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Cinclodes fuscus (AVES: FURNARIIDAE). A BENTHOPHAGOUS BIRD IN THE PARANA RIVER FLOODPLAIN, ARGENTINA

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ABSTRACT. The feeding ecology niche (breath and food availability) of the Bar-Winged Cinclodes *Cinclodes fuscus fuscus* (Vieillot, 1818) from the Paraná River Floodplain, revealed an omnivorous diet consisting of 13 taxonomic entities: Chironomidae larvae (*Chironomus domizzi*), others insects, Planorbidae, Crustacea and seeds. Chironomidae and Planorbidae were possibly electived. This investigation was carried out with the purpose of giving quantified data about trophic spectrum, niche amplitude, prey size and diet selection. In order to establish the food item contribution the Relative Importance Index (IRI) was applied, Pinkas, *et al.*, 1971. The trophic amplitude niche was calculated by Levins Index. Moreover, the estimator of selection was obtained of Dervo, *et al.*, 1991 criteria. The values of the Index of Relative Importance were following: Chironomidae = 9108; Planorbidae = 4700; Other Insecta = 2075 and Seeds = 1687. *Chironomus domizii* represented 60% of total quantified organisms, followed by Planorbidae which represented 9%. On the other hand, the vegetal fraction was made up of Gramineae seeds, Compositae and other seeds not identified that represented 23% of total. The trophic amplitude was 2.48. The size of the prey items, ranged from 1 to 12 mm, with a greatest occurrence within 6-9 mm, which corresponded to *Chironomus domizii*. The values of selection index were the following: Chironomidae = +0.33 (July 1990) and + 0.40 (August 1990); Planorbidae = + 0.85 (July 1990) and + 0.78 (August 1990). In conclusion, these results allow to amplify information about feeding ecology of *Cinclodes fuscus* in Paraná River Floodplain. The greatest presence of Chironomidae and Planorbidae defined a bentophagous diet.

RESUMEN. Se dan a conocer los resultados del estudio sobre la dieta de *Cinclodes fuscus*, remolinera común (Vieillot, 1818), residente invernal en el valle del río Paraná cuya dieta es omnívora, representada por 13 entidades taxonómicas: Larvas de Chironomidae (*Chironomus domizii*), otros insectos, Planorbidae, Crustacea y semillas. Chironomidae y Planorbidae fueron posiblemente los elegidos. La investigación se efectuó con la finalidad de presentar datos cuantificados sobre el espectro trófico, amplitud del nicho, tamaño de presas y selectividad dietaria. Con el objeto de establecer la contribución de cada categoría de alimento, se aplicó un índice de importancia relativa (IRI), según Pinkas *et al.*(1971). Mediante el índice de Levins (1968) se obtuvo la amplitud trófica del nicho, en tanto que como estimador de la selectividad, se siguió el criterio de

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Dervo *et al.*,(1991). El espectro resultó integrado por 13 entidades taxonómicas. 10 correspondientes a la fracción animal y 3 a la vegetal. La contribución de cada categoría de alimento obtenida por la aplicación del IRI arrojó los siguientes valores: Chironomidae: 9108, Planorbidae: 4700, otros Insecta: 2075 y semillas : 1687. Dentro de la fracción animal, los Chironomidae con *Chironomus domizii* representó el 60% del total de organismos cuantificados. Le siguieron los Planorbidae, que representaron el 9% del total. La fracción vegetal estuvo integrada por semillas de Gramíneas, Compuestas y otras no identificadas que representaron el 23% del total. La amplitud trófica fue 2,48. El tamaño de las presas osciló entre 1 y 12 mm, con un mayor ocurrencia por los organismos comprendidos en el intervalo 6-9 mm y que correspondieron a *Ch. domizii*. Los valores obtenidos del índice de selectividad fueron los siguientes: Chironomidae = +0,33 (julio 1990) y +0,40 (agosto 1990), Planorbidae = +0,85 (julio 1990) y +0,78 (agosto 1990). Los resultados permiten ampliar la información sobre la biología alimentaria de *C. fuscus* en el valle en el valle de inundación del río Paraná. La presencia mayoritaria de Chironomidae y Planorbidae definen una dieta básicamente bentófaga.

INTRODUCTION

Knowledge of the feeding ecology of the Bar-Winged *Cinclodes fuscus fuscus* (Vieillot, 1818) in the Paraná River floodplain (Argentina) is limited to a preliminary study by Beltzer & Neffen (1989) which revealed a diet of benthic insects and molluscs. The present study extends these findings by quantifying the diet in a larger sample of birds and by assessing the availability of the prey items in the aquatic habitat of the Bar-Winged Cinclodes while wintering in Argentina.

