

Bacteria Occurrence in *Sarotherodon malarotheron* and *Chrysichthys nigrodigitatus* in Brackish Water Environment

Abidemi-Iromini, A.O.* and Fofah, O.J.

Department of Fisheries and Aquaculture Technology, The Federal University of Technology, Akure, Nigeria.

*Corresponding author: attytej@gmail.com

ABSTRACT

The occurrence, load and prevalence of bacterial flora were investigated on *Sarotherodon malarotheron* tilapia fish and *Chrysichthys nigrodigitatus* catfish collected from Lagos Lagoon. The skin, gills and intestines were subjected to bacteriology examination. A total of fourteen (14) bacteria species were recovered; namely: (*Enterobacter* spp., *Pseudomonas* spp., *Proteus* spp., *Escherichia coli*, *Klebsiella* spp., *Salmonella* spp., *Serratia* spp., *Micrococcus leteus*, *Staphylococcus aureus*, *Actinomyces* spp., *Streptococcus faecalis*, *Lactobacillus* spp., *Staphylococcus epidermidis*, and *Bacillus* spp.). Twelve (12) bacteria were isolated from *S. malarotheron*, while eleven (11) bacteria flora were recovered from *C. nigrodigitatus*. Highest bacteria recovery was in intestine (46.2%), 33.3% in gills and 20.5% in skin for the fish species. Bacteria recoveries for both species were similar except for *Lactobacillus* spp which occurred only in tilapia fish. Descriptive statistical analysis used indicated significant ($P > 0.05$) relationship in bacteria recovery among species of fish and in the respective organs examined.

Keywords: *Sarotherodon malarotheron*, *Chrysichthys nigrodigitatus*, Bacteria occurrence, Lagos Lagoon.

INTRODUCTION

Fish are generally regarded as safe, nutritious and beneficial (WHO, 2007); the consumption of fresh silver catfish (*Chrysichthys nigrodigitatus*) and *Sarotherodon malarotheron* is on the increase in both rural and urban centres in Nigeria. Assessment of fish bacteria load for management and utilization purposes is an important measure towards successful fish production. Therefore, while fish take a large number of bacteria into their gut from water sediment and food (Geldreich and Clark, 1988), faecal coliform in fish demonstrates the level of pollution in their environment indicating presence of harmful disease causing organisms because coliform are large group of bacteria occurring in the fish environment (Gogoi and Sharma, 2013). The fresh water bodies have a complex flora of microorganisms which include genuinely aquatic species as well as component introduced from terrestrial, animal and plant sources. (Adams *et al.*, 1999).

Bacteria, a large group of single-celled, prokaryote microorganisms occurring almost everywhere in nature are microscopic organisms whose single cells have neither a membrane bounded nucleus nor other membrane bounded organelles like mitochondria and chloroplasts (Fredrickson *et al.*, 2004); and are noted for most fish diseases, fish spoilage and threats to public health (Ashbolt *et al.*, 2001). Assessment of the bacterial flora, load and prevalence associated with the organs of caught fish from environment give information on environment to fish relationship.

Water with high organic load predisposes fish to disease condition. The majority of fish pathogens are short, Gram-negative rods belonging to the Enterobacteriaceae and Pseudomonaceae families (Ashbolt *et al.*, 2001). Fresh and brackish water fishes can harbour human pathogenic bacteria particularly the coliform group (Leung *et al.*, 1990). Lagos lagoon is under consistent and sometimes severe pressure from diverse forms of human activities emanating from the surrounding communities (Ogunmwonyi *et al.*, 2008). Deterioration of the lagoon health results in changing physicochemical properties, macro benthic faunal composition, plankton diversity and fish species, and industrial wastes have led to biological consequences in the coastal aquatic environment, (Ajao, 1990).

