PRELIMINARY STUDY ON THE ASPECTS OF THE BIOLOGY OF SNAKEHEAD *PARACHANNA OBSCURA*,IN A NIGERIAN WETLAND

M. T. UDO and U. I. DANIEL

Department of Fisheries and Aquaculture, Faculty of Agriculture, University of Uyo, P.M.B 1017, Uyo, Akwa Ibom State, Nigeria (email: udomfon@yahoo.com)

Abstract

Between October 2000 and March 2001, a preliminary study on the aspects of the biology ofParachanna *obscura*, was investigated. Sex ratio revealed female preponderance [x^2 = 4,7338, df =1, p<0.05]. There was aseasonality in sex ratio during the wet season whereas there was dry seasonality increase in number of females over males [x^2 = 4.735, df = 1, p = < 0.05]. A curvilinear plot was obtained in the regression of the total length and total weight TW = 0.018621 $TL^{2.697}$, n= 408, r = 0.869, [p<0.001]. Trophic spectrum of *C. obscura* [size range 9.0 18.0 cm comprises ten food items. The items were re-classified into seven major groups consisting of detritus [coarse and fine detritus], fish [juvenile and remains of fish], Insecta [un-identified adult and remains of insects], macrophyte materials, mud, Oligochoetes [earth-worm], and abiogenic sand. Fish, insects and Oligochoetes were eaten as primary foods items. There was a complete ingestion of the array of the dietaries by both sexes. Exception of one item [coarse detritus] during the wet season, *P. obscura* consumed all the dietaries during the seasons. Nevertheless, the later season increased in the ingestion of 9 out of the 10 items in conformity with optimal foraging theory. *Parachanna obscura* is considered as piscivore-insectivore-invertivore in feeding habits. In the wake of doubts about the viability and prospects of aquaculture, farming of *P. obscura* is a possibility. This species possesses a number of positive attributes with regards to aquaculture. It is likely that efforts to culture this hardy carnivorous and fast-growing fish will spread in the coming years in Nigeria, if breeders and fish farmers will give it a chance.

Keyword: *Parachanna obscura*, Nigerian wetland, trophic spectrum, feeding habit, season, sex.

Introduction

There abound reports on the flood plains and wetlands in Africa. In Nigeria, for instance, Moses (1990) reported on the productivity of the Cross River flood plains. Another is the Northern Akwa Ibom Swamp Resources Survey. The documentation highlights untapped fishery resources from the flood plains of two important tributaries of Cross River System-Enyong Creek and Ikpa River. The wetlands here are typified by a complex biodiversity of flora and fauna, reservoirs, rivulets and streams. Conscious development of these ecosystems would generate many tons of fish and fishery products if sustainably exploited. Reports from the flood plains/wetlands indicate the presence of a fish species commonly known as snakehead or blackfish, *Parachanna obscura*.

The family Channidae (= Ophiocephalidae) of long cylindrical predatory fishes, common in Asia, has two African species. Parachannids have accessory respiratory organs and *Parachanna* is widely distributed in marshly places (McConnell, 1979). Based on the reproductive guild of fishes (Balon, 1984), eggs and young of Channidae are guarded by both parents. Reproductive biology of some allied species revealed that *Channa striatus* (Philippines) produces 100-1,000 eggs at a time, which take 3 days to hatch in a clearing in the vegetation; breeding occurs every month. Similarly, *C. punctatus* (Punjab) spawns between April and July, and the 500 strong brood is guarded for a month, until the fry are 10 cm long.

In Nigeria, two species are recognized, *Parachanna obscura* (Guther, 1861) and *P. africana* (Steindaachner, 1879). The distinguishing features between the two species are the transverse "< - shaped" dark bars on the flanks in adults which contrast with the longitudinal blotches seen in *P. obscura* (Teugels, *et al.*, 1992). Distinctive characters in the genus include: long dorsal and anal fins; a short nasal appendage. However, there are scanty reports on the breeding success of the species in aquaculture. So far efforts at culturing the species merely starts and ends at collecting them from the wild and watch them grow. The present paper is a support and contribution to understanding the biology of *Parachanna obscura* with a view to developing its pisciculture. Aspects considered include sex ratio, length-weight relationship and diet composition.

