

**WATER QUALITY ASSESSMENT AND DIETARY HABITS OF *ALESTES NURSE* IN GUBI DAM
BAUCHI STATE**

Abdulkarim, M.

mashemau@yahoo.com

**Animal Production Programme,
Abubakar Tafawa Balewa University,
Bauchi – Nigeria.**

and

Lamai, S. L.

**Department Fisheries and Aquaculture and Water Resources
Federal University of Technology,
Minna – Niger State.**

Abstract

*The study was conducted to determine water quality, stomach content and the dietary requirements of *Alestes nurse* caught in Gubi Dam, Bauchi. pH obtained in the dam was slightly acidic (6.8) in August, 2007 to moderately alkaline (9.0) in September, 2007 and January, 2008. The dam water had Ammonia (NH_3) that range from 0.0 – 12.50, Nitrite (NO_2) range from 0.0 – 0.1 and Nitrate (NO_3) range from 0.0 – 12.50. Majority (61%) of *A. nurse* obtained in dry season had empty stomach while few (7%) in wet season. Relative Importance Index was adapted for stomach content analysis of the fish in both dry and wet seasons. Stomach repletion was indicated as 0 for empty, 1, 2 and 3 for 25%, 50 – 75% and 75 – 100% of the volume respectively. Point method was used to ascribe points to stomach content based on stomach weight (SW) of specimens caught in a previous collection. Majority (61%) of *A. nurse* obtained in dry season had empty stomach while few (7%) in wet season. Relative importance index (AI) and frequency of food item obtained in wet and dry seasons showed that in wet season *A. nurse* preferred insect parts (AI=600 and F= 51), leaf parts (AI=484 and F= 44) and fish parts (AI=336 and F= 34) respectively, while in dry season both insect parts and detritus had the same value of food items encountered (AI = 80 and F = 16), suggesting that the fish fed on broad spectrum of food items. Commercial feed manufacturer should be encouraged to formulate a diet for *A. nurse* based on dietary habit of the fish in order to promote its aquaculture production.*

Introduction

Micro nutrient deficiencies or hidden hunger in one form or the other are affecting more than 2 million people worldwide. Each year, 5.5 million children die of causes related to hunger and malnutrition (Gubta, 2006). Fish and fish by - products can play an important role in addressing hunger in Nigeria. According to Gubta (2006) fish is a rich source of protein, vitamins and minerals. Fish is an important commodity providing first class protein and, from some species, high content of lipid.

Fish is the most abundant source of animal foods with wide range of species and yet the least known class of vertebrates. Each year about 100 new species are described. At present, about 31,000 species are recognized, which means that 3 out of every 5 vertebrates is a fish (Bone and marshall, 1982). The rapid increase in the world population has resulted in a huge increase in the demand for food especially animal protein and other nutritional requirements. According to Obam (1992) inland fisheries are fundamental to the livelihood of many African peoples. Freshwater fish contributes a considerable proportion of animal protein in diet, especially in areas close to streams and rivers. For example average fish consumption in Cameroon rain forest is

around 47kg/person/year, compared to 10kg/person/year of the general population.

Abdel – Tawwab (2000) reported that one of the key factors to successful fish culture is the understanding of some biological fundamentals of fish especially food and feeding behavior.

To advance the knowledge of feeding preferences of any one particular fish species, an understanding of the broader aquatic community is requisite. According to Weatherly (1963) if any two species are found to share the same niche, or even have an overlap, the weaker one will certainly languish. Fish scientist commonly analyse stomach content of fish in order to determine the diet of fish. Lima Junior and Goltein (2001) reported that a very common practice in the studies of fish feeding habits is to determine the diet of the species by an analysis of the stomach content. The closer different species rely upon the same food source the more the increased competition. Study on water quality assessment and dietary habits of fish are mainly carried out to determine the suitability of water in Gubi dam for fish growth and survival and also to evaluate the food and feeding habits of *Alestes nurse*. At present in Nigeria there is paucity of information on the food and feeding habits of *Alestes* species caught in dams apart from the early work of Reed *et al.* (1967). According to Lopez-

Peralta and Arcila (2002) information about the food and feeding habits of fishes is useful in defining predator prey relationship and of great value to fishery biologists and managers of fisheries.

Materials and Methods

Study Area

Bauchi State is located on latitude 10°17' and longitude 9°49' with a mean annual rainfall of 1099 millimeters (mm) and mean temperature of 25.4°C (FAO, 1988). The state is characterized mainly by shrubs inter spread with trees. Bauchi state has a projected total surface area of reservoirs and lakes of 5259.0 ha (Ita and Sado, 1985).