MATERIALS AND METHODS

A total of 12 samples each of *C. nigrodigitatus* and *S. malarotheron* were collected from Lagos lagoon and transported to laboratory where they were aseptically dissected. Samples were collected from skin, gills and intestine which were stored respectively in sample bottles for bacteriological studies. Serial dilutions (10^{-5}) were carried out, and viable microbial counts of samples were obtained using nutrient agar, MacConkey agar, Salmonella Shigella agar and Eosin methylene blue agar of the sample. Enumeration of bacteria was carried out using pour plate

technique. Inoculated plates for different agar were incubated at 37°C for 24 hours after which results of microbial colonies were counted using Gallenkamp colony counter per ml (cfu/ml); pure bacteria were obtained from different agar, and organisms were identified using biochemical tests to confirm the presence of the suspected microorganism by their reaction to tests: (motility, spore, catalase, indole, oxidase, coagulase, sugar fermentation, Oxidation fermentation) were carried out. All the isolates were transferred from the slants into the agar plates, incubated and used for identification such as cultural and morphological characteristics, biochemical tests using procedures outlined by World Health Organization (WHO, 1989).

Analysis of data was done using descriptive and inferential statistics. These include mean, simple percentages and chart. The inferential statistics was used to assess relationships among variables using simple statistic and chart.

RESULTS

Twelve (12) bacteria were isolated from *S. malarotheron* namely *Bacillus spp.*, *Klebsiella spp.*, *Salmonella spp.*, *Proteus vulgaris.*, *Actinomyces spp.*, *Micrococcus lettus*,

Staphylococcus aureu., *E. coli*, *Pseudomonas aureginosa*, *Lactobacillus spp.*, *Serratia marcesces* *Staphylococcus epidermidis*; and eleven (11) bacteria were isolated from *C. nigrodigitatus* namely: *Bacillus spp.*, *Micrococcus lettus*, *S. aureus*, *Salmonella spp.*, *P. vulgaris*, *Actinomyces spp.*, *P. aureginosa*, *Streptococcus faecalis*, *E. coli*, *Klebsiella spp.*, *Enterobacter aerogenes*. Fourteen (14) bacteria species were isolated from the two fish species, namely *S. epidermidis*, *S. marcesces*, *Lactobacillus spp.*, *Bacillus spp.*, *Micrococcus lettus*, *S. aureus*, *P. aureginosa*, *Salmonella spp.*, *E. coli*, *Klebsiella spp.*, *P. vulgaris*, *Actinomyces spp.*, *E. aerogenes*, *S. faecalis*. Figures 1-4 show some of bacteria identified in laboratory. Highest Bacterial load were found in intestine, followed by gills and least recovery made in skin respectively for both *S. malarotheron* and *C. nigrodigitatus* (Table 1). Figure 2 and Figure 3 show relationship of occurrence of bacteria on skin, gills and in intestine of *S. malarotheron* and *C. nigrodigitatus* respectively while Figure.4 shows relationship of bacteria load on the two fish species. Figures 5, 6 and 7 showed comparative Bacterial load on different agar plates for the skin, gills and intestine respectively on *S. malarotheron*; and bacteria load on different agar plates for *C. nigrodigitatus* were shown in Figures 8, 9 and 10 respectively for skin, gills and intestine.