Material and Methods

The study was conducted in the swamp/food plains of the Enyong creek in Nkana-Ikpe village in Ini Local Government Area (LGA), Akwa Ibom State, Nigeria. The study area ($5^0$20' $5^0$30'; $7^0$40' $7^0$50'), is drained by two major tributaries: the Igwu and Itu Rivers. The Ini LGA has a mean annual rainfall of 262 mm and 20 mm higher than the surrounding Ikono LGA. It has a humid tropical climate of 70 80% (Okoji, 1990).

Monthly samples (October, 2000 March, 2001) of the snakehead or black fish, *Parachanna obscura* were collected from the samples by means of traditional basket traps (Udolisa *et al.*, 1994). The collection of the samples for 6 months only was due to disappearance and/or un-availability of the species in the traps between April and September 2001.

The specimens caught were preserved in formaldehyde (10%) immediately after collection to stop digestive action. In the laboratory, the specimens were measured by means of a wooden measuring board to the nearest 0.1 cm total length (TL) and weighed on a top-loading electronic balance to the nearest 0.01g total weight (TW). The lengthweight relationship was computed using the formula (Lagler *et al.*, 1977):

$$TW = {}_a(TL)^b$$

Where, TW = total weight of fish, TL = total length of fish and *a* and *b* = constants. The values of *a* and *b* were estimated by least square regression using double transformed weight and length data pair according to the formula:

$$\text{Log TW} = \text{Log a} + \text{b Log TL}$$

The specimens were dissected and sexed by examining the gonads. Sex ratio was determined using the Chi-square test. To evaluate feeding intensity of *P. obscura*, the 'points' method (Hyslop, 1980) and stomach repletion under (SRI) were used.

In the 'points' method, each stomach was assigned a number of points proportional to its degree of fullness according to an arbitrary 0-20 point scale, thus: empty, ¼ full, ½ full, ¾ full and full stomach respectively. The frequency of occurrence of each item (f_i) and point score of each item (p_i) were noted. The integrated importance of each item was then expressed by food preponderal index (FPI) according to king (1991):

$$FPI = (f_i + p_i) / \sum_{i=1}^{n}(f_i + p_i) . 100$$

The index has a range of 0 100%: items with FPI > 10% were arbitrarily considered as primary dietaries, those with FPI = 1.0 9.9% secondary and those with FPI < 1.0 % as incidental. The percentage composition was used to describe the overall diet, intersexual and seasonal changes in food habits. Food richness was estimated and diet breadth (B) computed according to Angermeier (1982)

$$B = [(\sum P_i)^{2-1} 1] / n-1$$

Where, P = proportion of the diet comprised by resource type j and n = number of food categories in the diet.

Results

The overall sex ratio was significantly different from the expected 1:1 ratio. Out of the 244 specimens of *P. obscura* studied, 105 (43.03%) were males and 139 (56.97%) females giving a sex ratio of 1.00 male : 1.32 female, which was different from unity ($x^2 = 4.738$, df = 1, $P < 0.05$) in favour of females.

Seasonally, of the 203 specimens examined during dry season, 86 (42.36%) were males and 117 (57.64%) females giving a sex ratio of 1.00 male : 1.36 female, which was different from unity ($x^2 = 4.734$ df = 1, $P < 0.05$). Conversely, wet season sample of 41 specimens consisted of 19 (46.34%) males and 22 (53.66%) females, giving a sex ratio of 1:1.16, which was not different between the sexes ($x^2 = 0.220$, df = 1, $P > 0.05$).

The overall plot of total length (range 9.0 18.0 cm TL) and weight (range 5.68 38.34 g TW) of *P. obscura*, was positively correlated ($r = 0.860$, $P < 0.001$; n= 244), with a functional equation of the form:

$$TW = 0.018621\ TL^{2.607}$$

Dynamics of Feeding Intensity

Out of the 244 specimens of *P. obscura* (size 9.0 18.0 cm TL) studied for feeding intensity, 57 (23.36%) had full stomachs, 184 (75.41%) partiallyfilled stomachs and 241 (98.77%) non-empty stomachs.

