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White-faced Ibis Diet in Argentina

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Abstract.—Seasonal composition and sexual differences in the diet of the White-faced Ibis (*Plegadis chihi*) were investigated in Buenos Aires Province, Argentina. A total of 88 stomach contents were analyzed, from White-faced Ibis feeding on riparian pastures and grasslands in the Magdalena district, Buenos Aires Province, Argentina. Samples were obtained between 1992 and 1996, covering each season of the year. The trophic spectrum was determined based on the identification of 59 items, mainly belonging to animal taxa. Diet was composed of Insecta (43 items), Arachnida (3 items), Crustacea (5 items), Gastropoda (3 items), Hirudinea (3 items), Amphibia (1 item) and vegetable (1 item). Dietary composition was analyzed in terms of number, frequency of occurrence and volume, for each season and between sexes. Significant differences between sexes were found in the volume of the ingestion consumed. *Received 25 July 2005, accepted 25 February 2006.*

Key words.—Birds, *Plegadis chihi*, White-faced Ibis, diet, Buenos Aires, Argentina, Threskiornithidae.

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The White-faced Ibis (*Plegadis chihi*) is a resident species, distributed from north of Argentina to the northwest of Chubut province. Elsewhere, it occurs in Uruguay, Paraguay, southeast Brazil, Chile, east of Bolivia, Perú, Venezuela, central west USA and México (Navas 1995; del Hoyo *et al.* 1992). This species mainly frequents freshwater marshes, ponds, rice fields, flooded pastures, irrigated cultivation, dry fields and margins of large water bodies.

The literature on the White-faced Ibis is limited, and focused on the natural history of the species. Information about the diet of this species (and its congener the Glossy Ibis (*P. falcinellus*)), is scarce and tends to be limited to the enumeration of taxa encountered in a small number of samples.

The objective of this study was to investigate the composition of the diet of this species throughout the year, evaluating seasonal variation and differences between sexes.

STUDY AREA AND METHODS

A total of 21 visits were made to grasslands and riparian wetlands, located between La Balandra and Punta Blanca (District of Magdalena, Buenos Aires province). The samples were obtained during a study of contaminants and endoparasites of waterbirds. Stomachs from 88 specimens were obtained between 1992 and 1996 (13 in spring, 28 in summer, 24 in autumn and 23 in winter). In addition, information about sexes and morphometric measures were obtained.

Stomachs were removed in the field and preserved in 70% ethanol. In the laboratory, volumes of stomach contents were obtained by displacement. Organisms in the stomachs were separated and were identified as far as possible using a reference collection. Length and maximum width of the prey items were used to obtain reconstituted volume (following Duffy and Jackson 1986).

Food niche breadth (FNB) was estimated using Levins' (1968) index: $FNB = 1/(\sum pi^2)$, where pi is the proportion of prey taxon i in the diet. A standardized-niche breadth value (FNBst) was calculated, which ranged from 0 to 1: $FNBst = (FNB - 1)/(N - 1)$, where N is the total number of prey categories (Colwell and Futuyma 1971). Specific diversity was calculated using Shannon-Wiener index (Krebs 1999).

RESULTS

Analysis of Stomach Contents

All stomachs analyzed (N = 88) contained food items. Mean reconstituted volume of the samples was 8.5 cm^3 (SD ± 9.1) and contained an average of 31 prey items each (N = 2,731). Frequency of occurrence, importance by number and reconstituted volume of the stomach contents, are shown in Table 1.

The trophic spectrum used the identification of 59 different prey, mainly animal (see Appendix). Vegetable material was found in only three stomachs. The animal

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Table 1. Composition of the diet of White-faced Ibis (*Plegadis chihi*) at Buenos Aires province, Argentina as reflected by analysis of stomach contents (N = 88). Percent frequency of occurrence, numbers and reconstituted percentage volume.