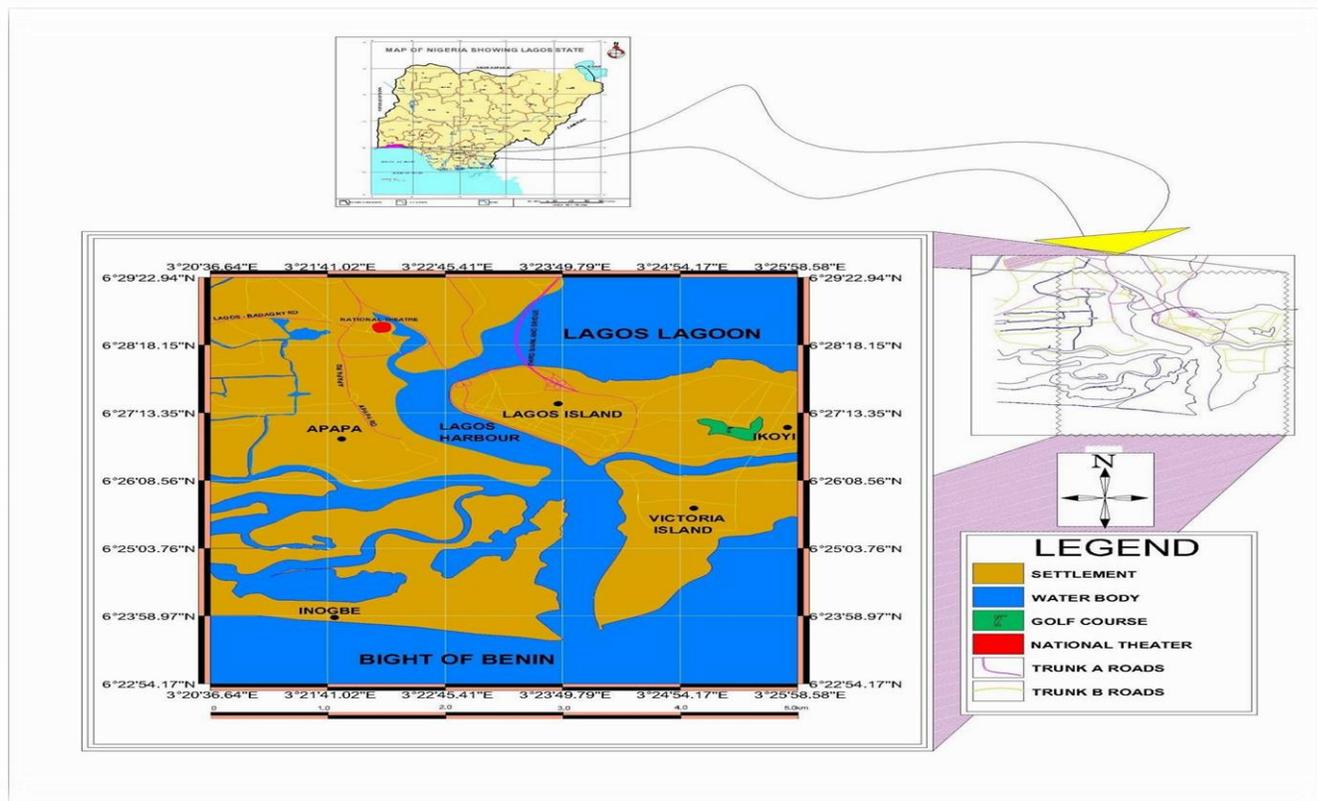


Figure 1: Map of Lagos Lagoon (SOURCE: GIS generated map)

Table 1: Bacteria isolate from the fish species

Fish species	Organs		
	Skin	Gill	Intestine
<i>S. malarotheron</i>	<i>Bacillus spp.</i> ; <i>M. Lettus</i> ; <i>S. Aureu</i> ; <i>Klebsiella spp.</i> ; <i>S. epidermidis</i>	<i>Salmonella spp.</i> ; <i>P. Vulgaris</i> ; <i>Actinomyces spp</i> ; <i>M. Lettus</i> ; <i>S. Aureu</i> ; <i>E. coli</i>	<i>Salmonella spp.</i> ; <i>P. aureginosa</i> ; <i>Lactobacillus spp</i> ; <i>M. lettus</i> ; <i>S. aureu</i> ; <i>E. coli</i> ; <i>Serratia marcesces</i>
<i>C. nigrodigitatus</i>	<i>Bacillus spp.</i> ; <i>M. lettus</i> ; <i>S. aureu</i>	<i>Bacillus spp.</i> ; <i>Salmonella spp</i> ; <i>P. vulgaris</i> ; <i>Actinomyces spp</i> ; <i>M. lettus</i> ; <i>S. aureu</i> ; <i>E. coli</i>	<i>Bacillus spp.</i> ; <i>Salmonella spp.</i> ; <i>P. aureginosa</i> ; <i>S. faecalis</i> ; <i>M. lettus</i> ; <i>S. aureu</i> ; <i>E. coli</i> ; <i>Klebsiella spp.</i> ; <i>P. vulgaris</i> ; <i>Actinomyces spp</i> ; <i>E. aerogenes</i>

