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**Fish physiology**

# STUDIES ON THE DISTRIBUTION, ABUNDANCE, GROWTH PATTERN AND DIETARY HABITS OF *BRYCINUS NURSE* RUPPEL, 1832 (OSTEICHTHYES: CHARACIDAE) IN THE RIVER JAMIESON, NIGERIA

# BADANIA NAD ZASIĘGIEM, ILOŚCIOWYMI PARAMETRAMI WYSTĘPOWANIA, CHARAKTERYSTYKĄ WZROSTU I ODŻYWIANIEM *BRYCINUS NURSE* RUPPEL, 1832 (OSTEICHTHYES: CHARACIDAE) W RZECE JAMIESON, NIGERIA

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Aspects of the ecology of *Brycinus nurse* Ruppel, 1832 in the River Jamieson, Nigeria were studied. *B. nurse* constituted 19.8% of the characid catch and was unevenly distributed in the river with perennial occurrence in the downstream station. Peak abundance was at the beginning of the dry season. Fish size ranged from 7.0 to 19.0 cm standard length and weighed 40.5–171.0 g. The growth pattern was allometric. Condition factor ranged from 1.99 to 2.65 and varied with individual length of fish. Condition factor was slightly higher during the wet season. *B. nurse* fed primarily on plant fragments and seeds and Hymenoptera while algae and various alate insets were of secondary importance. Immature aquatic insects were incidental food items. *B. nurse* was essentially both day and night time feeder with only quantitative variations in dietary habits in relationship to size and season

## INTRODUCTION

*Brycinus nurse* Ruppel, 1832 is a common freshwater characid species with wide distribution in the Guinean and Sudan-Sahelian basins of Africa excluding the Upper Guinea and Nile (Daget 1962; Daget and Iltis 1965; Paugy 1986; Teugels et al. 1992). This species which flourish in the River Jamieson, Nigeria is of commercial value and accordingly have received considerable scientific attention. Available published work on it includes: its taxonomy (Daget and Iltis 1965; Reed et al. 1967; Paugy 1980), distribution (Daget 1962; Sydenham 1977; Alberet and Merona 1978; Merona 1981; Tetsola 1988; Victor and Tetteh 1988), growth pattern and feeding habits (Blanche et al. 1964; Paugy 1980; Victor and Brown 1990). Despite the apparent abundant data on this species, information concerning the populations in the Niger Delta, Nigeria is scarce. Accordingly, this paper provides comparative data on *B. nurse* from the River Jamieson with a view to filling gaps in current knowledge on the species.

## STUDY AREA

The River Jamieson (Fig. 1) is a perennial river East of the upper reaches of the Benin River. It is a clear oligoinic freshwater river with its source in a watershed at Ugboko-Niro. It flows Westward for about 30 km through the rainforest and empties into the River Benin at Sapele. The River at the Sapele to Sakpoba stretch is constantly inundated by the tide from River Benin while its upper reaches are non-tidal.

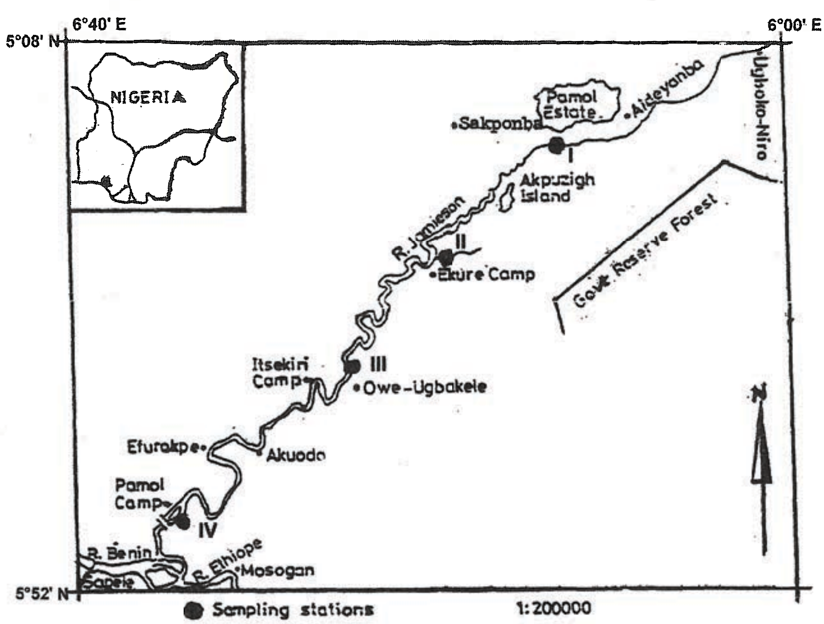


Fig. 1. Map showing the location of the River Jamieson in Nigeria (Inset) and Map of the River Benin showing sampling sites

The study area lies within the tropical rainforest climatic zone with two main seasons: Wet and Dry. The wet season (May–October) is marked by high precipitation (26.0–55.7 cm) while the dry season (November–April) is characterised by low precipitation (0.0–17.1 cm).

For the purpose of this study, four sampling stations were demarcated in the river: upstream (I), channel (II), midstream (III), and downstream (IV) (Fig. 1). The upstream station (I) was located 5 km from the river source. It was in the non-tidal zone of the river with average depth and width of 12 m and 7.5 m respectively. It was swift flowing (average 98.0 cm/sec.) and the substratum consisted of fine sand mixed with pebbles. The channel station (II) was located in the tidal zone about 5 km downstream station I. It was about 5 m wide and 4 m deep and fairly exposed during the ebb tide. It was heavily shaded with mean flow velocity of 6.72 cm/sec. The substratum was muddy and consisted of large quantities of allochthonous matters derived principally from fallen leaves. The midstream station (III) was located 10 km down stream the station II. Average width and depth measured 35 m and 14 m respectively. Mean flow velocity ate was 22.5 cm/sec. The substratum was mainly fine sand mixed with clay. The down stream station (IV) was situated about 10 km downstream the midstream station. The river was widest here with average width and depth of 60 m and 16 m respectively. Average flow velocity rate was 13.2 cm/sec. The substratum was silty sand.

