BINOMICS, CULTURE TRIAL AND DNA BARCODING OF CARIDEAN SPECIES FROM THREE LAGOONS, SOUTH-WEST NIGERIA

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CERTIFICATION

This is to certify that the Thesis:

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is a record of original research carried out

By

AKINWUNMI, MOSUNMOLA FLORENCE

in the Department of Marine Sciences

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CERTIFICATION

We certify that the work embodied in this Thesis for the award of the degree of Doctor of Philosophy (Fisheries) is a record of original research carried out by AKINWUNMI Mosunmola Florence under our supervision.

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DEDICATION

This thesis is deservedly dedicated to God Almighty, my parents, husband and children.

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LIST OF ABBREVIATIONS

ANOVA: Analysis of Variance

AOAC: Association of Official Analytical Chemists

AWG: Average Weight Gain

BLAST: Basic Local Alignment Search Tool

Bmm: *Macrobrachium macrobrachion* from Badagry Lagoon

Bmv: *Macrobrachium vollenhovenii* from Badagry Lagoon

Bpm: *Penaeus monodon* from Badagry Lagoon

CO1: Cytochrome c Oxidase Sub unit 1

CP: Crude Protein

DMRT: Duncan Multiple Range Test

EDTA: Ethylene Di-amine Tetra Acetate

Emm: *Macrobrachium macrobrachion* from Epe Lagoon

Emv: *Macrobrachium vollenhovenii* from Epe Lagoon

Estr: Strain of *Macrobrachium vollenhovenii* from Epe Lagoon

FCR: Food Conversion Ratio

FER: Food Efficiency Ratio

Lmm: *Macrobrachium macrobrachion* from Lagos Lagoon

Lmv: *Macrobrachium vollenhovenii* from Lagos Lagoon

Lpa: *Parapenaeopsis atlantica* from Lagos Lagoon

Lpm: *Penaeus monodon* from Lagos Lagoon

NFE: Nitrogen Free Extract

PER: Protein Efficiency Ratio

SGR: Specific Growth Rate

WG: Weight Gain

DEFINITION OF OPERATIONAL TERMS

AWG: The mean weight gain by the experimental prawns in the course of the experimental trial.

Binomics: The branch of biology concerned with the relations between organisms and their environment (distribution, ecology and occurrence).

Culture: The cultivation of prawn in captivity under defined environmental conditions.

DNA barcoding: DNA barcoding, use of short segment of DNA sequence in identifying a species.

FCR: The ratio of total dry feed fed to total wet weight gain in prawns.

FER: The reciprocal of FCR; ratio of total wet weight gain to total dry feed fed.

Lagoon: A body of water with little or no direct connection to the sea, thereby having far less saline conditions.

Meristic: The counting of body features such as rostrum teeth.

Morphometric: Measurement of body characteristics or features such as length and width.

Numerical method: The number of food items of a given type that were found in all the samples examined which is expressed as a % of all food items.

Frequency of Occurrence method: The number of stomach sample in which one or more of a given food item is found which is expressed as a % of all excluding empty stomachs examined.

PER: The relationship between wet weight gain of prawn and the protein content of feed.

Purified diet: A single nutrient diet which has no anti-nutritional factors.

Racial: The comparison of the morphometric and meristic features.

SGR: The daily percentage increase in weight.

