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MORPHOMETRIC AND MERISTIC STUDY OF *ETHMALOSA FIMBRIATA* (BOWDICH) FROM BRACKISH WATER AND MARINE ENVIRONMENT

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ABSTRACT

A study of *Ethmalosa fimbriata* (Bowdich) from Lagos lagoon (brackish water) and Lagos coast (marine environment) using meristic and morphometric characteristics was carried out. Length frequency distribution method was used to separate the sample fish to three age groups. One year old specimens from both the brackish water and marine environments were compared. The total lengths ranged from 9.9cm to 16.0cm. Variations were also studied for one year, two years and three year old specimens in the marine environments. Among the meristic and morphometric characters investigated dorsal rays, anal rays, left gill rakers and right gill rakers showed some differences that were statistically different among the three age groups. It is therefore concluded that *E. fimbriata* strains from brackish water and marine environment are genetically inseparable, since environmental factors such as salinity have effect on the migratory habit of the fish.

Keywords: *Ethmalosa fimbriata*, brackish water, marine, meristic

INTRODUCTION

E. fimbriata (Bowdich) is one of the commonest pelagic inshore fin fishes in West Africa. It belongs to the Clupeidae and is one of the important food fishes caught in coastal waters of Senegal, Gambia, Guinea, Sierra Leone and Nigeria (Leveque et al. 1990)

Lagos Lagoon being brackish has a salinity range of 0.5 – 28‰ with the highest salinity being recorded during the dry season (Fagade and Olaniyan, 1972 and Ajani, 2001). The marine environments on the other hand has a salinity that is higher than that of the brackish water, it is often close to $35^0/_{00}$. The migration of eggs and larvae from spawning ground is known as the larval drift (Cushing, 1975). The juveniles of *E fimbriata* according to Fagade and Olaniyan (1972) were found in very shallow region of the lagoon close to the shore while the immature adults usually one year old from the lagoon diffuse into the marine environments to join other adult stock. Longhurst (1960) and Olsen and Lefevere (1967) suggested that a considerable exchange of individuals or shoals of *E. fimbriata* takes place between the estuaries and offshore banks as far north as the border with Guinea. It therefore seems likely that spawning takes place in the vicinity of these shallow offshore banks and

that after metamorphosis the young fish migrate inshore. It was thus clear that *E. fimbriata* spends its life cycle in both the brackish and marine environments. The racial studies of fish in Nigeria had been done by Ezenwa and Kusemiju (1981) when they carried out investigation on the distribution and comparative racial study of the catfish *Chrysichthys nigrodigitatus* in brackish water area and major rivers in Nigeria. The aim of this study was to carry out investigation on meristic and morphometric characters.

MATERIALS AND METHODS

Study Area

Lagos lagoon lies between longitude 3^0 23' and 3^0 43' E and between latitude 6^0 22' and 6^0 38'N. It is a water body in the heart of Lagos metropolis and cut across the southern part of the metropolis linking the Atlantic Ocean in the West and south and Lekki lagoon in the east.

Collection of Specimens

120 specimens of *E. fimbriata,* of which 60 each were collected from the Lagos lagoon and off the Lagos coast from fishermen using pelagic set nets of 30mm mesh. Prior to the laboratory investigation the specimens were kept in the deeper freezer at a temperature of -20°C to avoid deterioration.

Laboratory procedures

For the morphometric and meristic studies of *E. fimbriata* from brackish and marine environments 60 specimens from each locality were used. The specimens used from the brackish water ranged from 9.9cm – 13.3cm standard length and 11.5cm – 24.0cm standard length for the marine specimens.

The meristic characters used in the laboratory were actual count of number of dorsal rays, pectoral rays, pelvic rays, anal rays, left gill rakers, right gill rakers and vertebrae. Measurement and counts were made on the left side of the fish except for the gill rakers which were counted on both the left and right sides (Kusemiju, 1975, Ugwumba, 1984 and Omoniyi, 1997).

Gill rakers

The gill rakers on the lower parts of the anterior gill arch were counted under the magnification of binocular microscope (x100) after removing the complete anterior gill arch from the operculum of the fish.

Fin rays

All the fin rays which include the dorsal rays, pectoral rays, pelvic rays and anal rays were counted visually except for smaller fishes from the brackish water in which their fin rays were counted under the magnification of hand lens, where the last two branched fin rays had a common root were counted as one and when they had distinct roots were counted as two (Kusemiju, 1975).

Vertebral Count

The vertebral count was done by boiling the fish in water to remove the flesh leaving only the bones. The number of vertebrae was determined by counting from the first vertebrae on the head to the last on the urostyle (Kusemiju, 1975).