The marginal vegetations in all stretches consisted of shrubs dominated by *Cyperus* and *Diplaxium* spp. and trees such as *Pandamus*, *Symphonia*, *Elaeis*, *Bambusia*, *Grewia*, and *Oxystigma* spp. The dominant aquatic macrophytes are *Pycreus lanceolatus, Ceratophyllum submersum*, and *Uticularia* spp. Human activities in the river include subsistence fishing, sand dredging, lumbering and disposal of waste.

## MATERIAL AND METHODS

Monthly fish sampling was conducted at each station during day and night from January 1994 to December 1995 using set gill nets and drag net of 22–70 mm and 10 mm mesh size respectively. Daily sampling was conducted between 7.30 and 12.00 h while night sampling was between 23.00 and 5.00 h. Fish on capture were preserved in 10% formalin solution pending laboratory examination. Field observation and gears used provide information on spatial distribution and habitat preference. In addition the spatial distribution was assessed by the Kolmogorov-Smirnov goodness of fit statistics ($D$) (Massey 1954). Biometric data taken for each fish were: standard length ($SL$) and total length ($TL$) measured to the nearest 0.1 cm and weight determined to the nearest 0.1 g.

The length-weight relationship of the fish was calculated using the method of LeCren (1951) while the Fulton condition factor of each specimen was determined according to Bagenal and Tesch (1978). For the purpose of analysis, the fish was categorised into size groups namely: small size group (*SSG*) or juvenile (1.0–6.9 cm), medium size group (*MSG*) or young adult (7.0–14.0 cm) and large size group (*LSG*) or old adults (> 14.0 cm) according to Paugy (1980).

Fish stomachs were removed and contents identified under the dissecting microscope (10–100 ×) to the lowest convenient taxonomic level. Food item occupying the greatest stomach volume was recorded as dominant content and then all other items were listed. The number of food categories in the fish diet was regarded as food-richness ($N_f$). The stomach content contents were analysed using the relative frequency (*RF*), relative dominance (*RD*), and index of food preponderance (*IFP*) methods (King 1989). The relative frequency and relative dominance of each item were computed according to the formulae:

$$RF = \frac{f_i}{\sum_{i=1}^{n} F_i} \cdot 100$$

$$RD = \frac{d_i}{\sum_{i=1}^{n} D_i} \cdot 100$$

where $f_i$ = frequency of item $i$; $F_i$ = frequency of the $n^{\text{th}}$ item (sum of all $f_i$); $d_i$ = frequency of item $i$ as dominant dietary; $D_i$ = frequency of the $n^{\text{th}}$ dominant item (sum of all $d_i$). Index of food preponderance (*IFP*) provides information on the integrated importance of each food item and it is calculated as the mean of %*RF* and %*RD*. Primary food items were considered as those with $IFP \geq 10\%$ while diets with values 1 to < 10% were regarded as secondary. Items with *IFP* values < 1% were classified as incidentals. Diel dietary variation was calculated on percent *RF* and *IFP* data.

## RESULTS

### Distribution and habitat

*B. nurse* was captured in all the sampling stations except the upstream station I. *B. nurse* moved in schools made up of homogenous sizes of both male and female. Fishes of SSG were not captured in the river. Fish of MSG and LSG occurred mainly in the main channel of the river. But make lateral movements in their separate schools to the bank to feed. Fish of MSG and LSG were sometimes captured along with juveniles of *Brycinus macrolepidotus*.

*B. nurse* in the river was a pelagic fish with preference for relatively gentle flowing stretches with fine sand substratum overlain with thin layer of organic debris.

### Relative abundance

Characids captured in the river numbered 5 787 and their composition is as follows: *Brycinus nurse* (19.8%), *Brycinus longispinnis* Günther (49.0%), *Brycinus macrolepidotus* Valenciennes (0.2%), *Rhabdalestes smykalai* Poll (17.2%), and *Anoldichthys spilopterus* Boulenger (13.8%).

Data on monthly abundance and spatial distribution (Fig. 2) indicate fluctuations in these parameters. In station II sample size of *B. nurse* was too small for meaningful analyses. In station III *B. nurse* was captured in all the months except in between July and October in 1994 and July and September in 1995. In station IV it was captured in all the months and the distribution in abundance showed of bimodal peaks, occurring at the beginning of dry season months of January/February and November. During this period the expanded habitat provided by the floods of the wet season still prevails. This interstational distribution was confirmed by the *D*-test (Table 1). Generally, higher numbers were captured in the early dry season months than in the rainy season months thus showing significant seasonality ($P < 0.001$). However during this period the expanded habitat provided by the floods of the wet season was at its peak. The monthly fluctuations in biomass followed the same pattern as in number. It was a reflection of variations in number of specimens (Fig. 2).

**Table 1**

Distribution and relative abundance of *B. nurse* in the four sampling station

| | Upstream (I) | Channel (II) | Midstream (III) | Downstream (IV) | *D* | Significance |
|---|---|---|---|---|---|---|
| Abundance $n = 1\ 146$ | 0 | 39 | 199 | 908 | 0.0219 | $P < 0.001$ |
| Biomass (g) 38 322 | 0 | 572 | 4 750 | 33 000 | 0.0171 | $P < 0.001$ |

### Length frequency distribution

The smallest male and female individuals of *B. nurse* recorded measured 7.0 cm, *SL* (9.6 cm, *TL*) while the largest female and male individual measured 18.0 cm, *SL* (20.6 cm, *TL*) and 19.0 cm, *SL* (21.6 cm, *TL*) respectively. The combined length frequency distribution (Fig. 3) shows that the population structure consist of two distinct length classes of 7.0–13.9 cm and 14.0 cm and above. The modal lengths were between 10.0 and 11.0 cm for the males and 11.0 and 13.0 for the females in the *MSG* and between 15.0 and 16.0 cm for the males and females respectively of fish in the *LSG*. Fig. 3 also shows that the distribution pattern of the length groups was leptokurtotic for both sexes. The monthly variation in the length frequency distribution (Fig. 4) shows that fish of both *MSG* and *LSG* were encountered throughout the study years. Recruitment of the *MSG* into the river occurred mainly in the dry season (November and December) and this group dominated the population during the period. Fish of *MSG* grew progressively with a modal shift into the *LSG* (≥ 14.0 cm) in May/June of the following year.

