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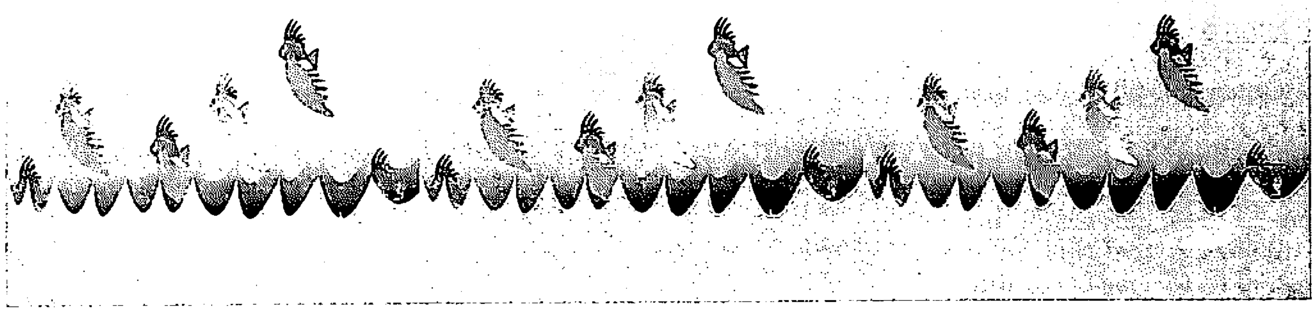

Growth Performance of Nigerian Fish Stocks

R.P. KING

Abstract

Parameters of the von Bertalanffy growth function are presented for 42 fish stocks belonging to 16 families, 22 genera and 27 species. The growth performance index, $\phi'(= \log K + 2\log L_\infty)$, was computed for each stock and was found to be highest in male *Gymnarchus niloticus* (Gymnarchidae) from Lake Chad and lowest in *Chrysichthys auratus* (Bagridae) from the Cross River. Mean ϕ' for major fish genera and families are also presented and was highest in brackishwater fishes, closely followed by freshwater and inshore marine water fishes.

Introduction

Interest in studies on growth in tropical fishes has recently grown in view of their relevance to the resultant parameters in pragmatic fisheries management. Growth parameters are important in the selection of fishes for aquaculture (Moreau et al. 1986; Mathews and Samuel 1992) and in estimating food consumption of fish populations (Palomares and Pauly 1989; Pauly 1989).

Numerous studies on the growth of tropical African fish stocks have been carried out as a result of this increased interest (e.g. Merona 1983; Hustler and Marshall 1990; Torres and Pauly 1991; Kolding et al. 1992; Makwaia and Nhwani 1992). However, up to now, no data have been gathered on the growth performance of fishes in Nigeria, where there is an important commercial fishing industry as well as active aquaculture. This paper summarizes the available growth parameters of Nigerian fish stocks from inshore marine water, brackishwater and freshwater ecosystems. The results may be entered into FishBase subsequently (Froese 1990; Pauly and Froese 1991) for use by other fisheries scientists and aquatic ecologists.

Materials and Methods

Information on length-growth parameters of Nigerian fishes were obtained from the available literature. Parameters for males and females of the same species were obtained whenever growth data had been or could be estimated separately. In all cases, length-growth patterns were described via the von Bertalanffy growth function (VBGF). When only age-length data pairs (in tables and/or graphs) were available, these were used to estimate the asymptotic length, L_∞ (total length, cm), and growth coefficient, K (yr^{-1}), using the Ford-Walford plot (Pauly 1983). When only three data pairs were available (e.g., lengths at ages 1, 2 and 3 years), it was not possible to directly apply the Ford-Walford procedures. Consequently, the VBGF parameters were obtained via the method described by Chittenden (1977) whereby the slope (b) and intercept (a) of the Ford-Walford plot were estimated as follows:

$$b = (L_3-L_2)/(L_2-L_1) \quad ...1)$$
$$a = L_2-bL \quad ...2)$$

where L_1, L_2 and L_3 are length at ages 1, 2, and 3 years, respectively.

The parameters L_∞ and K were subsequently estimated as follows:

$$L_\infty = a/(1-b) \quad ...3)$$
$$K = -\ln b \quad ...4)$$

The growth performance index (ϕ') was computed from the expression given by Pauly and Munro (1984): $\phi' = \log_{10} K + 2\log_{10} L_\infty$.

