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Short Communication

Size composition, growth, mortality and yield of *Alectis alexandrinus* (Geoffory Saint-Hilaire) in Bonny River, Niger Delta, Nigeria

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A twelve month study on the size composition, growth, mortality and yield of *Alectis alexandrinus* revealed a length range of 11.5 - 33.8 cm (standard length). Employing the length frequency method in the FISAT II package gave the following results for the Von Bertanlanffy growth parameters: L∞ = 35.23, K = 0.680, t_o = 0.3214 and ǿ = 2.926. The total mortality (Z) was 2.47, natural mortality (M) 1.39 and fishing mortality (F) 1.08.The relative biomass per recruit (knife edge selection) was Lc/ L∞ = 0.05, E_{10} = 0.355 and E_{50} = 0.278. Although the exploitation rate (E) was 0.44 the E_{max} was 0.421 indicating moderate exploitation of the fish in Bonny River. There is room for increased effort in the fisheries.

Key word: Size, growth, mortality, yield, *Alectis alexandrinus*.

INTRODUCTION

Alectics alexandrinus is one of the commercially valuable fishes in the gulf of Guinea, which could be relevant in sport fishing as obtainable in places like Hawaii (Honbrink, 2001). Bottom trawls, purse seine, set nets and line gears are commonly used for its capture (Schneider, 1990). The need to continuously assess the dynamics of the stocks especially commercially viable ones cannot be over stressed. Sustainable management of a fishery requires knowledge of the dynamics of fish population (King, 1995; Sparre and Venema, 1998). Furthermore, Ricker (1978) pointed out that the theory of population dynamics is a division of the general theory of the laws of reproduction, growth and the causes of death of living organisms. Musick (1999) reported that the ability of a stock to sustain its population is a function of its resilience to fishing pressure and productivity. This to a large extent depends on its reproductive capacity or fecundity in addition to survival in its natural environment. In view of this several levels of biological parameters that are required to allow for the classification of fish populations or species into categories of high, medium low and very low resilience or productivity have been suggested (Pamela et al., 2001; Musick, 1999). The need to monitor the changes in the population of a stock especially with changes in the environment is crucial, Larkin (1978) reported changes in the population of Pacific Salmon following changes in the environment as a result of human activities in the North Pacific Ocean, the Bering Sea and adjacent portions of the Arctic Ocean. The need to monitor key biological indices like reproduction, growth and mortality is therefore crucial to understanding of the dynamics of a fish stock.

MATERIALS AND METHODS

Samples were collected from artisanal fishermen at landing sites along the coast of the Bonny River which lies between 4°15 [1] to 4°45[1]N and 6°45[1] to 7°15[1]E. Collection was done between January and December 2005. Length and weight measurements obtained using a measuring board and top loading scale to the nearest 0.1 cm (standard length) and 0.1 g respectively.

The Von Bertalanffy growth function Lt = L∞ $(1^{-e-k(t-to)})$ was employed to determine the growth performance of the stock (Pauly, 1983). The yield was determined using the Knife edge selection method from the equation of Beverton and Holt (1957).

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$Y/R = Y1/R^*(W^{*en-(m (tr-to))})$

The total mortality (Z) was determined by a plot of length converted catch curve (Pauly, 1983). The value of Z/k was obtained from Powell-Wetheral plot (Wetheral, 1986). While the natural mortality was calculated by Pauly's empirical formula (Pauly, 1980b). Fishing mortality (F) was calculated from the relationship F = Z – M (Gulland, 1971). Exploitation rate (E) was obtained from the relationship E = F/Z (Gulland, 1971). The above analyses are incorporated in the FISAT package (Gayanilo and Pauly, 1996) which was used to estimate all the parameters.

RESULTS AND DISCUSSION

A total of 1300 samples were collected with weight range between 11.5 and 33.8 cm (standard length). The size distribution is given in Table 1. The Von Bertalanffy growth analysis gave the L∞ = 35.23, K = 0.680, ǿ = 2.926 and 0.3214.

The total mortality (Z) by converted catch curves was 2.47, M = 1.39 and F = 1.08, while results of Powell-Wetheral plot gave L∞ = 29.32 Z/K = 1.042 and the linear relationship as Y = 14.35 + (-0.490)*X. The probability of capture showed an increasing trend with size, ranging from 25% for 22.41cm to 75% for 27.79 cm. The maximum exploitation rate (Emax) was 0.421 but the prevailing exploitation rate was 0.44. The study revealed two peaks in the recruitment of the species and the relative biomass per recruit analysis (knife edge selection) gave Lc/L∞ = 0.05, E_{10} = 0.355 and E_{50} = 0.278.

The largest specimen recorded was 33.8 cm as against the maximum of 45 – 90 cm reported by Schneider (1990). Although the availability of the fish with respect to size followed normal distribution, the sharp abundance of the 16.6 - 19.5 cm class and subsequent quick drop in 22.6 - 25.5 cm class group was indicative of a population under exploitation thereby causing drastic non availability of the larger sizes in relative and adequate supply. The population of this stock is said to be dominated by the young class based on the classification of Schneider (1990).

Carangids are noted for the changes they undergo with growth (Böhlke and Chaplin, 1993). Honbrink (2001) stated that these changes have likely been responsible for misidentification of specimen and contributed to some of the general confusion that has occurred. An interesting example is that which occurs in juveniles of African pompano (*Alectis ciliaris*) which are easily recognized by the presence of long filaments arising from the first four or five rays of the dorsal and anal fins, which shorten with growth and eventually disappears (Randall et al., 1990; Myers, 1991).

Studies by Sudekum et al. (1991) gave L∞ as 183.8 cm for *Caranx ignobilis*, k = 0.11 and to = 0.097. Iwasaki (1995), gave L∞ = 93.02 cm, k = 0.214, and to = 0.449 for *Elagatis bipinnulata*. While Humphrey (1986) reported L∞ = 14.93, K = 0.314 and to = 0.0420 for *Seriola dumerili.* From the above comparisons, it is obvious that *Alectis*

Table 1. Size range and percentage of *A. alexandrinus* in Bonny River Niger Delta.

% of catch	Length range (cm)
0.6	11.5 - 13.5
10.9	13.6 - 16.5
40.3	16.6 - 19.5
24.4	19.6 - 22.5
8.1	22.6 - 25.5
8.8	25.6 - 28.5
6.6	28.6 - 31.5
0.3	31.6 - 34.5

above species with a K value of 0.680 and a growth performance index (ǿ) of 2.926.The natural mortality estimated in this work is very high (1.39) corresponding to 56.3%. With regards to causes of mortality among Carangids, Thompson and Murro (1974) stated that there is no evidence regarding factors causing morbidity and mortality in Carangids and their major predators are unknown.

Furthermore, the results of this work show that the stock was under moderate exploitation but with higher probability of capture for bigger individuals and could explain the reason for the reduced availability of the bigger size classes.

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