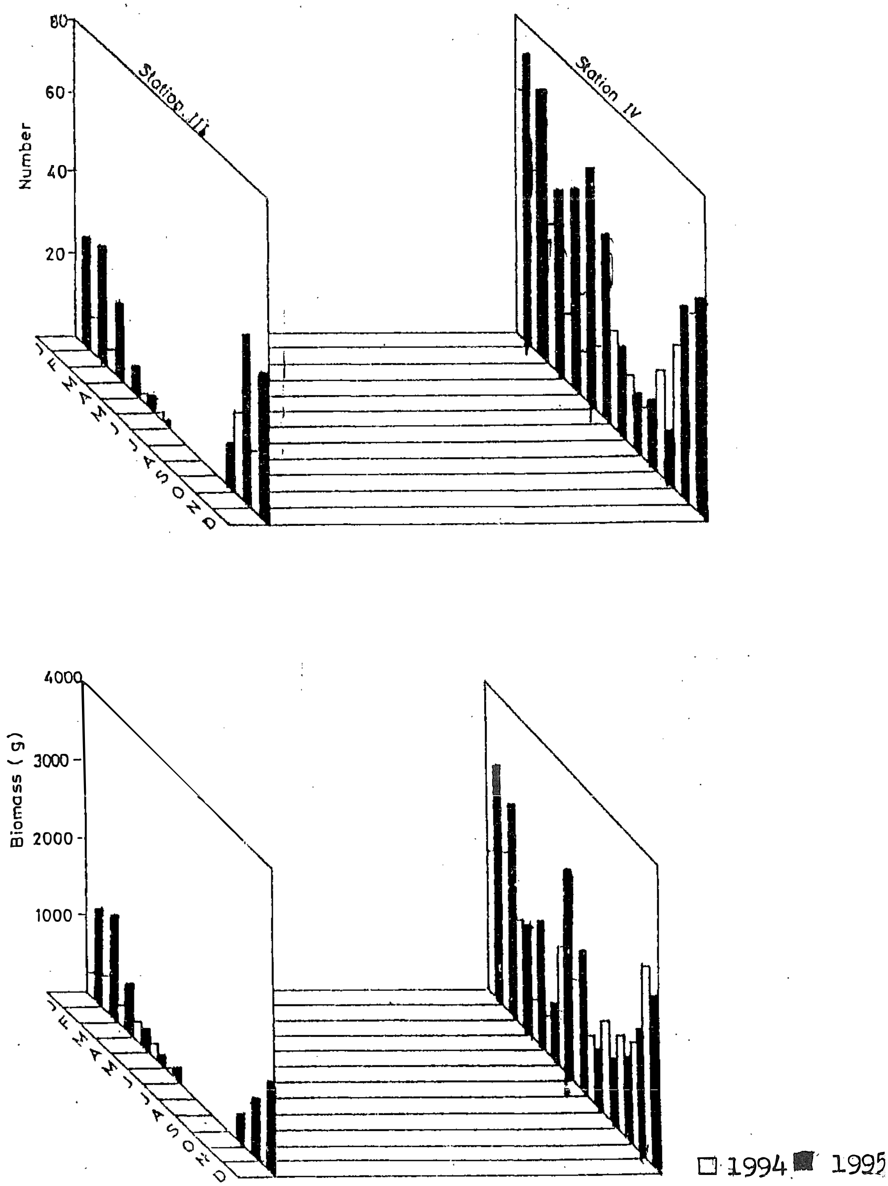


Fig. 2. Monthly variations in (A) abundance and (B) biomass of *B. nurse* from the River Jamieson

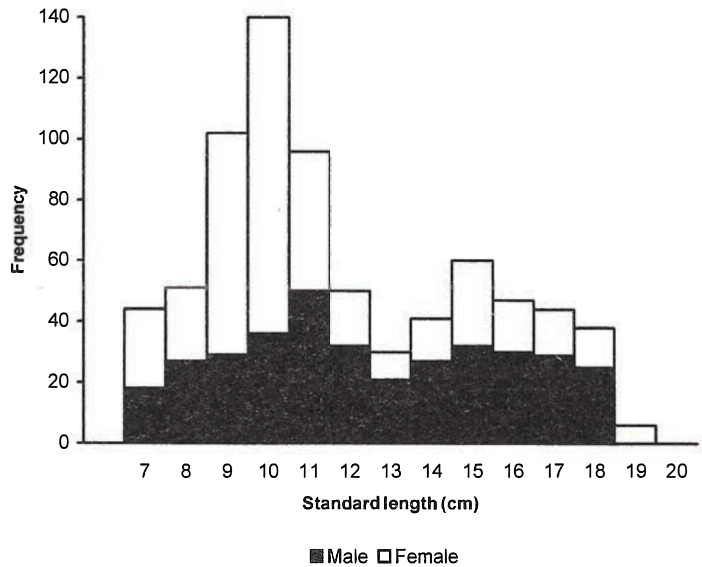


Fig. 3. Combined length frequency distribution of *B. nurse* from the River Jamieson

## Length-weight relationship

The weight of sampled *B. nurse* ranged from 40.5–170 g. The exponential relationship of the log length and log weight of both sexes provides the linear regression equation of the forms:

Male $WT = -2.109 \cdot SL^{3.414}$

$r = 0.998$; $n = 394$

Female $WT = -2.127 \cdot SL^{3.429}$

$r = 0.973$; $n = 752$

The values of the length exponent for both sexes (male: $b = 3.414$; female: $b = 3.429$) in the length-weight regression analysis in both sexes was greater then the cubic value (3). This indicates that increase in size was allometric. The *b*-values tested using ANOVA indicated no significance ($P > 0.05$). The correlation ($r$) between increase in length and gain in weight was significant. The log plot of the relationship between the length and weight is shown in Fig. 5.