Stomach repletion showed that females were significantly different in stomach fullness, SF ($d = 17.709$, $P < 0.001$) than males whereas the males increased in partially-filled stomachs, PS ($d = 9.817$, $P < 0.001$) than the former. However, there was no significant difference in nonempty stomachs, NES (d = test: $P < 0.05$) between sexes.

There was no significant seasonality in NES (d = test: $P < 0.05$). However, there was significant wet season increase in FS ($d = 5.413$, $P < 0.02$) and dry seasonality in PS ($d = 20.164$, $P < 0.001$).

Diet Composition

The overall stomach contents of *P. obscura* (Table 1) revealed that 10 food items were ingested. The food items were re-classified into 7 major groups comprising detritus (coarse and fine detritus), Pisces (juvenile and remains of fish), Insecta (unidentified adults and remains of insects), macrophyte materials, mud, Nematoda (earthworm) and abiogenic sand. The species fed, predominantly on insects (31.61%), fish (28.67%), earthworm (14.46%) and mud (10.54%) while the rest of the dietaries were of minor importance each forming < 3.92% of the diet.

Most of the stomachs of *P. obscura* examined were indicative of frequent feeding, evidenced by only 3 specimens having empty guts/ the inclusion of mud as a major food item is a clue that the species feed close to the bottom of the water.

Sex dependent changes in the food composition of *P. obscura* are summarized in Table 1. Food richness was the same as both sexes consumed a complete array of the dietaries. There was similarity in the intersexual rankorder of the food items ($rs = 0.9696$, $p < 0.002$), although the proportions of some of them were different. Diet breadth was 0.82 in males and 0.85 females.

Exception of one food item (i.e. coarse detritus) during the dry season, *P. obscura* consumed all the major groups of dietaries in the two seasons (Table 2). The observed feeding pattern probably accounted for high diet breadth during the wet season (0.82) in conformity with the optimal foraging theory. There was similarity in the rank-order of the food items ($r = 0.6994$, $P < 0.05$), although the proportions of some of them were different between the seasons.

The observed feeding patter probably accounted for high diet breath during the wet season (0.82) in conformity with the optimal foraging theory. There was similarity in the rank-order of the food items ($r= 0.6994$, $p < 0.05$), although the proportions of some of them were different between the seasons.

Table 1. Overall and sexdependent variation in food composition

	% Food ponderal index (FPI%)			
		Sex		
Food Item	**Overall**	**Males**	**Females**	**d-statistic**
Detritus				
- Coarse detritus	2.70	2.22	4.28	13.207**
- Fine detritus	3.92	1.48	3.27	12.703**
Pisces				
- Juvenile of Fish	3.92	4.44	5.35	4.651*
- Fish remains	24.76	28.88	23.00	13.031
Insecta				
- Unidentified adults	22.79	22.22	21.39	2.000*
- Insect remains	8.82	9.63	5.81	0.014ns
Macrophyte Materials	3.68	2.96	4.28	7.904**
Mud				
Nematoda	10.54	11.85	10.70	3.876*
- Earthworm	14.46	14.67	12.83	3.804*
Sand grains	4.41	2.22	5.85	18.075**
Food richness		10	10	
Diet breadth		0.82	0.85	

ns = not significant

*p = level of significance: *< 0.05; ** < 0.002; *** < 0.001

Table 2. Seasonal variation in food composition of *P. Obscura*

Food Item	% food ponderal index (FPI %)		
	Dry	Wet	d-statistic
Detritus:			
Coarse detritus	3.42	-	-
Fine detritus	4.49	5.88	19.318**
Pisces			
Juvenile of fish	4.97	2.35	
Fish remains	9.94	5.88	15.814
Maerophyte materials	3.73	3.53	1.230 ns
Mud	11.18	8.24	11.174**
Nematoda- Earth worm	13.35	18.82	15.936**
Sand grains	4.04	5.88	20.747**
Food richness	10	9	
Diet breadth	0.84	0.82	
Ns= not significant			
*P = level of significant:	* <0.022; **< 0.001		