Morphometric Characters

The morphometric characters used were the measurement of the standard lengths and head lengths. The measurement of the standard length was done by measuring the fish on a measuring digit board calibrated in cm from the tip of the snout to the structure base of the caudal fin while the head length

was measured from the tip of the snout to the projected most posterior margin of the opercular membrane.

Sex determination

This was done by dissecting the gonads using a dissecting kit. The presence of eggs in the gonad indicated that the fish was a female while the presence of testis indicated a male fish.

Statistical Analysis

For analysis of the counts, means and standard deviations were employed on the meristic and morphometric characters. t-test statistics was used to verify the observed differences in the characters while the graph developed from the length frequency distribution of the standard length was used to identify the groups in each of the two populations.

RESULTS

All data for meristic and morphometric characters comparisons were drawn from the collected 120 specimens for the two study environments. It was observed that lagoon species of *E fimbriata* were smaller in size than marine species (Figure 1).

From the length – frequency distribution of *E fimbriata*, specimens measuring 9.0 – 16.9cm standard lengths are placed in group I in lagoon system. In marine system, three groups were identified. Standard length ranging from 11.5cm to 15.5cm belongs to group I, while 15.5cm – 20.5cm belongs to group II and 20.5 – 24.5cm was identified as group III. An overlap in the standard length from 11.5 – 13.5cm was observed between the specimens from the two environments studied. The pelvic rays had a constant value of 7 while the vertebrae had a constant value of 12. The anal ray count of group I from Lagos lagoon ranged from 18 – 21 with a mean of 19.13±0.77 while those of Lagos coast ranged from 18 – 20 with a mean of 18.85±1.13. T- test ($p>0.05$) result showed that the difference observed was not statistically significant. The left gill raker count for group I from Lagos lagoon ranged from 58 – 77 with mean of 68.0±4.23 while those from Lagos coast ranged from 58 – 78 with a mean value of 72.0±6.69 . A t -test was carried out on the difference observed in the number left gill rakers was not significant at 5% level of significance. The right gill raker count for age group I of *E. fimbriata* from Lagos lagoon ranged from 62 – 75 with a mean of 68.0±3.55 while those from Lagos coast ranged from 53 – 76 with a mean of 71.0±5.42. The difference observed was not statistically significant ($p>0.05$).

The standard length of group I from Lagos lagoon ranged from 9.9 – 13.3cm with a mean of 11.14±0.67cm while those from Lagos coast ranged from 11.5 – 15.5cm with a mean of 14.13±1.07cm. The head length ranged from 2.2 – 3.8cm in Lagos lagoon with a mean of 2.79±0.31cm while those of Lagos coast ranged from 2.9 – 4.8cm with a mean of 3.9±0.45cm. The t-test analysis for the observed difference in the characters of the two populations indicated that there was no statistical difference in the two populations .

DISCUSSION

Studies carried out on length frequency distribution from both Lagos lagoon and Lagos coast showed that maximum standard length recorded for *E fimbriata* was 24.0cm and the minimum was 9.9cm. This length frequency data was then used to separate the specimens into three groups. Those specimens measuring 10cm – 16cm standard length were placed in group I and those whose their

standard lengths ranged from 17cm – 21cm belong to the group II and those ranging from 22cm – 24cm standard length belong to group III. This length range is likely to be standard length group at which *E. Fimbrata* move from lagoon environment to marine environment.

These observations agreed with the works carried out by Fagade and Olaniyan (1972) when they used length frequency distribution method to determine the age of *E fimbriata* from Lagos lagoon, in their results three modes of length distribution were recognized and these they used to age the specimens. Longhurst (1963), Salzen (1958) and Scheffeurs (1973) have all used length frequency distribution method to age *E fimbriata.* Salzen (1958) noted that *E fimbriata* rarely attained four years of age in the Sierra Leone River estuary, while Scheuffers (1973) noted that specimens caught in the St Louis attained only three years of age. Apart from these observations which agreed with the work carried out, other workers such as Papageourgiou (1979) used length frequency distribution method to age *Rutilus rutilus* (Roach) from Lake Voici. Kusemiju (1975) working on the aspect of the ecology and life history of the sculpin *Cottus aleutious* in Lake Washington used length frequency distribution method to age the fish.