Prey	Volume (%)	Frequency (%)	Number (%)
Gastropoda	76	74	47
Insecta	14	80	19
Crustacea	8	40	32
Others	2	21	2

fraction was represented by Insecta (43 taxa), Crustacea (5), Arachnida (3), Gasteropoda (3), Hirudinea (3), Amphibia (1). Gastropods were the main prey in terms of volume and numbers throughout the sampling period (55% to 90% of total volume). They were represented almost entirely (99.5%) by the South American ampullarid *Pomacea canaliculata*.

Insecta occurred in 70 samples, although their contribution in terms of volume and number was low. The main Orders of insects present were Coleoptera (68%), Orthoptera (16%) and Hemiptera (8%). Crustacea were mainly represented by the isopod *Armadillidium vulgare* (96% of Crustacea items) and although numerous, were present only in spring and autumn. Arachnida and Hirudinea were few.

Within insects, species from aquatic habitats were numerous, with the most numerous being *Tropisternus setiger*, other hydrophilid water beetles, the hemipteran *Belostoma elegans* and Odonata (dragonfly) nymphs. Terrestrial insect species such as those of genera *Dyscinetus* sp. and representatives of Curculionidae, Tenebrionidae, Scarabeidae, were frequently encountered. Related to the number of species consumed, the ibises fed more on terrestrial than aquatic prey items. Notwithstanding, aquatic prey were much more important in terms of number of individuals and mass.

Seasonal Variation of the Diet

Gastropods were the principal prey in terms of volume throughout the year. Considering the volume of each class of prey, significant differences between seasons were not found (Kruskal-Wallis test, n.s.). There was a major presence of insects during spring and summer and of crustaceans in autumn. The former represent nearly 20% of total volume consumed in spring and summer (Fig. 1). Number of prey consumed by season did not vary significantly (spring: 27.9 ± 19.9, N = 13; summer: 21.8 ± 17.9, N = 28; autumn: 37.6 ± 28.4, N = 24; winter: 36.1 ± 32.3, N = 25; Kruskal-Wallis test, n.s.).

Gastropods and crustaceans together represented 95% (autumn) and 83% (winter) of the total of prey consumed during the autumn and winter months, with crustaceans more important in autumn and gastropods in winter (Fig. 2). The gastropod *Pomacea canaliculata* and the isopoda *Armadillidium vulgare* constituted more than 97% of the prey captured for both Gastropoda and Crustacea over the year. *P. canaliculata* dominated in winter and summer (95% and 96% respectively considering only Mollusca and Crustacea prey), while *A. vulgare* dominated in autumn and spring (78% and 56% respectively, considering only Mollusca and Crustacea prey).

Insects increased in spring and summer, reaching almost 50% of all the prey items consumed in summer. Other taxa (Arachnida, Hirudinea, Amphibia and plants) represented an average of only 2% of the prey captured and were totally absent during the autumn. The niche breadth was higher in

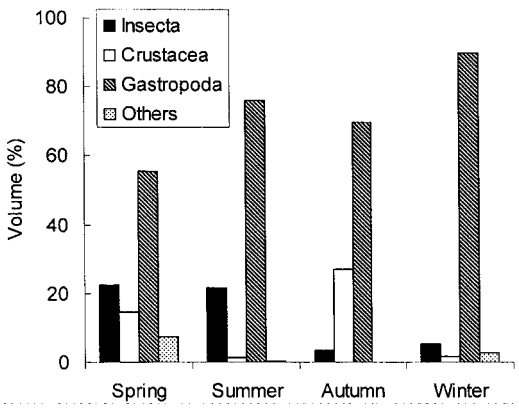

Figure 1. Percentage in volume of prey consumed by White-faced Ibis.

