AMERICAN JOURNAL OF FISH AND FISHERIES (AJFF)

VOLUME 1 ISSUE 1 (2026)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Fish and Fisheries (AJFF)

Volume 1 Issue 1, Year 2026
https://journals.e-palli.com/home/index.php/ajff

Microbial Load in the Gut of Wild Fish Species (Neoarius Berneyi) from the River-Nun at Amassoma, Bayelsa State: A Post Flood Assesment

LUCKY, Fineroad[1*]

Article Information

Received: November 02, 2025

Accepted: January 14, 2026

Published: September 14, 2026

Keywords

Amassoma, Bayelsa State, Cat Fish, Microbial Load, Neoarius Berneyi, Post Flood, River-Nun

ABSTRACT

The microbial burden in the gastrointestinal system of the Neoarius berneyi wild fish species from River Nun in Amassoma was assessed after the flood. The study's objectives were to identify and isolate the bacterial species that were present and evaluate any possible effects they might have on human health by way of the food chain. Using conventional laboratory techniques, specimens were taken from the mouth, stomach, and intestines of wild fish samples that were obtained from fishermen's catches for bacteriological investigation. The results showed that the highest percentage frequency was 8 (44.4%) for Bacillus subtilis, 5 (27.2%) for Escherichia coli, 3 (16.7%) for Staphylococcus aureus, and 2 (11.1%) for Salmonella enteritidis. The findings imply that catfish collected from rivers affected by flooding have a comparatively high bacterial load. Overall, the study shows that the bacteriological quality and safety of catfish are greatly impacted by floodwater intrusion from various sources.

INTRODUCTION

In Nigeria and the aquaculture sector, the African catfish (Clarias gariepinus) and allied species are considered to be extremely significant freshwater fish (Federal Department of Fisheries, 2007). This significance is attributed to several advantageous characteristics, including robust market value, rapid growth rate, high reproductive capacity, ease of artificial propagation, and resistance to a range of environmental conditions (Eyo *et al.*, 2014). African catfish consumption has increased in Nigeria's rural and urban areas because to its high nutritional value (Federal Department of Fisheries, 2007; Emikpe *et al.*, 2011). Notwithstanding these advantages, eating fish may be harmful to your health because of bacterial contamination from their aquatic habitats, which are frequently contaminated by household trash, agricultural runoff, industrial pollutants, and the use of animal dung as fertiliser in fish ponds. Because fish consume large amounts of bacteria through polluted food, water, and sediments, some of which can cause pathogenic diseases (Adedeji *et al.*, 2011), such pollutants may degrade fish quality and render them unfit for human consumption (Danba *et al.*, 2015). The genera Pseudomonas, Staphylococcus, Flavobacterium, Vibrio, Micrococcus, Bacillus, and Aeromonas are frequently found in bacterial populations linked to fish. These bacteria are normally found on fish gills, skin, fins, or inside the intestinal system and are a part of the pond's and big body of water's natural microflora. However, some of these microbes are harmful to both humans and fish, and environmental stressors can cause disease outbreaks (Oladosu-Ajayi *et al.*, 2011). Fish-associated pathogenic bacteria are classified as either indigenous or non-indigenous species by Kvenberg (1991) and Rodricks (1991). Salmonella species, Clostridium botulinum, Shigella dysenteriae, Staphylococcus aureus, Salmonella species, and Escherichia coli are examples of non-indigenous bacteria that contaminate fish or their environments from outside sources. Conversely, indigenous harmful bacteria, such as Vibrio and Aeromonas species, are found naturally in aquatic habitats (Rodricks, 1991). Even though these bacteria might not be dangerous to fish, eating contaminated fish can seriously endanger human health (Salihu *et al.*, 2012). Thus, the purpose of this study was to assess and compare the Neorius berneyi bacterial load obtained from the River Nun in Amassoma, Bayelsa State, following floods. The results of this study will add to our understanding of the bacterial species linked to recently harvested Neorius berneyi and offer important information for managing and preventing bacterial illnesses caused by flooding. Women are heavily involved in fish marketing, especially in riverine areas, and the Ijaw people in Bayelsa State are the ones who fish the most. Establishing the profile of bacteriological pathogens present in freshly collected catfish and comparing results with those from other parts of the nation require an understanding of the microorganisms associated with these fish both during and after flood times (Daniel *et al.*, 2006). Because of death, treatment expenses, missed sales, missed market possibilities, and the spread of zoonotic infections to fish handlers and customers, fish diseases cause significant financial losses. One typical mechanism for pathogens to spread to other foods during fish processing is through contaminated hands and surfaces, particularly during cleaning and evisceration (FAO, 2009). Fish are known to be carriers of foodborne