Results and Discussion

Estimates of growth parameters (L_∞, K) of 42 Nigerian fish stocks belonging to 16 families, 22 genera and 27 species are summarized in Table 1. Nomenclature of the fishes follows Lévêque et al. (1992) and Teugels et al. (1992).

A moderately high variation occurred in the growth performance index with values ranging from 1.06 in *Chrysichthys auratus* from the Cross River to 3.78 in male *Gymnarchus niloticus* from Lake Chad. The means for the major fish genera (i.e., those with at least two stocks) revealed values varying between 2.34 (*Pellonula*) and 3.76 (*Gymnarchus*) (Table 2). Average growth performance indices of major fish families showed minimum and maximum values in *Schilbeidae* and *Gymnarchidae*, respectively.

The observed variation in growth performance of the stocks can be attributed to the diversity of taxa and habitat because some taxa have an intrinsically higher growth rate than others, depending on environment and habitat. The stocks were categorized by the main aquatic ecosystem they inhabited: inshore marine water (10 stocks); brackishwater such as estuaries/coastal lagoons (7 stocks); and freshwater such as streams, rivers, ponds, reservoirs and lakes (25 stocks) (Table 1).

Mean ϕ' was highest in the brackishwater assemblage (ϕ' = 2.92); closely followed by the freshwater assemblage (ϕ' = 2.89) and the inshore marine water assemblage (ϕ' = 2.88). There is no significant difference between these mean values.

Munro and Pauly (1983) noted that the growth performance index can be used to distinguish between ecosystems since it is linked to metabolism, food consumption and energetics of habitats. Djama et al. (1989) have found that ϕ' was a useful tool for discriminating the Atlantic coastal stocks off Africa of the clupeid *Sardinella maderensis*.

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Table 1. Growth parameters of 42 fish populations (stocks) from Nigeria.

Family/species	L_∞ (cm)[a]	K (yr^{-1})	ϕ'	Ecosystem type[b]	Source
CLUPEIDAE					
Ethmalosa fimbriata	30.0	0.430	2.59	M	Moses (1988)
Ethmalosa fimbriata	33.6	0.360	2.61	M	Essen (1995)
Sardinella maderensis	37.5	0.386	2.67	M	Marcus (1984)
Ilisha africana	22.0	2.330	3.05	M	Stokholm and Isebor (1992)
Ilisha africana	29.6	0.800	2.85	B	King (in prep.)
Pellonula leonensis	15.6	0.810	2.30	F	Kunzel and Lowenburg (1990)
Pellonula leonensis	15.6	0.960	2.37	F	-do-

continued

Table 1. (continued)