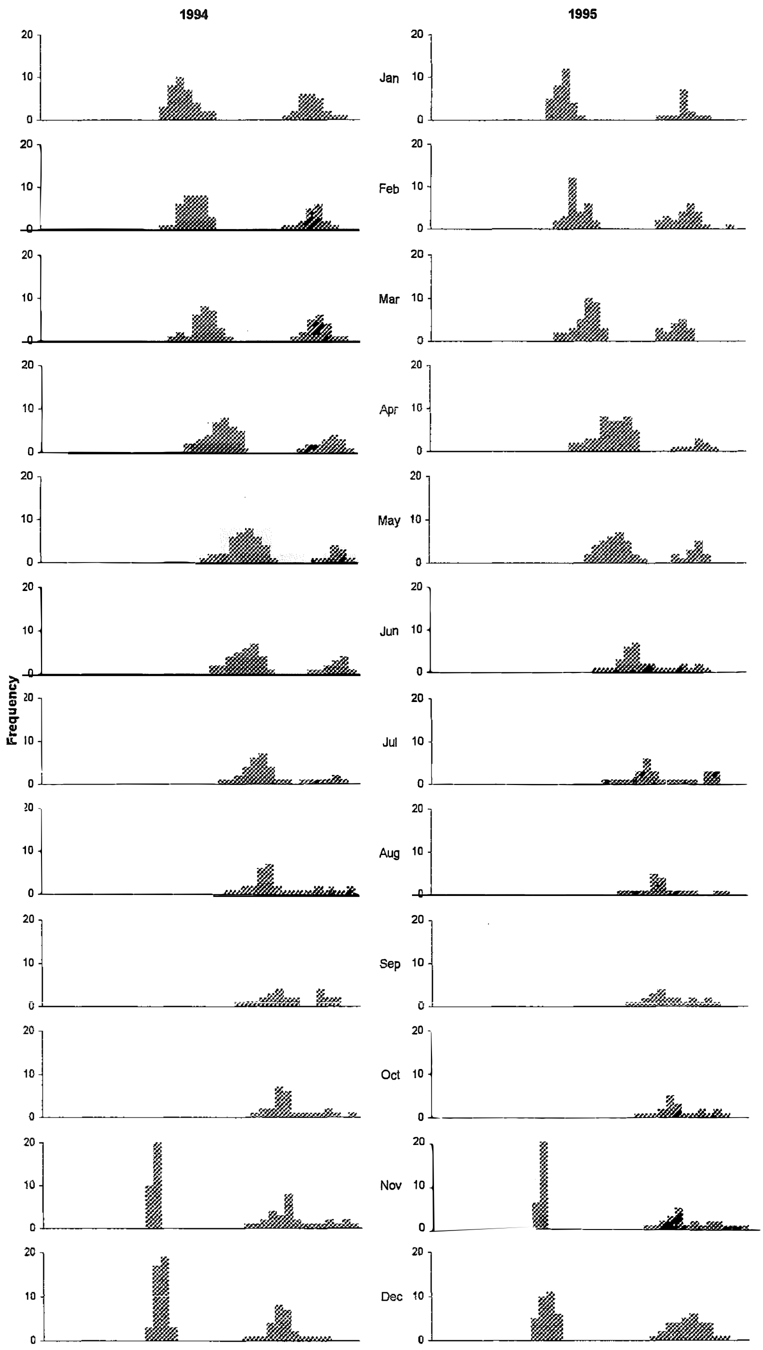


Fig. 4. Month variation in length frequency distribution of *B. nurse* from the River Jamieson

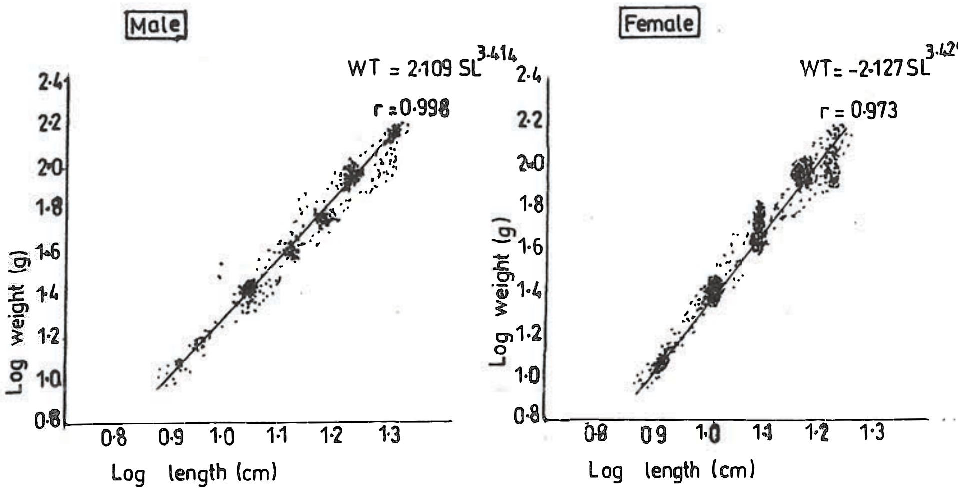


Fig. 5. Log length–log weight relationship of *B. nurse* from the River Jamieson

## Condition factor

Data of the mean monthly variation of condition factor in the fish is presented in Fig. 6. The value ranged from 2.33 to 2.65 in the wet season and 1.99–2.21 in the dry season. The peak value was obtained in July and the least value was in September where the value dropped dramatically. Generally *K*-values of the wet season were slightly higher. With respect to size and sex variations, mean *K*-values decreased with an increase size for fish of the 7–11 cm size range. But thereafter the *K*-values increased with additional size.

## Diel feeding pattern

Ninety four specimens each from the day-time and night-time samples were examined for stomach fullness. Of these 67 stomachs of the day-time samples scored 5 points an above on a scale 0–10. While among the night-time ones, the stomach of 59 specimens scored equivalent points. These values when tested statistically, these number of day and night feeding *B. nurse* were not significantly different ($\chi^2 = 0.51$; $P > 0.05$; $n = 188$).

## Diet composition

The trophic spectrum of *B. nurse* (7–20 cm SL; n = 568) (Table 2) indicates good food richness ($N_f = 16$). The *IFP* shows that *B. nurse* fed primarily on Macrophyta (plant fragments and seeds), Hymenoptera and detritus. Algae, insect remains, Coleoptera, Diptera, Orthoptera, feaces, fish, other alate insects, and earthworms were secondary food items. Immature aquatic insects (dipteran larvae, Odonata nymph) were of incidental importance. Of the primary food items, Macrophyta contributed significantly (> 19%) to the species diet. Hymenoptera, another primary dietary item was dominated by the driver ant *Dorylus* sp.