[1] Department of Fisheries, Niger Delta University, Bayelsa State, Nigeria
[*] Corresponding author's e-mail: odotarelove@gmail.com

microbial illnesses and intoxications, and they can also spread a variety of diseases to people. The microbial load of wild catfish (Neorius berneyi) following flooding occurrences is greatly increased in Bayelsa State due to the state's vulnerability to contamination from floodwaters combined with poorly maintained sewage facilities. In order to analyse the potential health effects of eating fish that have been taken from flood-affected waters, the current study focuses on the post-flood assessment of the microbial load in the gut of Neorius berneyi from the River Nun in Amassoma, Bayelsa State.

Aim and Objectives

The main aim of the study is post flood evaluation of microbial load in the gut of wild cat fish species (Neorius berneyi) obtained from the River-nun at Amassoma, Bayelsa State. The following specific objectives is to

- Identify the microbial load in the gut of wild catfish species (Neorius berneyi) obtained from River-nun at Amassoma, Bayelsa State.
- Determine the bacterial count in the gut of wild catfish species (Neorius berneyi) obtained from River-nun at Amassoma, Bayelsa State.

LITERATURE REVIEW

The amount of bacterial microbial load seen in fish gastrointestinal tracts from both natural and commercial sources is well documented. With a focus on the consequences for public health, Emikpe (2014) investigated the bacterial load on the skin and stomach of Clarias gariepinus and Oreochromis niloticus in Ibadan, Southwest Nigeria. Nevertheless, there are very few studies that concentrate only on human pathogenic bacteria, particularly enterobacteria in freshwater settings. In that study, Nile tilapia (Oreochromis niloticus) and African catfish (Clarias gariepinus) obtained from different aquatic settings in Ibadan were evaluated and compared for their total aerobic bacterial count and enterobacteriaceae load. The fish samples' guts and skin were examined for bacterial densities. With high microbial indices ranging from 10^{12} to 10^{13} ($\log_{10}$ cfu/cm^2 = 13.07–13.20; $\log_{10}$ cfu/g = 13.02–13.16), the results demonstrated that all samples were highly contaminated. There was no significant difference between the skin and stomach samples of catfish ($p > 0.05$), but the microbial load of captured tilapia was significantly larger than that of captured catfish ($\log_{10}$ cfu/cm^2 = 13.20; $t = 3.369$; $p < 0.001$). The microbial burden in O. niloticus was considerably higher in the skin than in the stomach. Additionally, compared to their corresponding skin samples, the stomachs of both captured catfish ($\log_1$ cfu/g = 13.04; $t = 3.235$; $p < 0.001$) and tilapia ($\log_{10}$ cfu/g = 12.86; $t = 3.629$; $p < 0.001$) had considerably higher enterobacteriaceae counts. The elevated microbial loads found in tilapia and wild catfish were linked by the scientists to widespread environmental contamination in the regions where the fish were caught. In a similar vein, Ohuoba (2023) evaluated the microbiological quality of fresh African catfish (Clarias gariepinus) that were procured from ponds in the city of Minna and sold in three marketplaces. According to the study, the skin and gills of Bosso Pond had total plate counts of 2.7×10^2 cfu/mL and 3.8×10^2 cfu/mL, respectively, indicating satisfactory quality. While Mobil Pond reported 2.5×10^3 cfu/mL on the skin and 2.5×10^2 cfu/mL on the gills, Kure Pond's total plate counts of 4.7×10^3 cfu/mL on the skin and 3.3×10^2 cfu/mL on the gills were likewise deemed satisfactory. Bosso Pond's total coliform levels were 3.8×10^2 cfu/mL for skin and 3.0×10^1 cfu/mL for gills, while Kure Pond's were 2.4×10^2 cfu/mL and 2.6×10^2 cfu/mL, respectively. On the other hand, Mobil Pond's skin had 4.6×10^3 cfu/mL and its gills had 3.2×10^4 cfu/mL of coliform. Market-sourced catfish were found to have greater levels of contamination. Unsatisfactory coliform levels of 5.6×10^4 cfu/mL (skin) and 4.0×10^5 cfu/mL (gills) were found in samples from Bosso Market. 1.6×10^3 cfu/mL (skin) and 7.2×10^3 cfu/mL (gills) were adequate values in samples from Kure Market, however samples from Mobil Market had marginal coliform counts of 6.0×10^4 cfu/mL (skin) and 4.8×10^4 cfu/mL (gills). While fungal loads were relatively greater at Mobil Market, fungal levels were generally good across markets. Escherichia coli, Bacillus subtilis, Staphylococcus aureus, Pseudomonas species, Streptococcus species, Shigella species, and Enterobacter species were among the bacterial species that were isolated, and Rhizopus species and Aspergillus niger were among the fungal species. The bacterial and parasite load of Clarias gariepinus collected from a fish pond and the River Niger in Onitsha, Anambra State, was examined by Mgbemena *et al.* (2019). Fish samples from 25 different species—both healthy and sick—were analysed, with skin, gill, and intestinal examinations performed. Staphylococcus species, Enterobacter species, Pseudomonas species, Escherichia coli, Streptococcus faecalis, Proteus species, Aeromonas species, Vibrio species, and Salmonella species were among the bacterial species found in the study. All of the body parts that were inspected included these organisms, however the intestine had the highest bacterial prevalence, followed by the gills and skin. Entamoeba spp., Trichodina spp., Ichthyophthirius spp., Gyrodactylus spp., and Neobenedenia melleni were all found by parasitological investigation, with Entamoeba spp. exhibiting the highest prevalence (84.0%). Fish from both natural and cultivated habitats may represent health dangers to the general people, as evidenced by the discovery that pond-reared fish had greater bacterial and parasite burdens than fish from the River Niger. Effiong *et al.* (2019) conducted a comparative evaluation of the bacterial load and diversity in the intestine, skin, and gills of cultured Clarias gariepinus raised in tarpaulin and concrete tanks. The study found substantial bacterial loads in the intestine and gills of fish from both growth systems using conventional microbiological methods. Catfish raised in tarpaulin tanks had heterotrophic bacterial levels ranging from 1.7×10^4 cfu/mL on their skin to 2.6×10^4