MATERIAL AND METHODS

Stomachs of 15 specimens captured in the Carabajal island (Province of Santa Fe, 31° 39' S - 60° 42' W) were used to determine the diet. The area of this island is 4000 ha. with numerous ponds, e.g.. La Cuarentena pond (250 ha.), La Cacerola Pond (80 ha.) and Vuelta de Irigoyen Pond (70 ha.). This island belongs to the Plain of Banks (Iriondo & Drago, 1972) (Fig.1). Specimens were captured in July and August 1990 between 09.00 and 19.00 hs in areas of shallow water frequented by this species only in winter (Fig. 2) (Vaurie, 1980; Navas & Bó, 1987; Beltzer & Neffen, *op. cit.*). Stomachs were individually examined, identifying and quantifying the organisms at different taxonomic levels. The criterion Hurtubia (1978) was followed to determine the trophic diversity. It involves determining the trophic diversity (H) for each individual bird after Brillouin (1965):

$$H = (1/N) (\log 2\ N! \Sigma \log 2\ Ni!)$$

where N is the total number of organisms found in the stomach of each individual and Ni the total number of prey items of the i species in each stomach. The individual estimations were sumed up at random, which constitutes the accumulated trophic diversity (Hk). Only the individuals that kept the key structures and components (heads, "elitros", jaws, etc.) that could be identified were used to count those organisms in an advanced state of digestion.

The index of relative importance (IRI) (Pinkas *et al., op. cit.*) was estimated to determine the contribution of each prey species to the diet of the species.

$$IRI = \%F (\%N + \%V)$$

where F is the frecuency of occurence of a prey

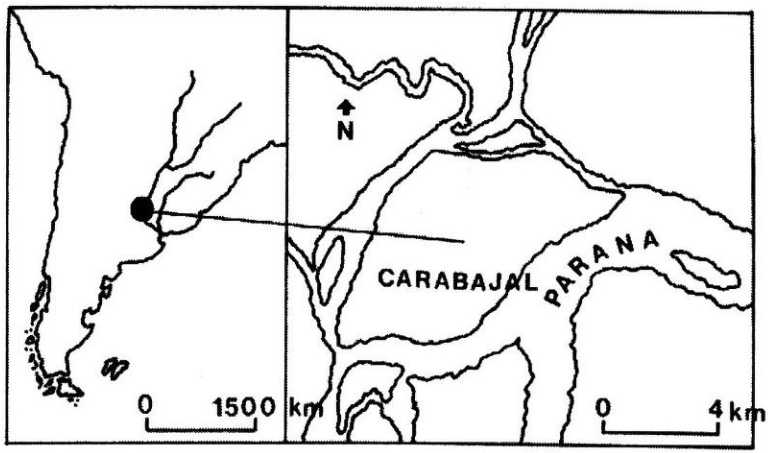

Fig. 1. Study sites. Carabajal Island (Santa Fe, Argentina).

species, N its numerical percentage and V its volumetric percentage. All the stomach contents from the 15 were considered as a single sample to calculate this index.

The Levins index (1968) was applied to determine trophic niche breadth for the period of study using the following equation:

$$N_B = (\Sigma p_{ij})^{2-1}$$

where p_{ij} is the probability of the item i in the sample j.

The Ivlev index (1961), is modified by Derbo *et al.* (*op. cit.*) was applied to determine the extend of selection for the prey type:

$$E = (F_i - P_j) / (F_i + P_j)$$

where F_i is the proportion of prey i in the ingestions and P_j its proportion in the habitat disponibility.

Samples of benthos were taken simultaneously in the places of capture of the specimens with sampler Eckman and analyzed with a stereoscopic maggnifying glass.

RESULTS

All stomachs analyzed (n = 15) contained food. The values of trophic diversity ranged between 0 and 1.4, the mean diversity (H) was 0.88 and the accumulated trophic diversity (Hk) 1.9. The resulting curve of the 15 samples tends to stabilize (Fig. 3), showing that the 15 stomachs provided a representative sample.

