

HEAT DISTRIBUTION ANALYSIS WITH 2 DIMENSIONAL MANAGEMENT OF MARINE TOURISM IN COASTAL WATERS OF BENGKALIS, RIAU PROVINCE: ANALYSIS OF *CLOSTRIDIUM PERFRINGENS* BACTERIA ON FISH MACKEREL (*Cybium commersoni*)

by:

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Abstract

Mackerel fish (*Cybium commersoni*) is one of the foodstuffs consumed by many people and contain high nutritional value, especially protein. Monitoring of marine water quality in coastal waters of Bengkalis to achieve sustainable management of marine tourism can be conducted bacteriological and protect fishery production that cause disease in humans. *C. perfringens* in mackerel (*Cybium commersoni*) allegedly increased the amount of pollution caused by domestic wastewater (sewage), anthropogenic activities and rapid development along the coastal waters of Bengkalis. Research objectives were to analyze *C. Perfringens* in mackerel (*Cybium commersoni*) as bioindicator of pollution so as to ensure the health and comfort of the local community and tourists. The research method is a survey method, using the media to TSC (*Tryptose Sulphite Cycloserine*). Mackerel samples obtained from Bengkalis waters, the study in March-April 2012, the data analysis of the total *C. Perfringens* by West (1989) and Fardiaz (1992). Observations of total *C. perfringens* on mackerel ranged between 3.1×10^4 to 6.0×10^6 cells/gram sample. Distribution of *C. perfringens* highest found in gills, compared to the digestive tract and mackerel meat. The results of the identification of bacterial isolates *C. perfringen* on mackerel fish are Gram-positive cells, stem shape, black in color, in-methyl, colonies, turned cloudy and gas bubbles are formed. *C. perfringens* on mackerel can grow at 37 °C. *C. perfringens* in fish mackerel are still below the threshold that could be categorized Bengkalis coastal waters has not been contaminated. Management of marine tourism in coastal waters of Bengkalis can be developed to improve public health and tourists, including protecting coastal ecosystems of Bengkalis.

Key words: C. perfringens, mackerel (Cybium commersoni), management of marine tourism

1. INTRODUCTION

Bengkalis is one of regencies in Riau province with its capital Bengkalis of Bengkalis island, separated from the island of Sumatera. The broad of Bengkalis are 11481.77 km², almost all districts in Bengkalis dealing with the sea. Bengkalis is one of the largest fish producing areas in Riau Province by the number of fish production in 2009 of the catch amounted to 9443.80 tonnes. Bengkalis also has a very strategic location because



it is traversed by the international shipping lanes leading to the Straits of Malacca (Marine and Fisheries Agency Bengkalis, 2009).

Bengkalis inshore ecosystems has had ecological function, the tropical mangrove forest with a variety of flora and fauna. In addition, the presence of mangrove forest is very important because it serves as a buffer, maintaining the stability of aquatic ecology, provision of nutrients, and certain types of fish spawning areas and fish care area economically important. One of the marine fishery commodities in Bengkalis and lots of potential is utilized mackerel (*C. commersoni*).

Mackerel fish (*C. commersoni*) is one of the foodstuffs consumed by the public and contain high nutritional value, especially protein. High protein content in mackerel is useful as a much needed animal protein for human growth and prevent various diseases such as coronary heart disease and cancer. Muharrama (2012) states that the mackerel fish (*C. commersoni*) belongs to the family Scombridae, which is a close relative of tuna, tongkol and kembung fish.

Production of marine fisheries are very important such as mackerel have been used by communities in the Bengkalis as a source of animal protein, nutrition and health. Baliwat (2004) states that mackerel contained protein 22.0 grams/100 grams of fish, omega-3 2.6 grams/100 grams of fish, and fat 13.9 grams/100 grms of fish.

The potential contained in coastal waters where their use regardless Bengkalis aspects of environmental management, it will have an impact on coastal waters. Community activities around the coastal waters can affect marine water quality factors such as physics, chemistry and biology. People usually do a variety of activities in both the land and marine environment. For example, the use of coastal waters as a means of transportation for boats and fishing areas.

Monitoring the quality of marine waters in coastal waters of Bengkalis to realize ecotourism management be performed fishery production that can cause disease to humans. Magos (1990) states that the sea contains a number of viruses, bacteria and fungi that are pathogenic to humans in part. *C. perfringens* bacteria in mackerel can be used as indicators of marine pollution. Pathogen by some bacteria will as a cause of deases and poisoning in humans who consumed mackerel fish. According to Lipp *et al.*, (2001), *C. perfringens* together with coliform bacteria, faecal coliforms, Streptococci and Enterococci are often used as a guide or indicator of pollution.

Organic pollution (*sewage*) and rapid development along the coastal waters of Bengkalis can increase the amount of *C. perfringens* bacteria. Monitoring the extent of pollution has increased the number of *C. perfringens* bacteria in mackerel that is by analyzing the distribution of *C. perfringens* bacteria.