cfu/mL in their gills. The gills had 1.2×10^4 cfu/mL of total coliform, while the gut had 3.9×10^4 cfu/mL. The intestines had the highest levels of Salmonella, whereas the gills of fish from tarpaulin tanks had the highest levels of Vibrio (4.2–4.6 x 10^3 cfu/mL). Interestingly, neither system's fish skin included Pseudomonas, Salmonella, or Escherichia coli. Escherichia coli, Salmonella enterica, Staphylococcus epidermidis, Vibrio anguillarum, Pseudomonas fluorescens, Serratia liquefaciens, Bacillus licheniformis, Shigella sonnei, Lactobacillus plantarum, Enterobacter aerogenes, Klebsiella pneumoniae, and Proteus vulgaris were among the bacterial species isolated in this investigation. In concrete tanks, Staphylococcus epidermidis was most common (75.0%), while Klebsiella pneumoniae was least common (2.0%) in tarpaulin tanks. All things considered, the detected bacterial flora included a number of potentially harmful pathogens that pose a serious threat to public health. Osuntokun *et al.* (2020) also assessed, isolated, identified, characterised, and compared the bacterial load of African catfish (Clarias gariepinus) raised in concrete and earthen ponds. The authors underlined the significance of African catfish as a favoured aquaculture species and a popular delicacy throughout Africa, highlighting the necessity of ongoing microbiological quality monitoring.

MATERIALS AND METHODS

Study area

Three fish samples of the same species that were taken from the River Nun in Amassoma, Bayelsa State, Nigeria, were used in this investigation. With an estimated 6,970 residents, Amassoma is a settlement in Bayelsa State's Southern Ijaw Local Government Area. The region's coordinates are 4°58'13.15 N latitude and 6°06' E longitude.

Procurement of fish

A local fisherman fishing on the River Nun provided the fish samples immediately. Following collection, the samples were delivered to the Department of Biological Sciences laboratory's Microbiology Unit under the proper circumstances. For microbiological analysis, swab samples were obtained from the mouth, stomach, and intestine, among other parts of the fish's digestive tract.

Laboratory analysis

sample collection

from each fish's gut, sterile swab sticks were first soaked with distilled water before being applied separately to the mouth, stomach, and intestine. Following collection, the samples were serially diluted five times.