Discussion

Sexes of *Parachanna obscura* could only be determined on dissection of the gonads. No literature was available for comparing the sex ratio of *P. obscura*. However, the overall sex ratio, which revealed female preponderance, indicates, probably the presence of sexdependent difference in longevity. The overall regression exponent in the lengthweight relationship of *P. obscura* was markedly different from the expected cubic value. This finding, suggests that the dynamics of the species population in the present study area cannot be studied using the various models, which assume isometry (Sparre and Venama, 1979). The feeding intensity by males of *P. obscura* was higher than that of the females, although, the latter had more individuals with full stomach. The exact reason for the observation is unknown but it may suggest energy requirements by the former to guard eggs and defend territory.

The trophic spectra of *P. obscura* indicate that it is an insatiable carnivore. In the wake of doubts of the viability and prospects of fish production from fish culture in Nigeria, attention paid to rearing of *P. obscura* could be desirable. Feeding is a crucial and indispensable activity in aquaculture. Its efficiency must always translate into fish growth at minimum culture period, and hence justification of investment. Considering that the species is an insatiable carnivore, it could be stocked 34 months after stocking the pond with *Tilapia* species. Overhead cost from feeds and feeding can thus be eliminated. Fingerlings/postfingerlings of *P. obscura* can attain an average of 1 kilogramme (in 5 months) when stocked in *Tilapia* ponds (authors unpublished). Culture of *P. obscura* can therefore, complement the already and increasing farming of the catfishes (*Clarias and Heterobranchus*).

In summary, this preliminary study revealed that in, *P. Obscura:* (a) Females were more than males; b) Length weight regression was allometric; (c) Ecologically, the species is an insectivore piscivore invertivore in feeding habits.

In the allied species (*Channa striatus* and *C. punctatus*). Fecundity estimates is between 500 and 1,000 eggs and breeding may occur yearround in individuals, but with peaks from April and July. However, successes in breeding technology and general reproduction of Nigerian species *(P. obscura* and *C.africana)*, are urgently required to kickstart its suitability and sustainability for aquaculture. Finally, *P. obscura* possesses a number of positive attributes when it comes to aquaculture. It is likely that efforts to culture this hardy carnivore and fastgrowing fish, will spread in the coming years in Nigeria and other parts of Africa.

References

Balon, E.K. 1984. Patterns in the evolution of reproductive styles in fishes. *In:* Fish Reproductive, Ed. G.W Potts and R.J. Wootton, pp. 35-53. London: Academic press.

King, R.P. 1991. The biology of *Tilapia mariae* Boulenger, 1899 (Perciformes: Cichlidae) in Nigerian rainforest stream. Ph.D Thesis, university of port Harcourt, Nigeria XIV + 237p

Moses, B.S. 1990. Distribution, ecology and fisheries potential of Nigeria Wetlands. *In:* Nigerian Wetlands (edited by Akpata, T.V.I. and D.U.O. Okali). Printed by offset Lithography, Ibadan. 167p.

Lowe-McConnell, R.H. 1987. Ecological studies in tropical fish communities. Cambridge university press, London. 382p

Nikolsky, G.V. 1969. The theory of fish population dynamics, New York and London. 351p

Okoji, M.A. 1990. Environmental impact of agricultural development in Ini L.G.A, Akwa Ibom State, Nigeria. *A publication of Department of Geography and Regional Planning,* University of Uyo, Uyo. Pp 666-675

Sparre, P. , and S.C. Venema. 1979. Introduction to tropical fish stock assessment. Part 1*: Nabyak-FAO Fish. Tech. Pap*. 306. 1-376

Teugels, G.G., Reid G.M. and Conservation Musee Royal del'Afrique Centrale, Tervuren, Belyique. *Annales Sciences Zoologiques*, Vol. 266, 132p

Udolisa, R.E.K., Solarin, B.B., Lebo, P.E. and Ambrose, E.E. 1994. A Catalogue of small scale fishing year in Nigeria. *RAFR Publication*, RAFR/014/FL/94/02. 142P.