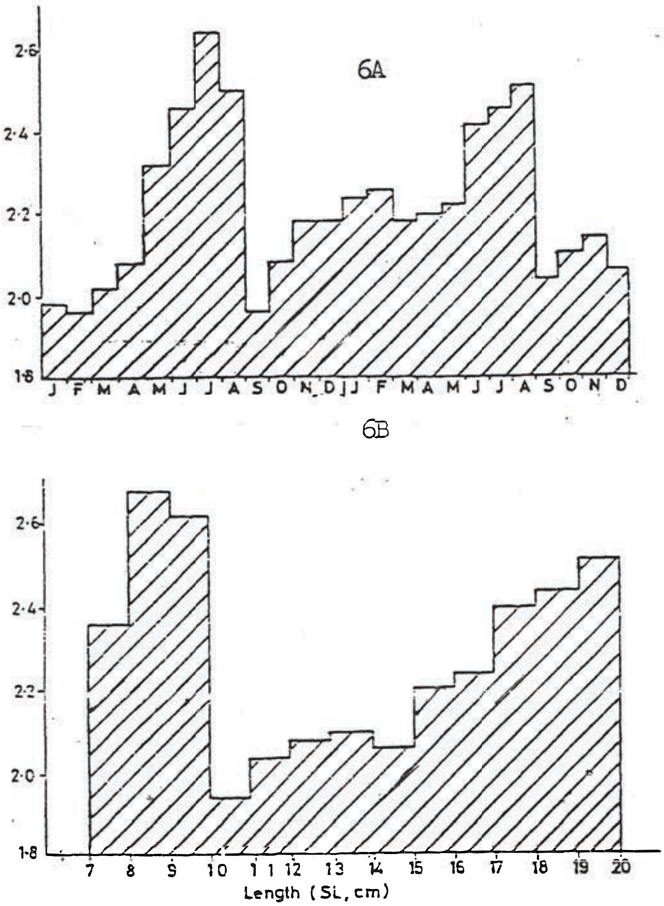


Fig. 6. Variations in the condition factor of *B. nurse*; (A) monthly variation and (B) variation according to size

Diets of different length groups are presented in Fig. 7. Mean food richness for fish of *MSG* ($N_f$ = 56) was marginally higher than food richness of the *LSG* ($N_f$ = 4.8). Macrophyta and Hymenoptera served as major dietary items for both the *MSG* and *LSG* fish. The 7–8 cm size fish did not feed on insects but rather fed mainly on algae and Mactrophyta. The fish appears to prefer macrophyte over insect as dietary items with increasing fish size. Fish and feaces were consumed mostly by fish of *LSG* while algae and immature insects were largely consumed by fish of *MSG*.

The temporal distribution pattern on the dietaries (Fig. 8) shows that the mean dry season food richness ($N_f$ = 6.8) was slightly higher than the wet season value ($N_f$ = 4.5). The figure also demonstrates that Hymenoptera and aquatic macrophytes were important food items throughout the study period. Peak consumption of Hymenoptera was in the wet season months while Macrophyta was in the dry season months. Other alate insects mainly Coleoptera (small beetles) and macrotermes, algae and immature aquatic insects were variably consumed in both season.

**Table 2**

The dietary composition of *B. nurse*

| Food items | Methods | | |
|---|---|---|---|
| | % *RF* | % *RD* | % *IFP* |
| Macrophyta | | | |
| Plants remains | 17.0 | 21.9 | 19.5 |
| Plants seeds | 20.7 | 32.2 | 26.5 |
| Algae | 2.8 | 2.3 | 2.6 |
| Insecta | | | |
| Insect remains | 5.1 | — | 2.6 |
| Alate insects | | | |
| Hymenoptera | 10.5 | 12.5 | 11.5 |
| Coleoptera | 4.3 | 6.2 | 5.3 |
| Diptera | 3.3 | 2.7 | 3.0 |
| Orthoptera | 2.9 | 1.4 | 2.3 |
| Other alate insects | 4.0 | 2.5 | 5.4 |
| Aquatic immature insects | | | |
| Dipteran larvae | 1.1 | — | 0.6 |
| Odonata nymph | 1.1 | — | 0.6 |
| Detritus | 13.0 | 12.7 | 12.7 |
| Sand | 3.3 | — | 1.7 |
| Feaces | 5.1 | — | 2.6 |
| Pisces | | | |
| Fish | 2.2 | 2.9 | 2.6 |
| Fish scale | 1.8 | — | 0.9 |
| Oligocheata | | | |
| Earth worms | 1.8 | 2.7 | 2.3 |

*RF*, relative frequency; *RD*, relative dominance; *IFP*, index of food preponderance

Data on the diel variations in the consumption of the different food items indicates slightly higher food richness for the day-time diet ($N_f = 15$) in comparison with the night-time one ($N_f = 13$) (Table 3).All the food items were consumed during both day and night except algae and Coleoptera which was not in the day-time diet and Diptera, Ortoptera, fish, and worms which were absent in the night-time diet. Of all the dietary items, only Hymenoptera was significantly consumed during the day than the night ($P < 0.001$). Other food items showed no significant diel variations in their contribution to the diet of the species ($P > 0.05$).