Preparation of Media

The presumptive isolation of bacteria was carried out using Nutrient Agar (NA) in compliance with the manufacturer's recommendations (28 g per 1000 mL). In a conical flask, 10.08 g of nutrient agar was weighed and dissolved in 360 mL of distilled water to provide 20 mL of medium for each of 18 Petri dishes. The mixture was wrapped with aluminium foil, thoroughly shook to guarantee full dissolution, then autoclaved for 15 minutes at 121°C to sterilise it. Following sterilisation, 18 sterile Petri dishes were aseptically filled with molten agar, which was then left to solidify before being inoculated.

Cultural Techniques

The pour plate method, as outlined by ISO (2007), was used to count and isolate bacteria. Triplicate plating of 1 mL aliquots from each sample's 10^{-3} dilution was used to calculate microbial counts. Nutrient Agar-filled sterile Petri dishes were used to inoculate the aliquots. Different colony-forming units (CFUs) seen on the plates after incubation were tallied. Colony-forming units per millilitre (cfu/mL) of sample was used to express the results.

Enumeration of bacterial colonies

Using the formula cfu/mL = (N × R) / A,
Where;
N is the number of colonies counted,
R is the reciprocal of the dilution factor, and
A is the volume of sample injected, the number of bacterial colonies was tallied and reported as cfu/mL.

Isolation of pure colonies

Based on unique colony morphology, specifically variations in colour and shape, a total of eighteen (18) pure bacterial isolates were chosen at random. Every sampling location yielded six isolates.

Identification of Isolates

Morphological Identification

Using a hand lens, the isolates were visually examined to determine their shape, size, and colouration in order to do preliminary identification

Gram staining

To distinguish between bacterial isolates, Gramme staining was used. After being cleaned, the glass slides were let to air dry. Each slide had a drop of normal saline on it. A sterile wire loop was used to transfer a portion of a pure isolate, which was then evenly spread and allowed to air dry. After 60 seconds of crystal violet flooding, the smears were washed with water and then subjected to another 60 seconds of Lugol's iodine. After 30 seconds of decolorisation with 95% ethanol, the area was rinsed with water. After 30 seconds of safranin counterstaining, the slides were cleaned and let to dry. We used oil immersion microscopy to evaluate the prepared slides. Gram-negative bacteria were rod-shaped and pink, whereas gram-positive bacteria were purple and frequently grouped.

Biochemical Test

Catalase Test

A sterile test tube was filled with about 3 mL of 3%

hydrogen peroxide. A part of a pure colony was transferred into the solution using a sterile glass rod. A positive catalase reaction was evidenced by the instantaneous production of bubbles.

Lactose Test

After aseptically inoculating sterile tubes with 3 mL of phenol red lactose broth, pure isolates were cultured for 24 hours at 35–37°C. A positive lactose fermentation outcome due to acid formation was shown by a colour shift from red to yellow.

Indole Test

After inoculating each pure isolate into a bijou bottle with 3 mL of sterile tryptone water, the bottle was incubated for 48 hours at 35 to 37°C. Following incubation, the mixture was gently agitated and 0.5 mL of Kovac's reagent was added. A positive indole test result was shown by the surface layer becoming red after 10 minutes, but a negative result was indicated by the absence of red colouration.

Coagulase Test

The pathogenic Staphylococcus species were identified using the coagulase test. Pure isolates were emulsified in distilled water drops that were positioned at either end of a sterile, clean slide. After adding a loopful of plasma to one end of the slide, clumping was checked within ten seconds. Clumps were a sign of a positive coagulase reaction, which is indicative of Staphylococcus aureus).

Statistical Analysis

descriptive statistics such as averages and standard deviations were computed. To evaluate variations in bacterial counts throughout the gastrointestinal areas examined, analysis of variance (ANOVA) was utilised. Tukey's HSD post hoc test was used to separate the means in cases where substantial variance was found. The statistical program SPSS version 23 was used to perform all analyses at a 95% confidence level.

RESULTS AND DISCUSSIONS

Results

The bacterial counts from each fish sample's gastrointestinal regions are shown in Table 1. The findings show that, for all samples, there was no discernible variation in the number of bacteria in the mouth and intestine. Nonetheless, a noteworthy distinction ($p < 0.05$) was noted in the numbers of stomach bacteria between Samples A and B. However, there was no discernible difference ($p > 0.05$) between Samples A and C, or between Samples B and C..