The use of meristic and morphometric characters have often being employed to determine the amount of variation among widely distributed species. Problems may however arise on what meristic characters should be used or as to what number is adequate since the effects of environment on a particular meristic character might be different from others, it was therefore logical to combine many characters for comparison (Kusemiju, 1975). Many workers have also reported the use of meristic and morphometric characters and on the effects of environmental changes such as temperature and salinity. Ezenwa and Kusemiju (1981) used meristic and morphometric characters to distinguish between races of catfishes from brackish waters and major rivers in Nigeria. The differences observed in the species were based on sizes and number of gill rakers and they concluded that the changes were due to environmental effects based on salinity gradients. Ugwumba (1984) also employed the use of both meristic and morphometric characters on species of ten pounder *Elops lacerta* from three environments to know whether the species have developed into racial strains, from his investigation the species were not genetically separable.

In the specimens investigated the use of meristic characters such as dorsal rays and anal rays and also vertebral and gill raker counts were employed to verify whether there were statistically significant differences in the meristic characters of *E. fimbriata* of age group I from both Lagos lagoon (brackish water) and Lagos coast (marine environment) and these showed that there were statistically significant differences between the meristic characters from the two localities. Analysis carried out on the meristic characters of the three groups from the marine environments did not show any statistically significant differences. Abowei (2009) described the morphology, abundance, condition factor and Length-weight relationship of *E. fimbriata* from Nkoro River Niger Delta Nigeria. He noted that the structure of described fish was not separated into different strains though on set of rains affected the condition factor of the fish.

The vertebral counts and the gill raker counts did not show any statistically significant differences between the group I from the Lagos lagoon and Lagos coast and also among the three groups from marine environment. Bainbridge (1961) elucidated that one of the most useful characters for distinguishing different species of Clupeid larvae is the total number of vertebrae. *E. dorsalis* the species of *Ethmalosa* found in Sierra Leone has an average of about 43 vertebrae as its larvae should easily be distinguished from those of *Sardinella spp* which have an average of 46 or more. This observation agreed with the work carried out by Bainbridge (1961) on the vertebral count of *E. fimbriata* which had an average value of 42 vertebrae in all the three groups.

The objective of this study was to determine if significant differences occurred in meristic and morphometric characters in specimens of the Bonga *E. fimbriata* of group I from Lagos lagoon and Lagos coast and also between the three groups from the marine environment. Since all the meristic characters statistically tested to verify whether the differences observed were due to some environmental factors were not statistically significant, the result could therefore be interpreted that most of the meristic characters although vary in number are laid down during the embryonic development and that the migration of *E. fimbriata* from Lagos coast (brackish water) when they are one year old to marine environment (Lagos coast) do not involve any significant modification of their meristic structures. Consequently, there are no structural modification of the meristic characters among the three groups when the statistical analysis carried out to verify any observable differences in the meristic characters did not show any statistically significant result. It is therefore possible to conclude that *E. fimbriata* strains from brackish water and marine environment are genetically inseparable, since environmental factors such as salinity have effect

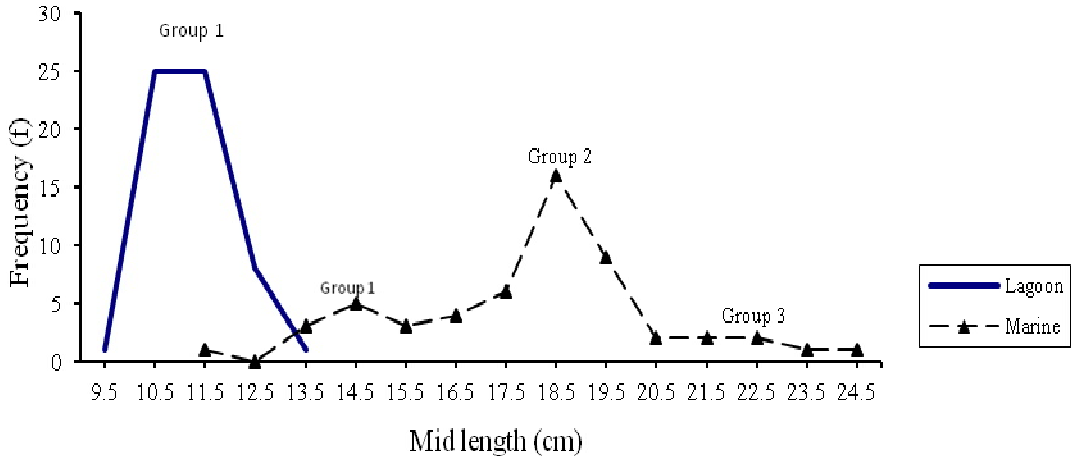

Figure 1. Length frequency distribution of *E. fimbrata* from lagoon and marine environments.

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