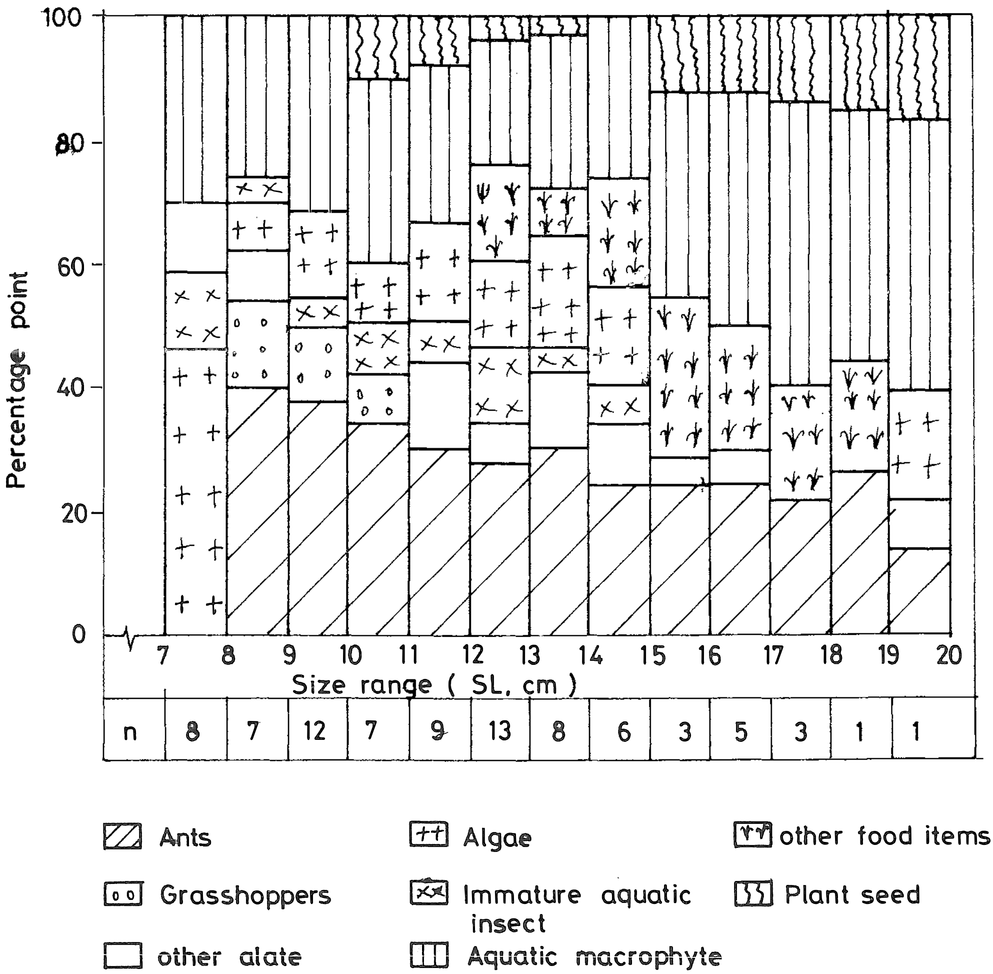


Fig. 7. Variations in the feeding habits of different length classes of *B. nurse* from the River Jamieson