Table 1: Bacterial count from the swab sample collected from gut of the fishes.

Fish (Neoarius berneyi)	MOUTH	STOMACH	INTESTINE
Fish sample A	54.50 ± 6.36a	71.00 ± 1.41ac	17.00 ± 7.07c
Fish sample B	33.00 ± 19.79a	35.00 ± 9.89b	16.50 ± 4.94c
Fish sample C	45.50 ±14.84a	52.00±1.41bc	14.00 ± 2.82c

Mean ± standard deviation. Means with the same letters on the same column are not significantly different (P=0.05). The distribution of bacterial counts in each fish sample's mouth, stomach, and intestine is shown in Figure 1. The mean bacterial count in Sample A was highest in the stomach (71.00), followed by the mouth (54.50), and lowest in the intestine (17.00). The mean bacterial counts for Sample B were 16.50 in the intestine, 35.00 in the stomach, and 33.00 in the mouth. The intestine continuously showed the lowest bacterial count among all samples, with Sample C recording mean values of 52.00 in the stomach, 45.50 in the mouth, and 16.50 in the intestine.

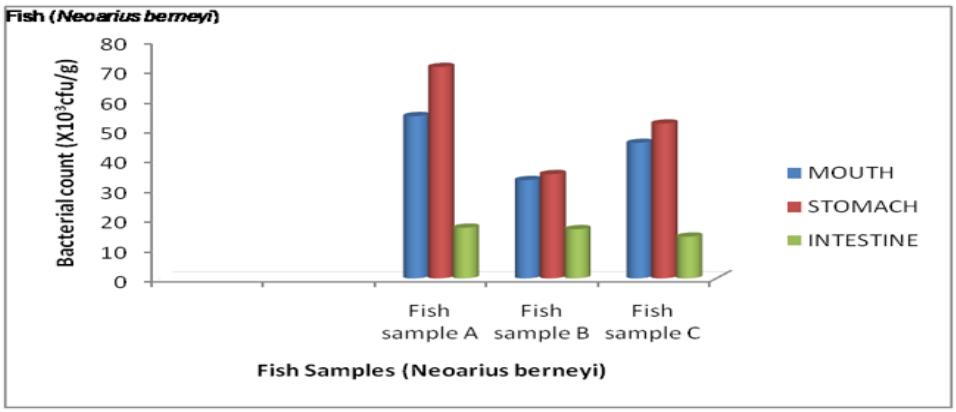

Figure 1: Bacterial count from the swab sample collected from gut of the fishes.

Figure 2 below show the bacterial count from the swab sample collected from mouth of the fishes. Sample A has a mean score of 54.50, sample B has a mean score of 33.00, and sample C has a mean score of 45.50. The result show that there is no significant different in bacterial count in the month for all samples.

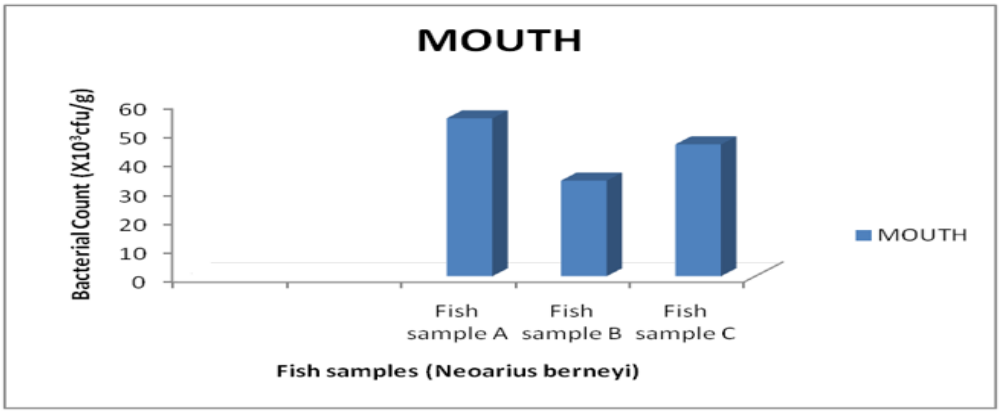

Figure 2: Bacterial count from the swab sample collected from mouth of the fishes.

Figure 3 below show the bacterial count from the swab sample collected from stomach of the fishes. Sample A has a mean score of 71.00, sample B has a mean score of 35.00, and sample C has a mean score of 52.00. There was a significant different ($p<0.05$) between sample A and sample B in bacterial count in the stomach.