Poisoning bacterium *C. perfringens* disorder characterized by abdominal cramps and diarrhea within 8-22 hours (Crouch, 2005). The bacteria can be found in the soil and the normal flora of the intestinal tract of humans or animals (Atwa & Ross, 2011). A variety of food and a source of water contamination, toxic bacteria are very sensitive to heat and cause human diseases such as bacteria *Clostridium* sp (Pommerville 2004).

Research on the *C. perfringens* bacteria as an indicator of bacteriological contamination in coastal waters of Bengkalis to create marine ecotourism development has not been done, so that is deemed highly necessary to monitor the security level of the region for marine fisheries consumption by local peoples. This study aims to analyze and evaluate the distribution of *C. perfringens* bacteria in mackerel fish in coastal waters of Bengkalis. The results are expected to give a presence of *C. perfringens* bacteria as indicators of marine pollution. Useful information for sustainable marine development and monitoring of bacteriological quality of the fishery so as to ensure the health of the community and tourists.

2. METHODOLOGY: QUANTITATIVE AND QUALITATIVE DATA



Measuring the quality of seawater carried out directly in coastal waters of Bengkalis. Analysis of *C. perfringens* bacteria on mackerel conducted at the Laboratory of Marine Microbiology, Faculty of Fisheries and Marine Sciences University of Riau. Test of the mackerel fish is fresh with the size of ± 1 kg / head as many as 5 fishes. The method used in this research is survey method. Fresh mackerel samples obtained from fishermen in coastal waters of Bengkalis on March-April 2012.

Samples of fresh mackerel (*C. commersoni*) taken at random. Bacteriological parameters based on the number of *C. perfringens* bacteria found in fresh mackerel (gills, digestive tract and meat). Bacterial colonies are counted black in the middle on the TSC selective medium (*Tryptose sulphite agar*). Test identification of bacterial isolates *C. perfringens* used crystal violet, 95% alcohol, iodine, safranin, H₂O₂ 3% solution, sulfide indole motility medium, and reagents metyl red (West, 1989). The data obtained is tabulated into a table with descriptive analyzed. Data of marine water quality were analyzed by descriptive.

3. RESEARCH FINDINGS

3.1. Analysis of *C. perfringens* Bacteria

Results of analysis of *C. perfringens* in the coastal waters of Bengkalis on fresh mackerel can be seen in Table 1. The observation of *C. perfringens* bacteria showed that the overall bacteria have been isolated from fresh mackerel. It is seen from the growth of black colonies bacteria on the TSC medium.

Table 1. The total *C. perfringens* bacteria in tenggiri.

Mackerel	Organs of Mackerel (Cfu/ml)		
	Gills	Digestive tract	Meat
1	9.3×10^4	5.0×10^7	6.8×10^4
2	7.2×10^6	6.5×10^5	8.0×10^4
3	1.2×10^7	8.9×10^5	2.1×10^4
4	6.0×10^6	9.0×10^3	5.7×10^5
5	2.0×10^4	5.1×10^5	7.3×10^4
Average	5.1×10^6	1.0×10^7	1.6×10^5

Source: Primary Data Research (2012)

The total of *C. perfringens* bacteria in Mackerel as in Table 1, ranged between 9.0×10^3 to 1.2×10^7 (Cfu/ml). The highest total of *C. perfringens* bacteria was obtained at digestive tract, and the lowest was obtained at meat mackerel. Wibowo and Ristanto (1988) states that good quality fish if the number of bacteria/gram sample of less than 10^6 cells per gram. According Fardiaz (1992), the threshold of a microorganism that causes diseases such as *Salmonella sp* 10^5 cell, *E. coli* 10^6 and *Clostridium perfringens* 10^6 cells.

The number of *C. perfringens* bacteria increased up to certain limits and eventually went through a phase of death. Buckle *et al* (1987) states that if there is an optimal environment and nutrients in the medium, there will be a maximum bacterial growth and increasing growth curve. Average yield of total *C. perfringens* bacteria in Mackerel can be seen in Figure 1.

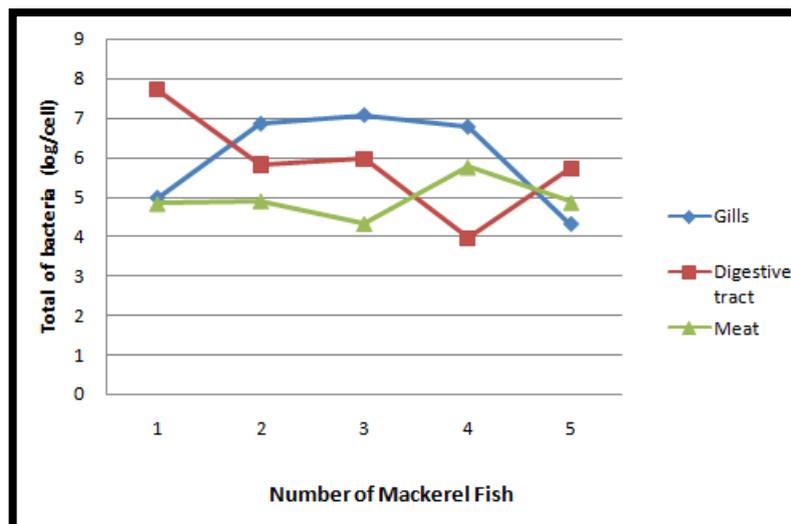


Figure 1. Average total of *C. perfringens* bacteria in Mackerel (Log x).