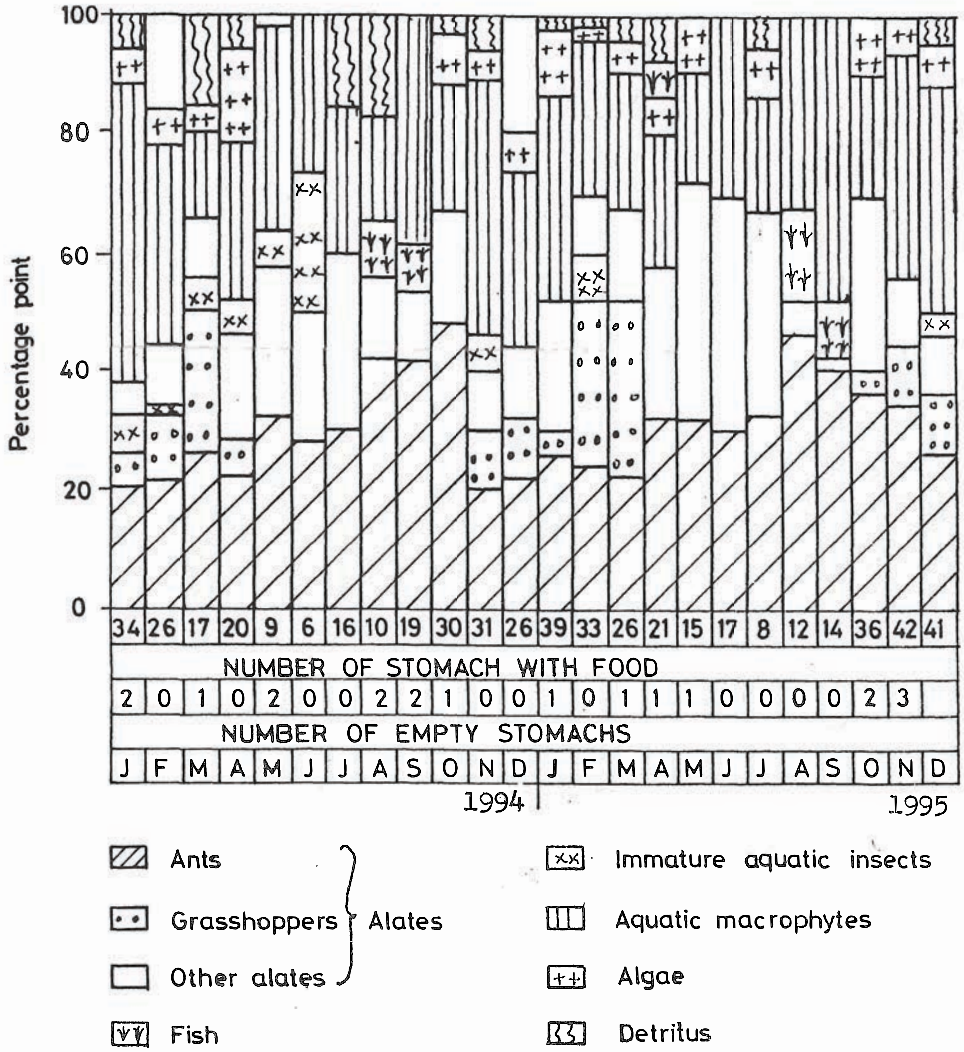


Fig. 8. Monthly variations in food habits of *B. nurse* from the River Jamieson

**Table 3**

Diel variations in the food habits of *B. nurse* in the River Jamieson

| Mathods | % *RF* | | | | % *IFP* | | | |
|---|---|---|---|---|---|---|---|---|
| Food items | Day | Night | $\chi^2$ | *P* | Day | Night | $\chi^2$ | *P* |
| Macrophyta | | | | | | | | |
| Plants remains | 34,2 | 30,6 | 0,20 | >0,05 | 50,5 | 45,3 | 0,23 | >0,05 |
| Plants seeds | 14,5 | 13,7 | 0,02 | >0,05 | 7,2 | 6,8 | 0,01 | >0,05 |
| Algae | — | 11,0 | — | — | — | 19,1 | — | — |
| Insecta | | | | | | | | |
| Insect remains | 4,8 | 3,8 | 0,85 | >0,05 | 3,4 | 2,1 | 0,31 | >0,05 |
| Alate insects | | | | | | | | |
| Hymenoptera | 13,5 | 4,5 | 5,88 | <0,001 | 17,7 | 6,5 | 5,18 | <0,001 |
| Coleoptera | — | 17,2 | — | — | — | 7,5 | — | — |
| Diptera | 0,9 | — | — | — | 0,4 | — | — | — |
| Orthoptera | 2,9 | — | — | — | 1,4 | — | — | — |
| Other alate insects | 3,4 | 3,0 | 0,03 | >0,05 | 2,1 | 1,5 | 0,59 | >0,05 |
| Aquatic immature insects | | | | | | | | |
| Dipteran larvae | 2,6 | 1,2 | 0,52 | >0,05 | 2,1 | 1,7 | 0,04 | >0,05 |
| Odonata nymph | 0,9 | 0,9 | — | — | 0,8 | 0,4 | 0,13 | >0,05 |
| Detritus | 7,7 | 5,2 | 0,84 | >0,05 | 5,3 | 4,6 | 0,05 | >0,05 |
| Sand | 3,4 | 3,7 | 0,13 | >0,05 | 1,6 | 1,3 | 0,03 | >0,05 |
| Feaces | 6,0 | 4,8 | 0,13 | >0,05 | 3,2 | 2,0 | 0,28 | >0,05 |
| Pisces | | | | | | | | |
| Fish | 2,6 | — | — | — | 1,8 | — | — | — |
| Fish scale | 0,9 | 0,9 | — | — | 1,3 | 1,2 | 0,04 | >0,05 |
| Oligocheata | | | | | | | | |
| Earth worms | 1,7 | — | — | — | 1,2 | — | — | — |
| Food richness $N_f$ | 15 | 13 | | | | | | |

## DISCUSSION

*B. nurse* in the River Jamieson occurred in considerable number and evidently the sub-dominant (≥ 15%) characid species in the river. Its distribution was uneven. Its occurrence in the downstream station was perennial while in the other stations it was seasonal. The perennial occurrence of the species in the downstream station may be its preference for the prevailing environmental conditions in the station namely: larger water body with relatively moderate flow velocity and silty sand substratum. Additionally, it may be an ecological device to have enough resources to sustain its huge biomass. *B. nurse* happens to be one of the characid species that undergo longitudinal migration in the river, the other being *B. macrolepidotus*. Migration into the upstream station occurs in the dry season during its peak abundance. This migration is connected with dispersal into favourable feeding grounds. The species does not reproduce in the River Jamieson as no sexually matured specimen was captured in the river. Accordingly, they undergo spawning migration westward into the Benin River (personal observation).

The largest *B. nurse* captured measured 20 cm SL. This falls within the size range (20.0–20.8 cm) of the species in some West African water bodies; River Niger (Daget 1952), Lake Chad (Blanche et al. 1964), Northern Nigeria rivers (Reed et al. 1967), rivers in Cote D'Ivoire (Paugy 1980). The length frequency distribution pattern was leptokurtotic. This implies the existence on more than one population of the species in the river. The length frequency distribution showed the occurrence of two distinct size groups in the river. The recruitment of the young adults (*MSG*) takes place once a year (November and December) and at such periods the population was dominated by this group. Recruitment into River Bandama, Cote D'Ivoire also takes place once in a year in September and November (Paugy 1980). These ones progressively increase in size and reduce in abundance into the next year to become the second year class (*LSG*).

The regression coefficient (*b*) evaluating the length-weight relationship in both sexes indicates allometric growth pattern. This implies that the fish becomes less rotund as it grows in length (Anderson and Gutreuter 1983). Condition factor varied with size of the fish. It was inversely related to increasing length in the medium size group. But with the large size group *K*-values increased with increasing fish size. It would appear that the environmental conditions were most favourable to the large size group. Similar observation was made by Paugy (1980). However, Brown (1985) reported inverse relationship with all size groups. The high rainy season peak in *K*-values may be related to the food regime of the fish. During this season, the fish was able to utilise the rich food resources and accumulate a lot of fat which probably resulted in the improved well-being.

Percentage diel variations in feeding intensity indicated no significant difference in the feeding intensity during both day and night. *B. nurse* in River Jamieson was basically phytophilous with its primary diet as vegetable materials and insects of allochthonous origin. Available data indicates that *B. nurse* under riverine conditions feeds mainly on plant materials and terrestrial insects (Victor and Brown 1990; Ikomi 1995) while under the lacustrine conditions they feed mainly on animal products (Blache et al. 1964; Lelek and El-Zarka 1973; Paugy 1986). The primary dietary items consumed by the fish were mainly of the surface water. Hence it is in line with the description of the fish as being pelagic. However, other items such as fish, detritus, immature aquatic insects, and sand (Table 2) found in the stomach of the fish indicates foraging for food in both the mid-water and the substratum. Generally, available literature indicates that the dietary habit of the species varied and dependent on the availability of food items. Ability to effectively utilise available food items show s its trophic flexibility. This is an attribute required to sustain its huge biomass wherever it occurs.

*B. nurse* did not show marked temporal qualitative variation in food habit as they fed basically on the primary diets during both climatic seasons. However, there were quantitative variations in the consumption of these items. For example peak consumption of Hymenoptera was more in the rainy season, when this food resource was most abundant and available. There were variations in seasonality of species food richness. Slightly higher values were recorded during the dry season. The optimal foraging theory of Pyke et al. (1977) and Angermeier (1982) postulates inverse relationship between species food richness values increases during the period of depressed resource abundance and declines during the period of high resource abundance. In the River Jamieson, high resource abundance was in the rainy season with the accompanying lower species food richness value. However, in the dry season, there was a slight expansion of this value due to contracted food resources.

The quantitative and qualitative dietary shift with fish maturation may have resulted from changes in food predilection and or foraging ability for preferred diet. This shift can not be related to gape size of fish at it was observed that there was decrease in affinity for the relatively larger allochthonous alate insects with increasing fish size. Diel variation in the food habit did not vary substantially. This was also reflected in the variations in the feeding intensities during both day and night.

## CONCLUSIONS

Aspects of the ecology of *B. nurse* in the River Jamieson were examined. The study shows the uneven distribution pattern in the river with perennial preference for the downstream station. This distribution pattern was governed by the prevailing environmental conditions namely: relatively larger water body, silty sandy substratum moderate flow velocity and rainfall regime. Peak abundance was at the peak of flood period (beginning of the dry season) when there was expanded habitat due to inundation by flood water and rich fish food resources. During the period the fish was able to utilise the prevailing conditions to improve on its well-being.