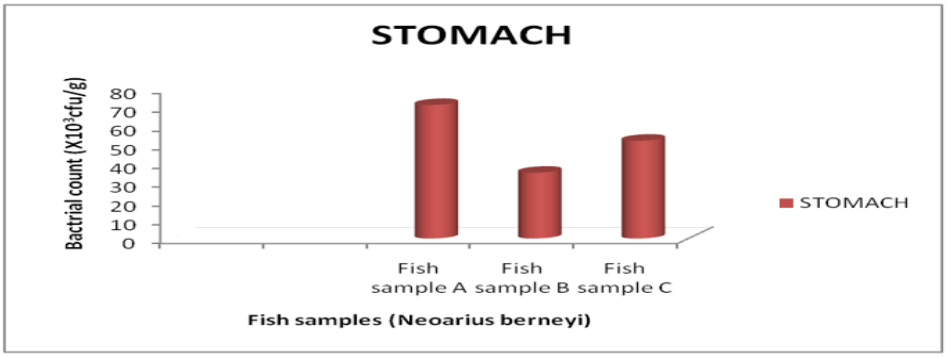

Figure 3: Bacterial count from the swab sample collected from Stomach of the fishes.

Figure 4 below show the bacterial count from the swab sample collected from stomach of the fishes. Sample A has a mean score of 17.00, sample B has a mean score of 16.50, sample C has a mean score of 16.50. The result show that there is no significant different in bacterial count in the intestine for all samples.

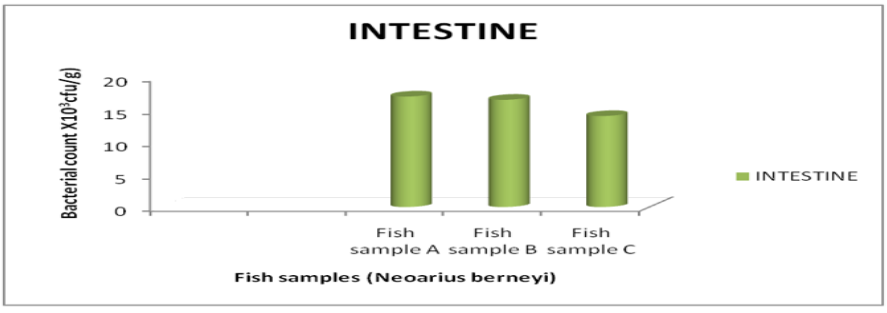

Figure 4: Bacterial count from the swab sample collected from Stomach of the fishes.

Table 2 below show the morphological and biochemical characterization of the identified bacteria from the fish's swab samples, which involves the sample code, colony morphology, gram reaction, identified bacteria and percentage of prevalence.

Table 2 : Morphological and biochemical characterization of the identified bacteria from the fish's swab samples.

Sample Code	COLONY MORPHOLOGY	Gram reaction	Cat.	Lactose	Coagulation	IDENTIFIED	
BACTERIA	% Prevalence						
A/B	Round & moist	-ve Rod	—	–	—	Salmonella enteritidis	2 (11.1%)
A/C	Light green colony	-ve cocci	+	+	+	Bacillus substilis	3 (16.7%)
B/C	White mucoid colony	-ve Rod	+	+	—	Staphylococcus aureus	3(16.7%)
B/A	Creamy Yellow & circular	+ve cocci	+	+	+	Bacillus substilis	3 (16.7%)
C/A	Light yellow convex colony	+ve cocci	—	+	—	Escherichia coli	5 (27.7%)
C/B	Creamy Yellow & circular	+ve cocci	+	+	+	Bacillus substilis	2 (11.1%)

A/B =Fish A and B, B/A = Fish B and A, C/A = Fish C and A, B/C= Fish B and C, B/A= Fish B and A, C/B= Fish C and B, Cat. = catalase. Ind. = Indole. Table 4.3 below show the percentage and frequency [(TN ×100) / 18] of the involving bacteria identified from the fish's swab samples.

Table 3 : Percentage frequency [(TN ×100) / 18] of the involving Bacteria identified from the fish's swab samples.

