

## MICROBIOLOGICAL ASSESSMENT OF THE VICTORIA-ISLAND BEACH AND LAGOS HARBOUR WATERS IN NIGERIA

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**ABSTRACT-** The bacteriological status of the Victoria-Island beach and the Lagos harbour waters were studied. Assessment was made for microbial density, *Escherichia coli* and *Vibrio* to determine their suitability for shrimp culture which is a novel technology currently adopted at the Nigerian Institute for Oceanography and Marine Research for shrimp farming in Nigeria. The Victoria-Island beach water was found to have a total viable count of between  $2.0 - 2.5 \times 10^2$  cfu/ml, and the Lagos harbour water  $7.5 - 8.4 \times 10^3$  cfu/ml. *Escherichia coli* and *Vibrio* were absent in the Victoria-Island beach water, but present in the Lagos harbour water. The need for good quality water in shrimp culture cannot be over-emphasized. The disease outbreak/mortalities in cultured shrimp and also disease transmission to humans are directly related to the water quality. From the results obtained, the Victoria-Island beach water is suitable for shrimp culture.

**Keywords:** *Escherichia coli*, *Vibrio* , Victoria-Island beach, Lagos harbour waters, Shrimp.

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### INTRODUCTION

The aquaculture industry has been globally recognized as the fastest growing food producing industry (NACA/FAO, 2000) and will continue to play an increasingly important role in meeting the demand for fish / shellfish, what with the over-exploitation and resulting decline in capture fisheries. The microbiological safety of aquaculture products has been subject to much research in recent years. The microbiological quality of the production environment impacts on fish health, which can be harmed either directly by pathogenic organisms or indirectly by increased susceptibility to environmental stressors that can in turn lay them open to disease; affect the microbial quality of the fish and ultimately the processed product.

Shrimp farming which is a rapidly growing business in the developed world is at its developmental stage in Nigeria. One of the most commonly cultured penaeid shrimp is *Penaeus monodon*. It is estimated that more than 50% of the world production is contributed by this species. (Anon 1994, Roseberry 1995). One of the most difficult aspect of shrimp farming has been that of disease outbreak which has continued to plague the industry. Viral diseases such as White Spot Syndrome Virus (WSSV) and Taura/Red-tail Virus have almost completely destroyed industries in Taiwan, Thailand, China and India. The most serious losses occurred from 1993-1999 (Chamberlain, 2002). Shrimp lack an antigen/antibody system and so cannot be vaccinated in the way fish can be. Prevention is the only cure. Nigeria as a novitiate has an advantage, since these diseases have not yet manifested themselves, more so as shrimp culturing is just starting.

Shrimp farming with good management practices and application of good science is

environmentally sustainable. Aquatic eco-system depends on the physical, chemical and biological composition of the water. However, from the health point of view, the microbiological contamination is usually the most important e.g. vibriosis has been implicated as a major mortality factor in juvenile penaeid shrimps (Lightner and Lewis, 1975). Vibriosis caused by *Vibrio oligolyticus* and *V. harveyi* is still a serious disease problem in *P. monodon* culture in India, while penaeid acute Viremia prevail in Asian countries. *Vibrio* species are considered as members of the normal bacterial flora of shrimps and culture environment (Otta and Karunasagar, 1999), often acting as opportunistic pathogen or secondary invaders, they induce mortality ranging from slight to 100% in affected population under stress (Lightner, 1998).

A wide range of other viral, bacterial and protozoan diseases results from the contamination of water with human faeces, leading to outbreaks of

Cholera, Typhoid and Diarrhea. It has been reported that over 80% of patients seen at the University of Ibadan with typhoid fever are aged between 10 - 30 years, with cases of mortality between 20- 28%. Typhoid fever remains a great socio-economic problem in Nigeria. Kidney and cardiovascular diseases have also been found to be water related (Sanni, 2009).

The total sterility of rearing water during the culture period, by pre-treatment is practically impossible (Boyd, 1996, Alabi et al 1997). Thus the opportunistic bacteria inadvertently enter into the culture water and may cause disease outbreaks. It was against this background that the bacteriological status of the Victoria beach and Lagos harbour water bodies were studied using indicator organisms as index of possible water contamination by human pathogen. Shrimp farming is highly beneficial to local communities as well as national economies.

harbor water and shrimp hatchery was added to 90 ml sterile peptone water (0.1% v/v). Ten- fold serial dilution of the suspension was made and 0.1 ml of the diluted suspension was plated in triplicate on standard plate count agar (SPCA) for total viable count, *Escherichia coli* was determined using standard most probable number (MPN) technique, *Salmonella* and *Vibrio* were enumerated using *salmonella/shigella* agar (SSA) and thiosulphate citrate bile salt sucrose (TCBS) agar for *Vibrio*.

## MATERIALS AND METHODS

Samples of water from the Victoria-Island beach, Lagos harbor water and shrimp hatchery were collected in sterile glass containers and transported to the laboratory immediately in insulated cold boxes to the Nigerian Institute for Oceanography and Marine Research Laboratory, Victoria Island. Analyses were carried out within six hours of sample collection.

