digestive bacteria and enzymes activities [12].

**Table 1.** Microbiological analysis of *Caesio cunning* and *Scolopsis taenioptera* harvested by using fish trap and trawl.

| Types of bacteria | *Caesio cunning* | *Scolopsis taenioptera* |
|-------------------|------------------|------------------------|
|                   | Trap             | Trawl                  | Trap                  | Trawl                  |
| Total bacteria count | 4.81±0.12<sup>A</sup> | 5.34±0.04<sup>B</sup> | 4.24±0.08<sup>B</sup> | 5.51±0.04<sup>B</sup> |
| Total coliform    | 3.28±0.29<sup>A</sup> | 4.59±0.11<sup>B</sup> | 2.85±1.01<sup>A</sup> | 3.60±0.82<sup>A</sup> |
| *Enterobacteriaceae* | 2.38±0.34<sup>A</sup> | 4.09±0.21<sup>B</sup> | 1.02±0.88<sup>B</sup> | 1.98±1.71<sup>B</sup> |
| *Pseudomonas* sp. | 2.73±0.30<sup>A</sup> | 4.48±0.23<sup>B</sup> | 1.66±1.49<sup>A</sup> | 2.82±0.03<sup>B</sup> |
| Yeast and Mould   | 2.65±0.55<sup>A</sup> | 4.23±0.09<sup>B</sup> | 2.45±0.40<sup>A</sup> | 3.30±0.53<sup>B</sup> |

Table 2. Bacteria identification of *Caesio cunning* and *Scolopsis taenioptera* harvested from the trap and trawl fishing techniques.

| Fish species          | Analysis                              | Trap                                   | Trawl                                  |
|-----------------------|---------------------------------------|----------------------------------------|----------------------------------------|
| *Caesio cunning*      | Total Bacteria Count                   | *Serratia fonticola*, *Aeromonas* sp.  | *Bordetella hinzii*, *Aeromonas* sp.   |
|                       | Total Coliform                        | *Photobacterium damselae*, *Aeromonas sobria*, *Aeromonas* sp. | *Hafnia alvei*, *Aeromonas* sp.        |
| *Enterobacteriaceae*  | *Providencia rustigianii*             | *Providencia rustigianii*, *Klebsiella pneumoniae* | *Klebsiella pneumoniae*, *Citrobacter freundii* |
| *Pseudomonas* sp.     | *Aeromonas* sp.                       | *Aeromonas* sp., *Enterobacter* sp.    | *Klebsiella pneumoniae*, *Citrobacter freundii* |
| Yeast and Mould       | Unidentified                          |                                        |                                        |
| *Scolopsis taenioptera* | Total Bacteria Count                   | *Sphingomonas paucimobilis*, *Serratia fonticola* | Unidentified                          |
|                       | Total Coliform                        | *Hafnia alvei*                         | *Aeromonas sobria*                     |
| *Enterobacteriaceae*  | *Hafnia alvei*                        |                                        | *Providencia rustigianii*              |
| *Pseudomonas* sp.     | *Aeromonas* sp.                       |                                        | *Aeromonas* sp.                       |
| Yeast and Mould       | *Citrobacter freundii*                |                                        | Unidentified                          |

Means with different superscripts (a, b) in the same row show a significant difference (p<0.05) between the microbiology analysis. Meanwhile means with different superscripts (A, B) in the same column show a significant difference (p<0.05) between trap and trawl. *Aeromonas* sp. were identified in *Caesio cunning* meanwhile *Sphingomonas paucimobilis* present in *Scolopsis taenioptera* harvested from the trap (Table 2). Moreover, *Serratia fonticola* were dominant in...
both species harvested from trap harvesting technique. *Aeromonas* sp., *Photobacterium* sp., *Providencia rustigianii*, *Enterobacter* sp., and *Klebsiella pneumonia*, were identified in *C. cunning* harvested from the trap and trawl. Meanwhile pathogenic bacteria such as *Hafnia alvei*, *Providencia rustigianii* and *Aeromonas* sp were found in *S. taenioptera*. The diversity of pathogenic bacteria in *S. taenioptera* were lower compared to the diversity of bacteria identified in *C. cunning*. The microflora found in both fish species was dominated by *Aeromonas* sp. *Aeromonas* sp. is a Gram-negative bacteria, facultatively anaerobic, rod-shaped and environmental bacteria that are detected in numerous gastrointestinal infections.

4. Conclusion
In conclusion, the trap harvesting techniques showed a better microbiology quality compared to trawling harvesting techniques. The bacteria diversity were found lower in *S. taenioptera* compared to *C. cunning*.

5. References
[1] FAO 2018. The State of World Fisheries and Aquaculture. FAO, Rome.
[2] Dhanya and Mathew 2017. Microbial Spoilage in Fish. *Imper J of Interdis Res.* 3:4.
[3] Rani M K, Chelladurai G, and Jayanthi G 2016. Isolation and identification of bacteria from marine market fish *Scomberomorus guttatus* (Bloch and Schneider, 1801) from Madurai district, Tamil Nadu, India. *J Parasit Dis*. 40(3), 1062-1065.
[4] Reynisson E, Lauzon H L, Thorvaldsson L, Margeirsson Á R, Marteinsons V P, and Martinsdottir E 2010. *European Food Res and Tech*. 231(2), 237-246.
[5] Jalal A J, Nurul L, Faizul, Noor I Y, Irwandi, and Mahbuba B 2017.. *Inter Food Res J*. 24:S298-S304.
[6] Suuronen P, Chopin F, Glass C, Lokkeborg S, Matsushita Y, Queirolo D, and Rihan D 2012.. *Fish Res*. 119-120.
[7] Hopkins N and Gautier M S 2019. *Apparatus for sorting marine species in fish trawl*. United States, U.S.CL CPC
[8] Hiddink JG, Jenning S, Sciberras M, Szosteka CL, Hughesa K M, Ellisd N, Rijnsdorpe A D, McConnaugheyf R A, Mazord T, Hilborng R, Collieh J S, Pitcherd C R, Amorosoi R O, Parmai A M, Suuronenj P, and Kaiseram J M 2017. *Global analysis of depletion and recovery of seabed biota after bottom trawling disturbance*. United Kingdom, Ocean Sciences.
[9] Karim NU, Nur Farhah A S and Sayed M Z S H 2017. *J of Sustain Sci and Manag*. 3, 111-118.
[10] Harrigan W F 1998. Sampling methods for the selection and examination of microbial colonies. In *Laboratory methods in food microbiology*. London, UK: Academic Press Ltd.
[11] Collins C H, Lyne P M, and Grange J M 1995. Identification methods. In *Microbiology methods*. (Oxford : Butterworth Heinemann) p 103.
[12] Boute P G, Rijnsdorp A D, Versteeg W S M, Kleppe R, Leeuwen J L, and Lankheet M J M 2018. A comparative study of spinal injuries in fishes caught by pulse trawling and traditional beam trawling. *ICESCM* 2018.