Bacteria identified	A/B 2:	A/C 3:	B/A 3:	B/C 3:	C/A 5:	C/B 2	% Frequency
Bacillus substilis	-	3	3	-	-	2	8 (44.4%)
Salmonella enteritidis	2	-	-	-	-	-	2 (11.1%)
Staphylococcus aureus	-	-	-	3	-	-	3 (16.7%)
Escherichia coli	-	-	-	-	5	-	5 (27.8%)

A/B =Fish A and B, B/A = Fish B and A, C/A = Fish C and A, B/C= Fish B and C, B/A= Fish B and A, C/B= Fish C and B.

Discussion

The microbial load in the guts of wild catfish species (Neoarius berneyi) that were obtained from River Nun in Amassoma, Bayelsa State, was evaluated in this study. Swab samples from the fish's mouth, stomach, and intestine were used to count the bacteria. Fish Sample A had mean bacterial counts of 54.50 ± 6.36 for the mouth, 71.00 ± 1.41 for the stomach, and 17.00 ± 7.07 for the intestine. The mean bacterial counts in the mouth, stomach, and intestine of fish sample B were 33.00 ± 19.79, 35.00 ± 9.89, and 16.50 ± 4.94, respectively. The mean values for the mouth, stomach, and intestines were 45.50 ± 14.84, 52.00 ± 1.41, and 14.00 ± 2.82, respectively, in Fish Sample C. Using the formula (TN × 100 / 18), the results also showed the percentage frequency of bacterial isolates found in the study. Bacillus subtilis, with a frequency of 8 (44.4%), was the most common. The environmental circumstances of the fish's habitat may have an impact on the organism's existence (Draser & Hill, 1976; Shinkafi & Ukwaja, 2010). Numerous infectious diseases, such as meningitis, wound and foodborne infections, septicaemia, and respiratory and urinary tract infections, have been linked to Bacillus species (Morales *et al.*, 2004; Shinkafi & Ukwaja, 2010; Bassey & Andy, 2015). The percentage frequency of Salmonella enteritidis was 2 (11.1%). This bacteria is known to be extremely harmful (Mahmuda *et al.*, 2010) and has been linked to systemic infections and enteritis (Shinkafi & Ukwaja, 2010). Its presence in the examined catfish samples raises the possibility of contamination from the harvesting source or the environment in which the fish were handled and sold. Furthermore, Staphylococcus aureus was found to be one of the less commonly isolated species in River Nun at Amassoma, with a percentage frequency of 3 (16.7%). Fish collected from aquatic habitats may have poorer microbiological quality due to the presence of S. aureus, which is frequently linked to waste entering water bodies, especially during the rainy season (Bassey *et al.*, 2016; Eja *et al.*, 2010). Ultimately, a percentage frequency of 5 (27.8%) was obtained for the isolation of Escherichia

coli. The results of Olugbojo and Ayoola (2015), who found comparable bacterial profiles in economically significant fish species taken from the University of Lagos' aquaculture unit and lagoon front, are in line with the bacterial species found in this investigation.

CONCLUSION

The results from the microbial analysis are summarized below

The percentage frequency of Bacillus subtilis was 8 (44.4%).

The percentage frequency of Salmonella enteritidis was 2 (11.1%).

The percentage frequency of Staphylococcus aureus was 3 (16.7%).

The percentage frequency of Escherichia coli was 5 (27.8%).

The purpose of this study was to assess the microbial load in the guts of wild catfish species (Neoarius berneyi) from River Nun in Amassoma, Bayelsa State. The results revealed different numbers of microorganisms in the fish's mouth, stomach, and intestine. The mean bacterial counts in the mouth, stomach, and intestine of Fish Sample A were 54.50 ± 6.36, 71.00 ± 1.41, and 17.00 ± 7.07, respectively. The equivalent values were 33.00 ± 19.79, 35.00 ± 9.89, and 16.50 ± 4.94 for Fish Sample B and 45.50 ± 14.84, 52.00 ± 1.41, and 14.00 ± 2.82 for Fish Sample C. The findings indicate that catfish collected from rivers affected by flooding had comparatively high bacterial burdens. The study shows that floodwater intake from various sites, which may introduce a variety of microbiological pollutants into the aquatic environment, has a substantial impact on the bacteriological quality and safety of catfish.