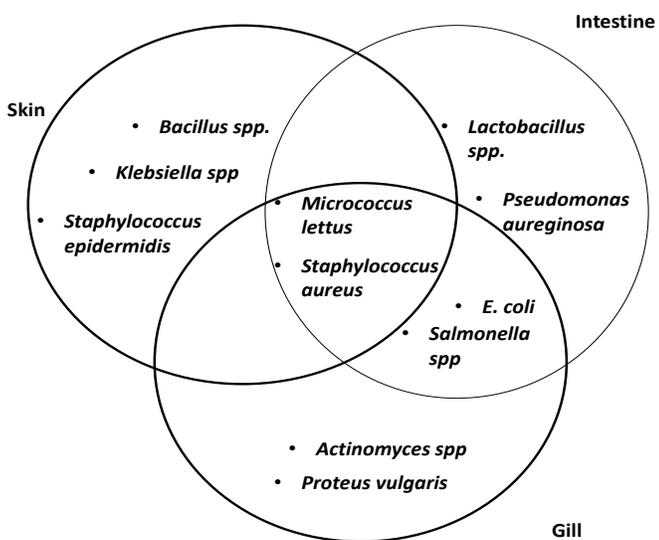


Figure 2: Occurrence of bacteria in gill, skin and intestine of *S. malarotheron*

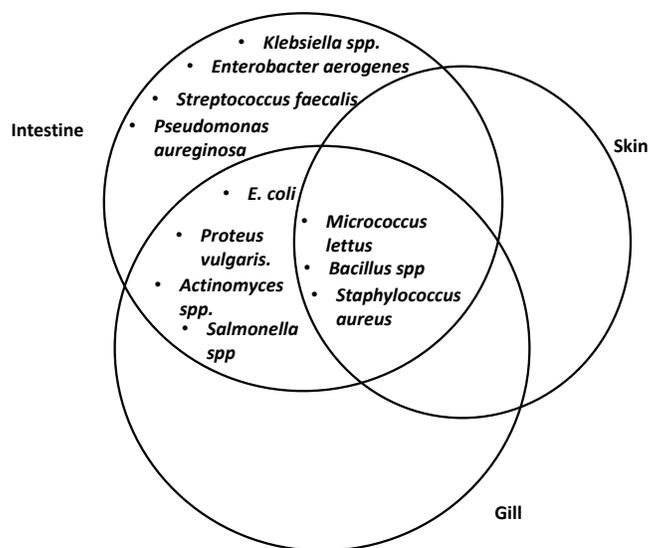


Figure 3: Occurrence of bacteria in gill, skin and intestine of *Chrysichthys nigrodigitatus*

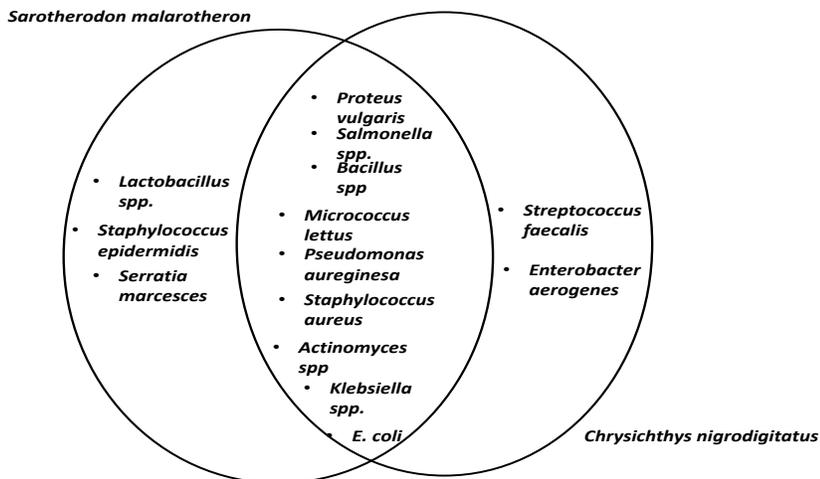


Figure 4: Occurrence of bacteria between *C. nigrodigitatus* and *S. malarotheron*