The construction of Gubi dam at Piro village, Ganjuwa Local Government, Bauchi State began on 1st November, 1976 and was completed 12th December, 1987. According to Ezra and Nayaya (1999) Gubi dam is a product of damming of four major rivers (Gubi, Makaranta, Ran and Tagwaye), and it is the largest fresh water body in Bauchi state. The dam is an earth fill dam with clay core. It has a total storage capacity of $3.84 \times 10^6 \text{ m}^3$. The maximum height of the dam is 27 km², length of the embankment is 3.8 km, freeboard is 3m and spill way is 70m. The dam has a catchment reservoir area of 590 ha and an expected yield from the reservoir of approximately 90,000 m³/day.

Water Quality Analysis

In order to determine the water quality of Gubi Dam the amount of Nitrite, Nitrate, Ammonia and pH in Gubi dam were determined twice weekly with calorimeted water checker (Koi Pond Master Kit) with product code 2750, England (August, 2007 – July, 2008). Temperature of the surface water in the dam was taken twice in the week with ordinary mercury thermometer throughout the period of the study. Dissolved oxygen (D.O) of the water was determined by using Winkler titration method (APHA, 1985).

The following procedure was followed for the collection of water samples from the dam water surface, water was collected carefully with 100ml field stoppered bottles filled until the water overflow. The bottle was stoppered to ensure that no air bubbles were trapped. Within a few minutes of filling, the stopper was removed and 0.5ml of Manganous sulphate was introduced below the surface and 0.5 ml of Winkler reagent (Lithium hydroxide and potassium iodine). The reaction creates pale precipitate, Tetra-oxo-sulphate VI acid was added to the solution to reduced the pH and to dissolve the precipate. 20 ml out of the 100ml of the prepared solution was transferred to a titration flask, it was titrated with Sodium Thiosulphate (Na₂S₂O₃) until the

sample changed from yellow to colourless (end - point), (Grasshoff, 1983).

Conductivity of the water from the dam was measured for a year with Marton microsiemens, model 4075214.

Stomach Content Analysis

Cast net was used in both the wet and dry seasons of the year to catch two hundred *Alestes* species; their length and weight were taken (2007 - 2008). Stomach repletion was indicated as 0 for empty, 1, 2, 3 for less than 25%, 50 – 75% and 75 – 100% of the volume respectively (Koubi *et al.*, 1990). Standard Weight (SW) was determined according to the method described by (Lima and Goltein 2001). SW is the arithmetic mean of weights of stomach contents of specimens caught in a previous collection. The SW in this first sample was used as a constant value for the analysis of the subsequent samples. In order to analyze seasonal variations of stomach content of the fish diet, points was ascribed in a separate way to stomach content for analysis, according to its proportional weight in relation to the SW. Four points was ascribed to SW. An empty stomach with its total contents representing a weight of approximately 25% of the SW was ascribed only 1 point. On the other hand, stomach whose total contents double the SW receive 8 points. The points obtained were distributed to stomach content, among the items in the stomach (Lima and Goltein, 2001).

The fish was dissected and the gut removed and its total length was measured. The stomach was removed and dissected and its content mixed with 1ml of distilled water per gram in a Petri dish.

Microscope and hand magnifying lens were used to identify the food materials consumed by *Alestes nurse*. Phytoplanktons in the stomach were identified using the key provided by (Needham and Needham, 1962 and Mellanby, 1975).

Relative Importance Index was followed as described by Hyslop (1980) for the analysis of stomach content of the fish.

$$AI_i = F_i V_i$$

where: AI_i: Importance Index of the identified food item in the sample, F_i is the Occurrence Frequency of the item and V_i is the Volumetric Analysis Index of the item.

$$F_i = 100ni / n$$

where:

F_i: frequency of occurrence of the *i* food item in the sample

ni: number of stomachs in which the *i* item is found;

n: total number

$V_i = 25 M_i$

Where:

V_i : Volumetric Analysis Index of the i food item in the sample;

25: multiplication constant to obtain a percentage;
 M_i : mean of ascribed points for the i food item.
 Lima and Goltein (2001).



Plate1. *Alestes nurse*

Results and Discussion
Water Quality Analysis

Table 1 shows the Physiochemical analysis of surface water taken within one year. pH obtained was slightly acidic (6.8) in August, 2007 to moderately alkaline (9.0) in September, 2007 and January, 2008. The dam water had Ammonia (NH_3) that ranged from 0.0 – 12.50, Nitrite (NO_2) ranged from 0.0 – 0.1, and Nitrate (NO_3) range from 0.0 – 12.50.

Mean dissolved oxygen (DO) recorded was highest (17.34mg/l) in August, 2007 and lowest (7.53mg/l) in December, 2007. The values obtained for dissolved oxygen in the dam were glorious to the fish survival

and growth. Water conductivity obtained was highest (245 μS) in December, 2007 and lowest (100 μS) in March, 2008. Temperature recorded ranged from 19°C to 31°C, this temperature has no effect on warm water fish species. In January the Ammonia value in the dam was 12.5mg/l. This means that the physiochemical values of the water in the dam was suitable for growth and survival of the fish species. The values obtained for Ammonia, Nitrate and Nitrate are within the safety ranged recommended for fresh water aquatic life (Ammonia: 1.99 – 15.7 mg/l, Nitrate: 25- 40mg/l and Nitrite: 0.02 – 0.06 mg/l), (Nordin and Pommen, 1986).