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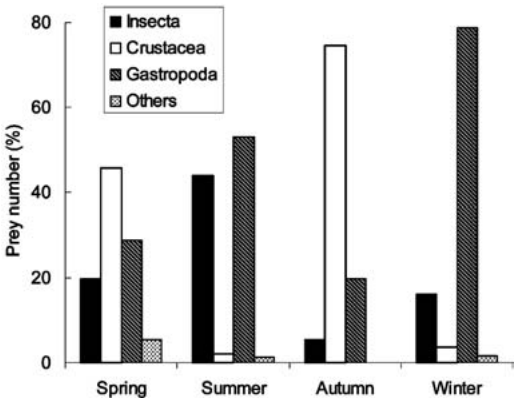

Figure 2. Prey number (%) of the different items consumed by White-faced Ibis during the year.

spring and summer (FNBst = 0.069 and 0.041 respectively) than in autumn or winter (FNBst = 0.012 and 0.011 respectively). Shannon-Wiener Index (H) showed similar trends: spring: 2.73, summer: 2.52, winter: 1.42 and autumn: 1.28 indicating that during summer and spring the diet was more diverse.

Dietary Variation between Males and Females

Table 2 shows the percentages by frequency, number of prey and volume, consumed by male and female White-faced Ibises. Statistical analysis of the dietary samples between sexes revelled significant differences in the mean volume of the food consumed (Males = 10.7 ± 10.5 cm^3, N = 55; Females = 5.5 ± 4.3 cm^3, N = 32; $P < 0.001$), but not regarding the number of prey consumed by both sexes (Males = 33 ± 29.9, N = 55; Females = 28 ± 19.4, N = 32; Mann Whitney U test, n.s.). No significant differences were found in the numbers of aquatic and terrestrial items consumed by the sexes (Mann Witney U-test, n.s. Table 3).

Males ate proportionately more molluscs than females in all the seasons, while females generally consumed more insects, particularly during summer and winter months (Fig. 3). Regarding morphometric measures, the mean male and female mass differed significantly (Males = 537 ± 68g, N = 55 and females = 469 ± 40g, N = 33; $P < 0.001$), as the total length of the culmen (Males: 124.7 ± 6.9 mm, N= 9; Females = 101.8 ± 4.6 mm, N = 9; $P < 0.001$).

DISCUSSION

Previous studies (see Table 4) found insects predominated over other items in the diet of White-faced Ibis. Del Hoyo *et al.* (1992) indicated that the diet of White-faced Ibis is composed mainly by insects, although they mentioned that other prey have also been recorded. The ibises in this study also consumed mainly insects, Crustacea and Mollusca constituted the bulk of the diet in all seasons in terms of number (79% of total number of prey consumed), and volume (85% of total volume consumed). The mollusc *Pomacea canaliculata* was the main prey, representing more than 76% of the total volume over the year.

The trophic spectrum was wide and varied (59 taxa). It contained 37 terrestrial taxa and 22 aquatic and humid habitats taxa. Although the number of terrestrial species ingested by the ibises was higher than aquatic items, the number of aquatic prey taxa greatly exceeded the former (see Table 3). Diet changed seasonally, with increased insects from spring to summer. During autumn-win-

Table 2. Dietary composition in male (M) and female (F) White-faced Ibis (*Plegadis chihi*) at Buenos Aires province, Argentina, as reflected by analysis of stomach contents. Frequency of occurrence, importance by number and reconstituted volume, expressed as percentages (N = 88).

	Frequency %		Number %		Volume %	
	Male	Female	Male	Female	Male	Female
Gastropoda	82	59	52	37	80	62
Insecta	73	91	13	31	12	21
Crustacea	44	34	34	29	7	12
Others	14	31	1	3	1	5

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Table 3. Aquatic and terrestrial prey consumed by males and females of White-faced Ibis (*Plegadis chihi*) at Buenos Aires province, Argentina.

	Aquatic		Terrestrial	
	% species	% number	% species	% number
Males	37	88	63	12
Females	36	85	64	15

ter, a considerable increased in the number of prey was recorded than in the warmer seasons. This may be related to seasonal decreases in the availability of items common in spring and summer (e.g., insects) and to the type of prey mostly consumed that have indigestible parts.

Another aspect that requires consideration about seasonal variation is the relative importance of aquatic and terrestrial prey in the diet. During cold months the aquatic prey dominated, representing more than 95% of the total of prey ingested, while during spring and summer terrestrial prey increased reaching 22% and 29% of the total prey captured. This may reflect that the White-faced Ibis fed in aquatic environments all the year (especially during cold months), turning partially to terrestrial habitats during warm months. This change in foraging areas could be related to changes in abundance and/or availability of prey between seasons (e.g., increased insect availability in spring and summer), relative availability of water bodies.