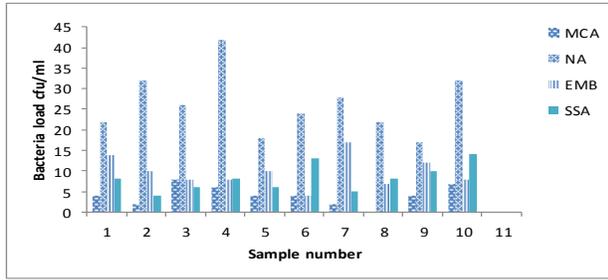


Figure 5: Occurrence of bacteria on the skin of *S. malarotheron*

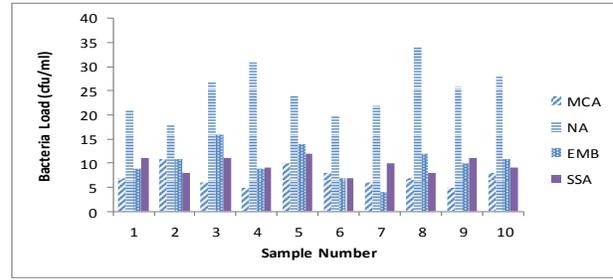


Figure 6: Occurrence of bacteria on the gills of *S. malarotheron*

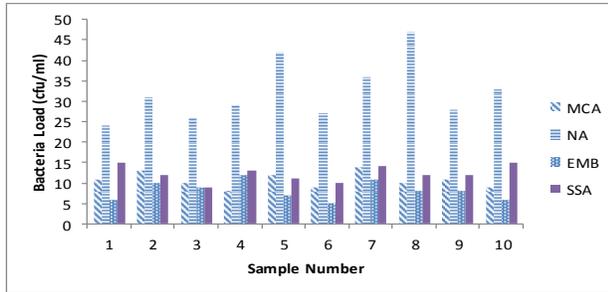


Figure 7: Occurrence of bacteria on the intestine of *S. malarotheron*

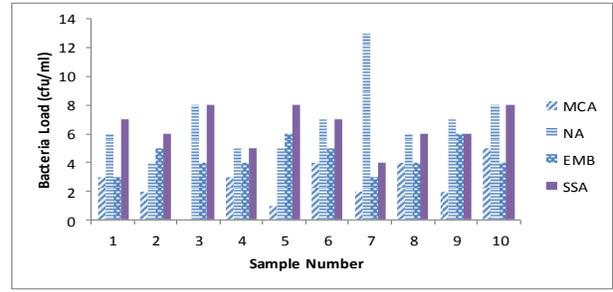


Figure 8: Occurrence of bacteria on the Skin of *C. nigrodigitatus*

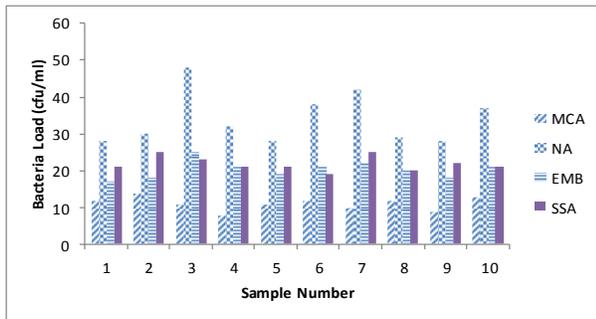


Figure 9: Occurrence of bacteria on the gills of *C. nigrodigitatus*

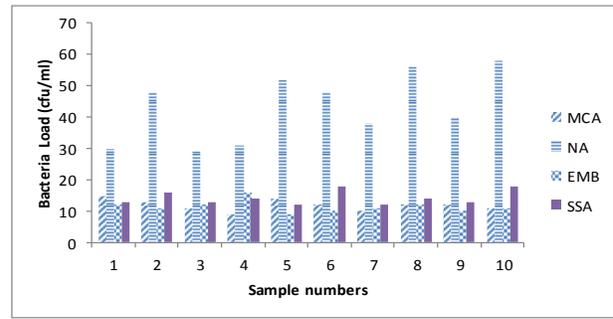


Figure 10: Occurrence of bacteria on the intestine of *C. nigrodigitatus*

Table 2: Mean Bacteria Load (10^{-5} cfu/ml) from *Sarotherodon malarotheron* and *Chrysichthys nigrodigitatus* using different Agar plates