## ACKNOWLEDGMENT

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REFERENCES

**Albaret J.J., B. Merona,** 1978: Observations sur faune ichthyologique du bassin de I'Agnebi (Cote D'Ivoire). ORSTOM, Bouaka.

**Anderson R.O., S.J. Gutreuter,** 1983: Length, weight and associated structural indices in fisheries techniques. [Nielsen L.A., D.L. Johnson (eds.)]. Amer. Fish. Soc., Bethesda: 215–237.

**Angermeier P.L.,** 1982: Resource seasonality and fish diets in an Illinois stream. Env. Biol. Fish., 7, 3: 251–264.

**Bagenal T.B., F.W. Tesch,** 1978: Age and growth. In: Methods of Assessment of Fish Production in Freshwater [T.B. Bagenal (ed.)]. Blackwell Sci. Publ., Oxford: 101–136.

**Blache J., M.F. Miton, A. Stauch, A. Iltis, G. Louben,** Les poissons du bassin Chad et du bassin adjacent du Mayo-Kebbi: Etude systematique et biologique. ORSTOM.

**Brown C.A.,** 1985: The food and feeding relationship of non cichlid fishes of Ikpoba River, downstream of the dam. MSc Thesis, University of Benin, Benin City, Nigeria.

**Daget J.,** 1952: Memoires sur the biologie des poisson du Niger. I. Biologie et crossance des especies du genre *Alestes*. Bull. Inst. Franc. Afri. Noire, **15**, 1: 191–225.

**Daget J.,** 1962: Res poissons du fonta Dialon et la basse Guines. Mem. Inst. Franc. Afri. Noire, **65**: 1–210.

**Daget J., A. Iltis,** 1965: Poisson de Cote d'Ivoire deuces et saumatre. Mem. Inst. Franc. Afri. Noire, **74**: 1–385.

**Ikomi R.B.,** 1995: The ecology of the characids (Cypriniformes, Characidae) in the River Jamieson, Delta State, Nigeria. PhD Thesis, University of Port-Harcourt, Nigeria.

**King R.P.,** 1989: Distribution, abundance, size and feeding habits of *Brienomyrus brachyistius* (Gill, 1862) (Teleostei: Mommyridae) in a Nigerian Rainforest stream. **13**, 1: 25–36.

**LeCren E.D.,** 1951: The length-weight relationship and seasonal cycle in gonad weight and condition in the perch *Perca fluviatilis*. J. Anim. Ecol., **20**: 201–219.

**Lelek A., S. El-Zarka,** 1973: Ecological comparison of pre-impounded fish fauna of river Niger and Kainji Lake, Nigeria. Geophysical Monograph, **17**: 655–660.

**Massey F.J.,** 1951: The Kolmogorov-Smirnov test for goodness of fit. J. Amer. Statist. Assoc., **5**: 11–121.

**Merona B.,** 1981: Zonation Ichthyologique du bassin du Randama (Cote d'Ivoire). Rev. Hydrobiol. Trop., **14**: 63–75.

**Paugy D.,** 1980: Ecologie et biologie des *Alestes nurse* (Pisces, Characidae) des riveres de Cote d'Ivoire. Cah. ORSTOM, ser. Hydrobiol., **12**, 3–4: 245–275.

**Paugy D.,** 1986: Revision systematique des *Alestes* and *Brycinus* Africans (Pisces, Characidae). ORSTOM, Etudes et Thesis, Paris.

**Pyke G.H., H.R. Pulliam, E.L. Charnov,** 1977: Optimal foraging: a selective review of theory and tests. Quart. Rev. Biol., **52**: 137–154.

**Reed W., J. Burchard, A.J. Hopson, J. Jenness, Y. Yaro,** 1967: Fish and fisheries of Northern Nigeria. Ministry of Agriculture, Northern Nigeria, Zaria.

**Sydenham D.H.J.,** 1977: The qualitative composition and the longitudinal zonation of the fish fauna of the River Ogun, Western Nigeria. Rev. Zool. Afri., **91**: 974–996.

**Tetsola E.A.,** 1988: Distribution and feeding relationship of the fishes of Warri River, Nigeria. PhD Thesis, University of Benin, Benin City, Nigeria.

**Teugels G.G., G.M. Reid, R.P. King,** 1992: Fishes of Cross River basin (Cameroon – Nigeria): Taxonomy, Zoogeography, Ecology, and Conservation. Musee Royal de L'Afrique Centrale Tervuren Belgique UL., **224**: 1–124.

**Victor R., C.A. Brown,** 1990: The food and feeding habits of two species of characids fish in a perturbet West African River. J. Afr. Zool., **104**: 97–108.

**Victor R., J.O. Tetteh,** 1988: Fish communities of a perturbed stream in South Nigeria. J. Trop. Ecol., **4**: 49–59.

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# BADANIA NAD ZASIĘGIEM, ILOŚCIOWYMI PARAMETRAMI WYSTĘPOWANIA, CHARAKTERYSTYKĄ WZROSTU I ODŻYWIANIEM *BRYCINUS NURSE* RUPPEL, 1832 (OSTEICHTHYES: CHARACIDAE) W RZECE JAMIESON, NIGERIA

## STRESZCZENIE

Badano ekologiczne aspekty występowania *Brycinus nurse* Ruppel, 1832 w rzece Jamieson, Nigeria. *B. nurse* stanowił 19,8% wszystkich przedstawicieli rodziny Characidae w połowach. Jego rozmieszczenie w rzece było nierównomierne, jednakże w dolnym biegu spotykano ten gatunek ryby w ciągu całego roku. Szczyt występowania obserwowano na początku pory suchej. Długość ryb wynosiła 7,0–19,0 cm (*longitudo corporis*), zaś ich masa 40,5–171,0 g. Reprezentowały one allometryczny schemat wzrostu. Współczynnik kondycji wahał się od 1,99 do 2,65 i był zależny od długości poszczególnych ryb. Współczynnik kondycji był nieco wyższy w porze deszczowej. *B. nurse* żywił się głownie kawałkami roślin, nasionami i błonkoskrzydłymi (Hymenoptera), podczas gdy glony i różne inne skrzydlate owady miały drugorzędne znaczenie. Młodociane formy owadów wodnych były przypadkowymi elementami diety. *B. nurse* żerował zarówno w dzień jak i w nocy, wykazując pewne ilościowe różnice w charakterystyce żerowania w zależności od wielkości ryby i pory roku.

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