The following suggestions are given in light of the study's findings

- Catfish collected from the flood-affected River Nun should be handled, processed, and transported by fishermen in the research region using more hygienic methods.
- To lessen bacterial pollution, government regulatory bodies should implement regulations that prohibit the careless release of drainage effluents into rivers.
- It is best to prohibit human behaviours that pollute aquatic habitats, such as throwing household trash and human waste into rivers.
- To get rid of dangerous bacteria and lower the chance of contracting a fish-borne illness, fish should be boiled and processed completely before eating.
- The prevalence of foodborne illnesses linked to eating fish should be reduced by raising public awareness of proper fish handling and processing procedures.

REFERENCES

Adedeji, O. B., Okerentugba, P. O., & Okonko, I. O. (2011). Bacteriological and physicochemical studies on Otamiri River, Owerri, Imo State, Nigeria. *Nature and Science, 9*(11), 1–13.

Danba, E. P., Onuoha, S. C., & Egbe, N. E. (2015). Bacteriological assessment of some selected fish ponds in Kaduna metropolis, Nigeria. *Journal of Environmental Science, Toxicology and Food Technology, 9*(11), 52–58.

Daniel, U. I., Umoh, V. J., & Okonko, I. O. (2006). Microbial load of fish caught from river Kaduna, Kaduna state, Nigeria. *African Journal of Biotechnology, 5*(21), 2074–2079.

Emikpe, B. O., Adebisi, T., & Oladiran, B. E. (2011). The bacteria load and the occurrence of Escherichia coli in fish from aquaculture ponds in South Western Nigeria. *Middle-East Journal of Scientific Research, 10*(3), 303–308.

Eyo, A. A., Olatunde, A. A., & Atanda, A. N. (2014). Growth response of African catfish, Clarias gariepinus, juveniles reared in different culture systems. *Journal of Fisheries and Aquatic Science, 9*(2), 102–111.

Food and Agriculture Organization of the United Nations. (2009). *The state of world fisheries and aquaculture 2008*. Rome, Italy: Author.

Federal Department of Fisheries. (2007). *Fisheries statistics of Nigeria* (4th ed.). Abuja, Nigeria: Author.

Kvenberg, J. E. (1991). Nonindigenous pathogenic bacteria. In D. R. Ward & C. R. Hackney (Eds.), *Microbiology of marine food products* (pp. 267–284). New York, NY: Van Nostrand Reinhold.

Oladosu-Ajayi, A. O., Suleiman, M., & Odeyemi, O. (2011). Bacterial flora of fresh Tilapia fish (Oreochromis niloticus) from Lake Alau, Maiduguri, Nigeria. *Journal of Applied Sciences and Environmental Management, 15*(3), 503–507.

Rodricks, J. V. (1991). Indigenous pathogenic bacteria. In D. R. Ward & C. R. Hackney (Eds.), *Microbiology of marine food products* (pp. 247–266). New York, NY: Van Nostrand Reinhold.

Salihu, M. D., Junaidu, A. U., Oboegbulem, S. I., & Egwu, G. O. (2012). Bacteriological quality of fresh fish (Clarias gariepinus) sold in Sokoto, Northwestern Nigeria. *Journal of Public Health and Epidemiology, 4*(10), 306–310.

Effiong, E. D., Williams, I. O., & Inyang-Etoh, A. P. (2019). Comparative assessment of bacterial load and diversity in the gills, skin and intestine of cultured African catfish (Clarias gariepinus) raised in tarpaulin and concrete tanks. *Nigerian Journal of Microbiology, 33*(1), 4385–4394.

Emikpe, B. O. (2014). Bacterial load on the skin and stomach of Clarias gariepinus and Oreochromis niloticus in Ibadan, South-west Nigeria: Public health implications. *Bulletin of Animal Health and Production in Africa, 62*(4), 387–395.

Mgbemena, I. C., Nnaji, J. C., & Okafor, N. A. (2019). Assessment of bacterial and parasitic load of Clarias gariepinus from a fish pond and River Niger in Onitsha, Anambra State, Nigeria. *Journal of Applied Sciences and Environmental Management, 23*(8), 1447–

1452.

Ohuoba, A. N. (2023). Microbiological assessment of fresh African catfish (Clarias gariepinus) obtained from ponds and sold in three markets within Minna metropolis. *International Journal of Fisheries and Aquatic Studies, 11*(1), 92–98.

Osuntokun, O. O., Olajuyigbe, F. M., & Ogunyebi, A. L. (2020). Assessment, isolation, identification, characterization and comparison of bacterial load in African catfish (Clarias gariepinus) reared in concrete and earthen ponds. *Journal of Advances in Microbiology, 20*(10), 60–74.