Specimens	MCA	NA	EMB	SSA
<i>S. malarotheron</i> skin	2.0±0.02	13.1±0.21	5.2±0.02	4.0±0.03
<i>S. malarotheron</i> gill	7.3±0.24	24.7±0.06	11.3±0.35	9.6±0.01
<i>S. malarotheron</i> Intestine	10.7±0.42	32.3±0.28	8.2±0.22	12.3±0.25
<i>C. nigrodigitatus</i> skin	3.6±0.02	6.9±0.31	4.4±0.16	6.5±0.37
<i>C. nigrodigitatus</i> gill	11.4±0.25	33.8±0.03	20.1±0.41	21.9±0.27
<i>C. nigrodigitatus</i> intestine	12.0±0.04	42.7±0.27	11.4±0.53	14.5±0.22

KEY: MCA- macconkey agar, NA- Nutrient Agar, EMB: Eosin methyleneblue, SSA- Salmonella Shigella agar

DISCUSSION

A total of fourteen (14) species of bacteria were recovered from the skin, gills and intestine of *C. nigrodigitatus* and *S. malarotheron*. Seven (7) out of the fourteen probable bacteria recovered from the two fish species were Gram negative. These include *Enterobacter spp.*, *Pseudomonas spp.*, *Proteus spp.*, *Escherichia coli*, *Klebsiella spp.*, *Salmonella spp.* and *Serratia spp.*. The other seven (7) bacteria recovered were Gram positive, and they include: *Micrococcus leteus*, *Staphylococcus aureus*, *Actinomyces spp.*, *Streptococcus faecalis*, *Lactobacillus spp.*, *Staphylococcus epidermidis*, *Bacillus spp.*

The study neither agree nor disagree with the findings of Ahmed and Naim, (2002) who reported that the bacterial identified from the brackish pond water, sediments and healthy tilapia cultured in Saudi Arabia were predominantly Gram negative. High bacteria recovery from intestine of the fish species also disagree with the argument of Jara and Chodynietcki (1999) that gills come into direct contact with the environment and any of the pathogen.

The occurrence of bacteria in the skin, gills and intestine of *S. malarotheron* and *C. nigrodigitatus* also in the lagoon (Lagos lagoon) in which they inhabit is in support of Hansen *et. al.*, (1992) findings that, bacteria are abundant in the environment in which fish live. It is therefore rather impossible to avoid them being a component of their diet. Also, the presence of the isolated organisms was not surprising since according to Draser and Hill (1976), fish lives in water habitat full of microorganism. Okpokwasili and Alapiki (1990) confirmed that bacteria flora associated with a Nigerian water culture include the genera, *Bacillus*, *Lactobacillus*, *Staphylococcus*, *Escherichia*, *Micrococcus*, *Proteus* and others. The presence of *Salmonella spp.* indicates faecal contamination of water from which the fishes were harvested. *Bacillus spp.* are implicated in causing a wide range of infectious diseases including abscesses, bacteremia/septicemia, wound and food borne infections, ear infections, endocarditis, meningitis, ophthalmitis, osteomyelitis peritonitis and respiratory and urinary infections (Morales *et al.*, 2004). *Serratia mercenscens*, has been reported to cause lower respiratory tract infections and urinary tract infection. Never the less, result obtained from this study indicated that fish can be infected with variety of microbial species especially bacteria, which is a function of bacteria found in their habitat. The existence of pathogenic bacteria in the fish species (*C. nigrodigitatus* and *S. malarotheron*) from Lagos lagoon are of public health significance since bacteria isolated from fish samples are a function of bacteria found in the lagoon (Lagos lagoon); where industrial effluence, domestic and agricultural waste are being emptied.

CONCLUSION

Disposal of untreated human, agricultural and industrial waste into lagoon environment should be prevented to

reduce stress on fish; and hence, preventing fish from bacterial infection; and fish harvested from such environment should be properly processed/ cured before consumption so as to prevent bacteria infestation. Further study should be carried out on the occurrence of bacteria and impact on health status of environment to both human and in other fish species found in Lagos Lagoon.

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