Table 1: Physicochemical Parameters of Gubi dam Water from August, 2007 to July, 2008

Months	Physicochemical Parameter						
	pH	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Mean Temperature (°c)	Mean Dissolve Oxygen (mg/l)	Conductivity (Micro/Siemens)
August, 07	6.8	0.0	0.0	0.0	28	17.34	230
September	9.0	0.1	0.0	0.1	31	16.32	230
October	8.5	0.0	0.0	0.0	31	8.28	240
November	8.4	0.0	0.0	0.0	31	8.00	240
December	8.0	0.1	0.0	0.1	28	7.53	245
January,08	9.0	12.5	0.1	12.5	21	16.90	120
February	8.5	0.1	0.0	12.5	19	16.20	120
March	8.5	0.1	0.1	12.5	26	16.00	100
April	8.5	0.1	0.0	12.5	27	15.80	130
May	7.0	8.0	0.0	0.0	31	15.84	130
June	7.1	0.0	0.0	0.0	30	15.82	110
July	6.9	0.0	0.0	0.0	30	16.53	246

Percentage Stomach Repletion of *A. nurse* in Wet and Dry season

Majority of the *A. nurse* obtained in dry season had empty stomach (61%) while few (7%) in wet season. Similarly, Shinkafi and Ipinjolu (2001) reported that 50.6% of *Synodontis clarias* had food in their

stomach while 49.4% were with empty stomach. According to the authors the percentage of stomach with food was highest in July and August and lowest in May and June, the periods fall within the rainy and dry seasons in Nigeria respectively. Ikomi and Siskoki (2001) observed that in River Jamieson

Brycinus nurse there were no significant difference ($\chi^2 = 0.55$; $P > 0.05$; $n = 188$) between the stomach fullness of *B. nurse* caught in the day time and those caught in the night time. The availability of food in wet season may be due to influx of food materials into the dam that is responsible for present of food in most of the stomach of the fish specie. Oloja *et al.* (2003) found out that monthly / seasonal variations in feeding habits of *Synodontis nigrita* showed an increase in the stomach fullness during the rainy season and decreases in the dry season. The proportion of empty stomach was highest in the dry season.

Food and Feeding Habit of *Aletes nurse* in Gubi dam

Table 2 reveals that all the food items consumed by the fish species were found in both wet and dry seasons this may not be unconnected with the lentic

condition of the dam. The most preferred food items found in the stomach of *A. nurse* were insect parts in wet season (AI = 600 and F = 51), leaf part (AI = 484 and F = 44) and Fish parts (AI = 336 and F = 34) while in dry season both insect parts and detritus and maize bran were the most common food items encountered (AI = 80 and F = 16). This agreed with the findings of Reed *et al.* (1967) that young *Alestes* species feed on insects and water beetles, while the adults prey upon other fish. According to Shinkafi and Ipinjolu (2001) juveniles (<10cm TL) *Synodontus clarias* an omnivorous fish fed mainly on phytoplankton (16.7%) and the adults (>-10cm TL) (11%). Contrary to the findings of this research Ikomi and Sikoki (2001) reported that Index of food preponderance shows that *Brycinus nurse* which is also a Characid fed on macrophytes (plant fragments and seeds), hymenoptera and detritus, faeces, fish and earthworm.

Table 2: Frequency of Occurrence and Relative Importance Index of Stomach Content in *A. nurse* Wet and Dry Seasons

Food Items	Wet Season		Dry Season	
	Frequency of Occurrence (F)	Relative Importance Index (AI)	Frequency of Occurrence	Relative Importance Index
Zooplankton				
Daphnia	10	25	4	3
Rotifer	5	3	2	1
Algae				
Bacillariophyceae	24	21	3	2
Chlorophyceae	13	46	2	7
Animal Materials				
Fish parts	34	336	12	36
Insets parts	51	600	16	80
Worms	13	143	2	1
Plant Materials				
Leaf part	44	484	7	13
Maize bran	30	165	16	41
Plant seed	34	268	3	2
Others				
Detritus	22	119	16	80
Stone particles	24	132	10	26

Conclusion

The water quality measured especially pH, Dissolved oxygen; Temperature and Nitrogen were within the ranged of safety for fresh water aquatic life. This means that the water in the dam was suitable for growth and survival of the fish species. There was more *A. nurse* with emptied stomach in the dry than wet season. *A. nurse* fed on a broad spectrum of diets: insect parts, fish parts, leaf parts and maize bran. Commercial feed manufacturer should be encouraged to formulate a diet for *A. nurse* based on the dietary habit of the fish in order to promote its aquaculture production.

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