**Microbiological analysis.** 10 mls of each of the water samples from the Victoria-Island beach, Lagos

**Table 1: Results of microbiological analysis of the Victoria- Island beach**

PARAMETER	VICTORIA ISLAND BEACH (DIFFERENT SEASONS-RAINY/DRY)						
	TVC-10 <sup>2</sup>						
	1	2	3	4	5	6	7
TVC	2.1	2.5	2.0	2.5	2.1	2.2	2.0
<i>E.coli</i>	-	-	-	-	-	-	-
<i>vibrio</i>	-	-	-	-	-	-	-
salinity	31.8	33.6	34.0	34.0	34.0	35.0	36.0
pH	8.52	8.44	8.39	8.10	8.10	8.10	8.10

**Table 2: Results of microbiological analysis of the Lagos harbour water**

PARAMETER	LAGOS HARBOUR WATER (DIFFERENT SEASONS-RAINY/DRY)						
	TVC-10 <sup>3</sup>						
	1	2	3	4	5	6	7
TVC	7.5	8.2	7.9	7.5	8.0	8.4	8.0
<i>E.coli</i>	+	+	+	+	+	+	+
<i>vibrio</i>	+	+	+	+	+	+	+
salinity	28.8	33.3	33.7	2.0	1.0	3.0	8.0
pH	8.29	8.44	8.38	8.0	7.8	8.0	8.0

**Table 3: Results of microbiological analysis of the shrimp hatchery**

PARAMETER	SHRIMP HATCHERY (DIFFERENT SEASONS-RAINY/DRY)						
	TVC-10 <sup>2</sup>						
	1	2	3	4	5	6	7
TVC	1.75	1.8	2.18	2.0	2.1	1.9	1.8
<i>E.coli</i>	-	-	-	-	-	-	-
<i>vibrio</i>	-	-	-	-	-	-	-
salinity	35.0	35.0	35.0	35.0	35.0	35.0	35.0
pH	7.08	7.08	7.10	7.08	7.09	7.08	7.08

Note: The study was over a period of six months

### RESULTS

The study was done for over a period of about six months, and sampling was done on a weekly basis. The result of the analysis is presented in Table 1-3. The TVC counts ranged between 2.0 – 2.5 x 10<sup>2</sup> cfu/ml for the Victoria Island beach (VB) as shown in table 1, the TVC counts for the Lagos harbour were between 7.5 – 8.4 x 10<sup>3</sup> cfu/ml as shown in table 2 while the TVC counts ranged between 1.75 – 2.8 x 10<sup>2</sup> cfu/ml for the shrimp hatchery water as shown in table 3. *E.coli* was not detected in the VB and the shrimp hatchery waters, but was present in the Lagos harbour water. *Vibrio* was observed to be present in the Lagos harbor water, but absent in the Victoria-Island beach and shrimp hatchery waters

### DISCUSSION

The TVC counts ranged between 2.0 – 2.5 x 10<sup>2</sup> cfu/ml for the Victoria Island beach (VB) as shown in table 1, the TVC counts for the Lagos harbour were between 7.5 – 8.4 x 10<sup>3</sup> cfu/ml as shown in table 2 while the TVC counts ranged between 1.75 –

2.8 x 10<sup>2</sup> cfu/ml for the shrimp hatchery water as shown in table 3.

The values obtained for the VB was quite low and this maybe due to the fact that distribution of bacteria in sea water is not uniform as they are usually accumulated round particles of organic matter. It has been reported that seaport waters may contain 10<sup>3</sup> bacteria/ml, inland seas 5 x 10<sup>2</sup> bacteria/ml and open seas may contain 250 bacteria/ml (Zdenek, 1971). The TVC values recorded for the shrimp hatchery were a little lower than that of the VB, and this may be as a result of the treatment (chlorination) given the water prior to use in the hatchery. The Lagos harbor water contained too many viable organisms and as such may not be suitable for use in the shrimp hatchery. This may however, not be unconnected with the numerous human activities along the water body.

*E.coli* was not detected in the VB and the shrimp hatchery waters, but was present in the Lagos harbour water. *E. coli* is the most common aerobic organism of the intestinal tract of man and animals (Gram, 2004), and its presence is an indication of direct or indirect fecal contamination of the water. Most strains of *E.coli* are harmless commensals that colonize the intestinal tract and probably play a role

in maintaining internal physiology, but a few are pathogenic. They are responsible for the outbreak of gastroenteritis- diarrheal disease which may result in renal failure. The disease though may affect all age groups, children are more susceptible.

*Vibrio* was observed to be present in the Lagos harbor water, but absent in the Victoria-Island beach and shrimp hatchery waters. *Vibrio* species are obligate halophiles and are a normal micro-flora of estuarine and coastal waters. Some species are recognized as food—poisoning agents. It grows very rapidly at ambient temperatures in the tropics and it is heat-sensitive. This makes cooking and freezing effective means of quality control.

### CONCLUSION AND RECOMMENDATION

The bacteriological quality of the Victoria-Island beach water sample was found to be better than that of the harbour/jetty water and as such could be used in the shrimp hatchery. Even though disinfectant is still applied to the water before use in the shrimp hatchery, this would bring about a reduction in the quality and also cost of the said disinfectant.

Recommendations from this study are the following:

- With shrimp farming still at its novel developmental stage, attempts should be made to ensure strict compliance with international standards, with the aim of being a brood-stock centre, and ensuring sustainability of the industry.
- That our water bodies be surveyed as a matter of routine to ensure the sanitary quality of seafood caught from these water bodies, as the microbiological quality of the water impacts on the microbiological quality of seafood as indicated by health risks associated with seafood.

Most current health risks associated with seafood safety originate from the environment and should be dealt with by control of harvest or at point of capture.

- Consumers should be informed of the risks associated with eating raw seafood, especially Molluscan seafood. They should be advised to cook seafood sufficiently to destroy parasites and bacterial contamination before consumption.

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