The trophic spectre based on the identification of 256 preys was composed of 13 taxonomic groups, 10 of them animal and 3 to the vegetal fraction (Table 1). The values of the index of relative importance (IRI) that revealed the contribution of each food category to the diet of the species were: Chironomidae = 9108; Planorbidae = 4700; other insects = 2075 and

seeds = 1682 (Fig. 4). In the animal fraction, Chironomidae with *Chironomus domizii* represented 60% of the total food items. This chironomid is characteristic of environmets of oxygen deficient shallow waters enriched with organic matter that may reach a state of anoxia. The remaining insects ranged between 3.1% for Curculionidae, 0.77% for Helolidae and Dytiscidae larvae and 0.39% for Noteridae and Hydrophilidae. All the insects found belonged to the aquatic component of the benthic complex in its larval stage or connected with vegetation.
Molluscs (Planorbidae, IRI = 4700) comprised 9% of the total of the organisms found in the stomachs and followed in order of importance. Crustacea were represented by 2 specimens of *Hylalella curvispina* in one stomach.
The plant fraction was represented by seeds of Graminae and Compositae and others not identified that represented the 23% of the total food items. In all cases the seeds were ripe.
The trophic breath of the niche during winter in the area of the Paraná river was of 2.48; being very similar to the values of the previous study (2.56) (Beltzer and Neffen, *op. cit.*)
The size of the prey itemes ingested by *C. fuscus* ranged between 1 and 12 mm, with *Ch. domizii* (6-9 mm) the most common species (Fig. 5). The smallest prey (1-3mm) were seeds while the greatest ones the crustaceans *H. curvispina*. The values obtained from the selectivity index were: Chironomidae = +0.33 (July 1990) and +0.40 (August 1990); Planorbidae = +0.85 (July 1990) and +0.78 (August 1990). This values are represented in Fig. 6 where the positive selection due to Chironomidae and Planorbidae can be observed. The rest of the entities of the spectre were not analyzed because of the low values registered. Samples of the benthos were

Fig. 2. Location where the sampling took place.

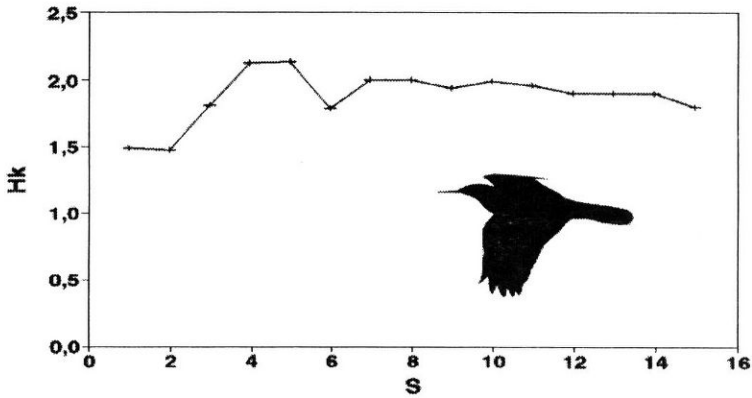

Fig. 3. Acumulated trophic diversity curve based on the stomachs number.

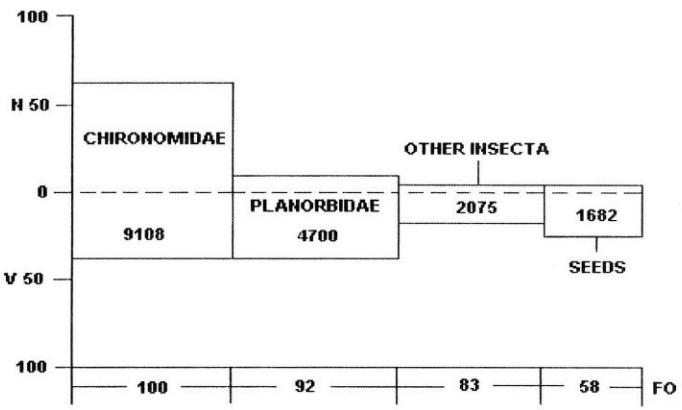

Fig. 4. Relative importancy index (IRI) N = numeric percentage; V = volume percentage; FO = frecuence of ocurrency percentage.

Table 1: Trophic spectrum of *Cinclodes fuscus fuscus* N= number of organisms; F= capture frequency.

	n	%	f
Vegetal fraction			
Seeds			
Gramineae (Not identified)	1	0,37	1
Compositae (Not identified)	31	11,56	2
Not identified	30	11,19	3
Animal Fraction			
Insecta			
Coleoptera			
Noteridae			
Suphisellus sp.	1	0,37	1
larvae	1	0,37	1
Curculionidae	8	2,17	5
Hydrophilidae	1	0,37	1
Dytiscidae			
Derallus sp.	1	0,37	1
larvae	2	0,74	1
Helodidae (larvae)	2	0,74	1
Diptera			
Chironomidae			
Chironomus domizii	156	58,20	15
Mollusca			
Gastropoda			
Planorbidae (Not identified)	32	11,94	13
Crustacea			
Hyalellidae			
Hyalella curvispina	2	0,74	1