ABSTRACT

Macrobrachium species are crustaceans found in most inland water and low brackish areas and are of economic importance and possible recruitment into aquaculture. The binomics, culture trial and DNA barcoding of caridean species Brackish water prawn (*Macrobrachium macrobrachion*) and African River prawn (*Macrobrachium vollenhovenii*) from Badagry, Lagos and Epe Lagoons, Nigeria were carried out between June 2013 and May 2015. The physico-chemical parameters of the study sites (N 6º 29′ 24.9856″ latitude, E 2º 45′ 52.5347″ longitude – Badagry Lagoon, N 6º 31′ 31.7846″ latitude, E 3º 48′ 23.9768″ longitude – Lagos Lagoon, N 6º 34′ 26.0″ latitude, E 3º 58′ 35.3″ longitude – Epe Lagoon) were measured *in-situ*. *M. macrobrachion* and *M. vollenhovenii* collected for 24 months were analyzed to determine their morphometric characteristics. *M. vollenhovenii* was reared in triplicate glass tanks with different Crude Protein (CP) levels of purified feed (25%, 30%, 35%, 40% and 45%) and 40% local diet as a control. Molecular technique (DNA barcoding) was used to identify *Macrobrachium* species found in the study areas. The DNA of the species was extracted using the phenol-chloroform protocol and Norgen tissue kit. Amplification and sequencing of *M. macrobrachion* and *M. vollenhovenii* were carried out and further identification of the species was done by comparing with sequenced data in the Genbank. The water temperature for the three lagoons ranged between 21.00 and 32.30 ºC; Dissolved Oxygen ranged from 1.50 to 14.00 mg/L; pH ranged between 5.00 and 9.39; salinity values ranged from 0.00 to 25.00 ‰; water transparency ranged between 17.78 and 175.00 cm and the conductivity ranged between 65.40 and 39600.00 µS/cm. Out of the 4729 specimens collected during the study period, 1770 specimens were from Badagry Lagoon, 924 from Lagos Lagoon and 2035 from Epe Lagoon. The total length (total weight) of *M. macrobrachion* from the three lagoons ranged from 4.8 cm to 12.8 cm (1.1 – 40.1 g), while *M. vollenhovenii* ranged from 4.3 cm to 22.6 cm (1.1 – 140.0 g). The condition factor (K) for the combined sexes of *M. macrobrachion* ranged from 0.3 – 1.4, 0.3 – 1.4 and 0.3 – 1.9 while *M. vollenhovenii* ranged from 0.4 - 2.7, 0.4 – 3.1 and 0.1 – 2.1 for Badagry, Lagos and Epe Lagoons respectively. The edible parts of *M. macrobrachion* constituted 44.93 % - 92.04 % of the body weight while that of *M. vollenhovenii* constituted 40.32 % - 89.80 % in the three lagoons. The stomach contents of *M. macrobrachion* and *M. vollenhovenii* from the three lagoons were made up of Bacillariophyta, Chlorophyta, Cyanophyta, Bivalves, Crustaceans, Copepods and detrital materials. The results of the food and feeding habit showed that *M. macrobrachion* and *M. vollenhovenii* had preference for detritus. The sex ratio (male: female) for *M. macrobrachion* and *M. vollenhovenii* were 1:1.03 and 1:0.21 respectively from Badagry Lagoon, 1:2.60 and 1:1.65 from Lagos Lagoon and 1:0.67 and 1:0.3 from Epe Lagoon. There were significant difference ($P < 0.05$) in the sex ratio recorded in the three lagoons except for *M. macrobrachion* from Badagry Lagoon, which showed no significant difference ($P > 0.05$). At the end of the culture trial, the tank that received 40% CP, compounded from local ingredients performed significantly ($P < 0.05$) better than the other treatments in terms of average Weight Gain (1.18g), Specific Growth Rate (0.61 %/day), Food Conversion Ratio (5.50), Protein Efficiency Ratio (0.60), Food Efficiency Ratio (0.21) and the survival rate (70.83%). New species of *M. asperulum* and *M. nipponense* were observed in Badagry and Epe Lagoons respectively. This study established the occurrence and distribution of *M. macrobrachion* and *M. vollenhovenii* from three interconnecting lagoons with the culture potentials of *M. vollenhovenii* in the laboratory. The phenol-chloroform protocol gave better gel-images than the Norgen tissue kit. The DNA barcode identified that some other species of *Macrobrachium* were present in Badagry and Epe Lagoons.