Family/species	L_∞ [a] (cm)	K (yr^{-1})	ϕ'	Ecosystem type[b]	Source
OSTEOGLOSSIDAE					
Heterotis niloticus	107.3	0.399	3.66	F	Welcomme (1979), FAO/UN (1970)
Heterotis niloticus (male)	177.9	0.129	3.61	F	Adekeye (1993)
Heterotis niloticus (female)	193.6	0.103	3.59	F	-do-
NOTOPTERIDAE					
Papyrocranus afer	57.1	0.288	2.97	F	King (in prep.)
MORMYRIDAE					
Mormyrops anguilloides	129.1	0.122	3.31	F	Welcomme (1979)
GYMNARCHIDAE					
Gymnarchus niloticus	211.3	0.123	3.74	F	Sagua (1986)
Gymnarchus niloticus (male)	152.5	0.260	3.78	F	-do-
CITHARINIDAE					
Citharinus citharus	112.4	0.126	3.20	F	Welcomme (1979)
CYPRINIDAE					
Labeo senegalensis	43.6	0.220	2.62	F	Merona (1983)
BAGRIDAE					
Chrysichthys auratus	31.0	0.012	1.06	F	Udo (1994)
Chrysichthys auratus	44.3	0.160	2.50	F	Sturm (1984)
Chrysichthys nigrodigitatus	109.3	0.165	3.30	B	Ezenwa and Ikusemiju (1981)
Chrysichthys nigrodigitatus	126.0	0.191	3.48	B	Udo (1994)
SCHILBEIDAE					
Schilbe intermedius (female)	33.6	0.106	2.08	F	Olatunde (1979)
Schilbe mystus (male)	21.7	0.176	1.92	F	-do-
Schilbe mystus (female)	41.3	0.208	2.55	F	-do-
Schilbe mystus	44.6	0.507	3.00	F	Welcomme (1979)
CENTROPOMIDAE					
Lates niloticus	112.5	0.309	3.59	F	-do-
CARANGIDAE					
Selene dorsalis	38.6	0.600	2.95	M	Isebor (undated)
Chloroscombrus chrysurus	33.6	0.560	2.80	M	-do-
SCIAENIDAE					
Pseudotolithus elongatus	48.0	0.280	2.81	B	Nawa (1987)
Pseudotolithus elongatus	60.0	0.380	3.14	B	Etim et al. (1994)
CICHLIDAE					
Tilapia mariae	22.1	0.461	2.50	F	King (1991)
Tilapia guineensis	26.5	0.475	2.52	F	Fagade (1980)
Tilapia zillii	34.3	0.632	2.87	F	Moreau et al. (1986)
Tilapia zillii	31.9	0.720	2.86	F	-do-
Oreochromis niloticus	72.7	0.405	3.33	F	-do-
Oreochromis niloticus	56.7	0.262	2.93	F	Arawomo (1983)
Sarotherodon galilaeus	62.3	0.469	3.26	F	Moreau et al. (1986)
GOBIIDAE					
Periophthalmus barbarus[c]	17.8	0.360	2.06	B	King (in prep.)
CYNOGLOSSIDAE					
Cynoglossus canariensis	51.2	0.331	2.94	M	Ajayi (1983)
Cynoglossus canariensis (male)	47.4	0.333	2.87	M	-do-
Cynoglossus canariensis (female)	54.5	0.306	2.96	M	-do-
Cynoglossus goreensis	82.1	0.097	2.82	B	Nawa (1987)
TRICHIURIDAE					
Trichiurus lepturus	119.0	0.157	3.35	M	Amadi (1984)

[a] total length
[b] ecosystem types: M = inshore marine water, B = brackishwater, F = freshwater.

Table 2. Mean growth performance indices for major fish genera and families in Table 1.

Genera	n	Mean φ'	Family	n	Mean φ'
Ethmalosa	2	2.60	Clupeidae	7	2.68
Ilisha	2	2.95	Osteoglossidae	3	3.62
Pellonula	2	2.34	Gymnarchidae	2	3.76
Heterotis	3	3.62	Bagridae	4	2.59
Gymnarchus	2	3.76	Schilbeidae	4	2.39
Chrysichthys	4	2.59	Carangidae	2	2.88
Schilbe	4	2.39	Sciaenidae	2	2.98
Pseudotolithus	2	2.98	Cichlidae	7	2.90
Tilapia	4	2.69	Cynoglossidae	4	2.90
Oreochromis	2	3.13			
Cynoglossus	4	2.90			

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Diet Composition and Daily Ration Estimates of Selected Trawl-Caught Fishes in San Miguel Bay, Philippines*

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Abstract

The diet composition of fish caught in San Miguel Bay, Philippines, in April and May 1993 was studied. The diets of *Otolithes ruber*, *Stolephorus commersonii* and *S. indicus* consisted mainly of zooplankton, primarily crustaceans. The stomach contents of *Leiognathus bindus* was found to consist mostly of detritus and unidentified materials. Daily rations estimated were: 1.90 g·day^{-1} for *O. ruber* of 17.3 g mean body weight (BW), 0.078 g·day^{-1} for *S. commersonii* of 3.8 g mean BW, 0.062 g·day^{-1} for *S. indicus* of 3.9 g mean BW and 0.56 g·day^{-1} for *L. bindus* of 7.7 g mean BW.

Introduction

Information on the daily ration and diet composition of fish are important for the construction of trophic models of aquatic ecosystems (Christensen and Pauly 1993). It is still difficult to obtain this information even though much research has been done on the topic. Most of the models proposed in the past involved laboratory experiments, requiring special equipment, and the results of such experiments were often biased and/or inaccurate because experimental fish were under stress. There are, however, straightforward models of stomach contents dynamics requiring a minimum of data (e.g., a single 24-hour cycle of stomach contents) which are easily obtained from field studies. Moreover, the results are not affected by stress.

This paper presents the results of a study of the diet composition and food consumption of four species of trawl-caught fishes sampled in San Miguel