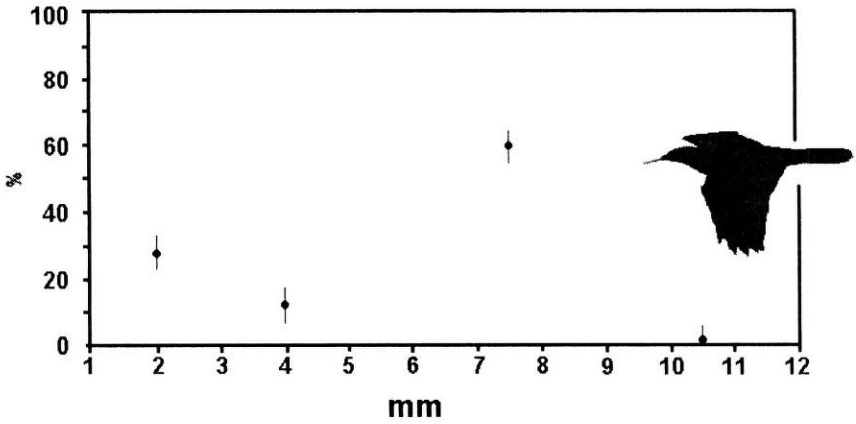

Fig. 5. Percentual relationship of the prey items by size and its desviations.

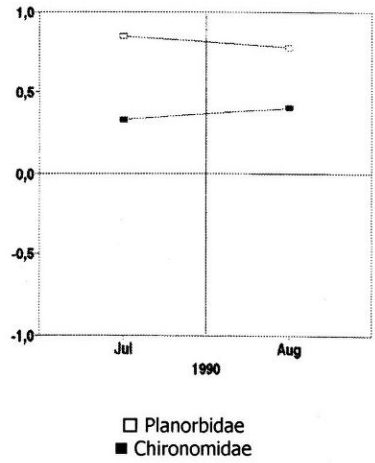

Fig.6. Selectivity index of Ivlev for Chirono-midae and Planorbidae.

composed of Oligochaeta (40%) with Lumbricidae, *Eiseniella tetraedra* and *Dero obtusa*, Chironomidae (*Ch. domizii*, 38%), Planorbidae (7%). The other groups, that belonged to *Parachironomus* sp. (4%), Orthocladinae (not identified) (3%), Enchytraeidae (2%), Copepoda (not identified) (2%), Cladocera (not identified) (1%), Tipulidae pustule (0.9%) and Elmidae larvae (0.9%), showed in comparison very low values.

DISCUSSION AND CONCLUSIONS

The previous work in the Paraná river (Beltzer and Neffen, *op. cit.*) only included animal organisms.

Present results allow us to enlarge the above-mentioned information. Although the trophic breadth of both is similar, the preserve of seeds indicate that seeds make the diet onmivorous. The diet consists primarily of insects, especially Chironomidae, and molluscs Planorbidae.

The predominance of Chironomidae (*Ch. domizii*) and Planorbidae indicates a basically benthic diet. This is in accordance with the results of the selectivity index that revealed this preference for *Ch. domizii*. This would be explained by the red colour coming from the hemoglobin dissolved in the hemolym, whose concetration is proportional to the oxygen deficit (Margalef, *op. cit.*). As this characteristic makes them visible, there exists an active depredation based on chromatic perception. On the other hand, these organisms make in sediments vertical or j-shaped tubes in the shaped of a chimney that makes its detection easier. It is also worth noting that Chironomidae represent between half and the 2/3 part of the fauna of the benthos (Margalef, *op.cit.*; Marchese, 1984, Bertoldi de Pomar *et al.*, 1986).

The remaining Chironomidae were not taken into account because of its low numerical density of its way of life. This is the case of *Parachironomus* sp. that lives in the paleal cavity of the pulmonates (Margalef, 1983 and *Ablabesmyia* sp. whose behaviour is vagrant and nomadic).

The frequency of Planorbidae in the Bar-Winged Cinclodes diet is probably determined by the abundance of the snails and by their slow movements. They occur commonly in the diets of other species of the Paraná river (Beltzer, 1985).

Although the most numerous species of the benthic fauna was the oligochaete *Eiseniella tetraedra*, it was not eater their behaviour renders them unavailable to the birds (Wetzel, 1981).

The origin of ripe seeds in the diet is uncertain.

They might have been taken directly from the plants, or they could have been fallen seeds that the birds obtained from benthic sediments, although most seeds remain floating (Beltzer *et al.*, 1991, Mosso & Beltzer, 1991).

Finally, studies of the feeding biology of most of the Passeriformes of the Paraná River Floodplain to date indicate that *Cinclodes fuscus fuscus* is the only benthophagous species of the system, whose feeding biology most closely resembles that of the waders (Beltzer, 1986, a-b-c, 1991).

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