As Figure 1. can be seen that the highest total of *C. perfringens* bacteria found in digestive tract for each treatment. Risks contained in the digestive tract is awareness, but risks contained in the meat mackerel is taken low. The results of this analysis in accordance with the Murano (2003) which states that the existence of microbial life in a fish or a new arrest is usually low.

The presence of *C. perfringens* bacteria in the sea can be sourced from domestic waste. Settlements inhabited the waters around the coast, increasing the consumption level of local communities and other events, resulting in domestic waste such as garbage and waste detergent. Domestic waste can spur the growth of *C. perfringens* bacteria.

Fardiaz (1992) states that toxicity of *C. perfringens* bacteria can invade the digestive tract and *C. perfringens* can produce botulinum neurotoxin that attacks the nerves and cause paralysis, which for healthy adults, infants and the elderly require only 1-10 cells can be a pain.

Factor selection of some species of fish is more expensive than chicken and beef, or perhaps public awareness about the value of food and fears of the emergence of diseases of high fat foods. Therefore, this study was also conducted to get an idea about the background of consumer preferences for fresh mackerel for protein. Jamal (1998) states that a high presence of microbial indicators in a sample described the presence of microbial pathogens.

3.2. Biochemistry Test of *C. perfringens* Bacteria

Environmental factors was affect *C. perfringens* bacteria growth. *C. perfringens* bacterial colonies that have grown observed on color, shape and performed the identification of isolates (Table 2). The results showed that the *C. perfringens* bacteria colonies in all treatments which the cells are stem-shaped, Gram-positive, black spores and formed gas bubble. *C. perfringens* bacteria in all treatments to grow at 37 °C.

Table 2. Biochemical test of *C. perfringens* bacteria in Mackerel.

Biochemicals Tests	Organ of Mackerel		
	Gills	Digestive tract	Meat
Gram stain	+	+	+
Cell shape bacterial	Stem	Stem	Stem
Spore staining	Black	Black	Back
Catalase test	+	+	+
Oxidase test	+	+	+
Anaerobic test	+	+	+
Methyl red test	+	+	+
Sulfide (H ₂ S) test	+	+	+
Thioglycolate broth test	+	+	+

Source: Primary Data Research (2012)

Fardiaz (1992) stated that the destruction of food such as fish, is caused by bacteria that have a variety of enzymes that break down the components of the complex into simple compounds. This happens due to various changes in properties such as color, odor, taste and texture of the food. According Hadiwiyoto (1993), fish that contain a lot of microorganisms like bacteria, the fish is quickly becoming rotten. Therefore, the examination of the number of bacteria can be used to determine fish freshness and safety related consumer health.

3.3. Water Quality Parameters

The measurement results of water quality of the Bengkalis coastal waters as seen in Table 3 still support for the growth of Mackerel. Fluctuations in the average water temperature is not so evident in the range between 29-30 °C, while the average pH ranged from 7.1-7.5. Fluctuations in the average salinity ranged from 28.0-30.0 ‰, while the average brightness ranged from 50-51 cm and flow velocity is 0,2-0,3 cm/sc. This is influenced by tidal waters at high tide that is, lower oxygen concentrations and at low tide is higher. Fardiaz (1992) states that the number and type of microorganisms in the water is affected by physical and chemical factors such as temperature, pH, osmotic pressure, hydrostatic pressure, aeration and penetration of the sun and the types of pollutants that enter the waters.

Environmental factors causing pollution of microorganisms, toxic residues being destroyers and heavy metal residues (Amaraneni 2002). Control of fish after capture, is sold in markets, restaurants or processing plants as a source of microorganism contamination, health impacts on consumers (Forsythe & Hayes, 1998; Jensen & Greenless 1997).

Table 3. Measurement of water quality parameters in Bengkalis coastal waters.

Marine Water Quality Parameters	Stations		
	I	II	III
Temperature (°C)	30	30	29
Flow velocity (m/sc)	0,2	0,3	0,2
Brightness (cm)	50	51	51
Salinity (‰)	30	29	28
pH	7,5	7,1	7,4

Source: Primary Data Reserch (2012)

4. CONCLUSION

Based on the results of research on *C. perfringens* bacteria in mackerel in the Bengkalis coastal waters can be concluded that *C. perfringens* on the meat of mackerel was lowest. The total *C. perfringens* bacteria on digestive tract is still highest because it is still below the threshold value. The results showed that for the consumption of mackerel

recommended of meat only. Microorganisms that play a role in the meat of mackerel, it is advisable to conduct further tests on the identification of *C. perfringens* bacteria. The results can be used as information in the implementation of marine ecotourism development in coastal waters of Bengkalis.

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