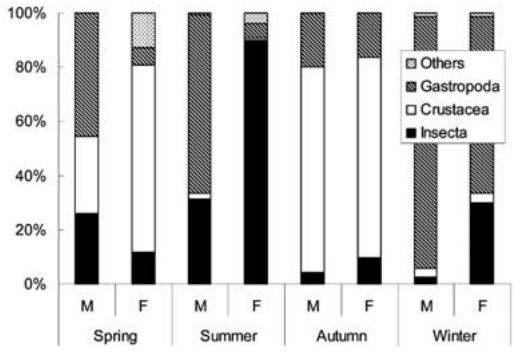

Figure 3. Prey number (%) consumed by males (M) and females (F) of White-faced Ibis by each season.

Amat and Rilla (1994) studied White-faced Ibis foraging behavior in relation to habitat, group size, and sex in grasslands and wetlands in southeastern Uruguay, near our study area. They recorded that females were proportionally more abundant on grasslands than in wetlands. They also found that frequency of aggressions was similar between the two habitats, but the level of aggressiveness between individuals was higher in wetlands. In these habitats, females are probably more affected than males by interference due to agonistic behavior. Our results show that the most common aquatic prey in the diet tend to be consumed more by males than by females, probably indicating that males feed more frequently in wetlands than on grasslands. Thus males ate more molluscs in

Table 4. Available information about the diet of White-faced Ibis (*Plegadis chihi*), at different localities.

Site	N	Insecta	Vegetal material	Gastropod	Other Invertebrata	Amphibia	Total items	Ref.
Buenos Aires, Argentina	3	6	1				7	(1)
Buenos Aires, Argentina	5	10	1	1		1	13	(2)
Brazil	1			2			2	(3)
USA	16				1		1	(4)
USA	?	X		X	X		?	(5)
Buenos Aires, Argentina	88	43	1	3	11	1	59	(6)

References: N = dietary sample numbers; numbers indicated taxa; (1) Aravena (1928); (2) Zotta (1934); (3) Schubart *et al.* (1965); (4) Bray and Klebenow (1988); (5) Ryder and Manry (1994); (6) Present study.

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all seasons, while females generally consumed more insects, principally during summer and winter months.

Using volume, male and female stomach contents were significantly different, but this difference was not present in the number of prey consumed by each sex. This may be due to the fact that males consumed larger prey that females, and in particular, these differences could be a consequence of males consuming more snails (*Pomacea canaliculata*), the largest prey found in the study.

ACKNOWLEDGMENTS

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LITERATURE CITED

Amat, J. A. and F. D. Rilla. 1994. Foraging behavior of White-faced Ibises (*Plegadis chihi*) in relation to habitat, group size, and sex. Colonial Waterbirds 17: 42-49.

Aravena, R. O. 1928. Notas sobre la alimentación de las aves. Hornero 4: 153-166.

Bray, M. P. and D. A. Klebenow. 1988. Feeding ecology of White-faced Ibises in a Great Basin Valley, USA. Colonial Waterbirds 11: 24-31.

Colwell, R. K. y Futuyma D. J. 1971. On the measurement of niche breadth and overlap. Ecology 52: 567-576.

del Hoyo, J., A. Elliott and J. Sargatal, Eds. 1992. Handbook of the Birds of the World. Vol. 1. Lynx Edicions, Barcelona.

Duffy, D. C. and Jackson, S. 1986. Studies of seabird diets: a review of methods. Colonial Waterbirds 9: 1-17.

Krebs C. J. 1999. Ecological methodology, 2nd ed. A. Wesley Longman, New York.

Navas, J. R. 1995. Fauna de agua dulce de la República Argentina. Vol. 43. Aves. Fasc. 1 C. Ciconiiformes: Threskiornithidae y Phoenicopteridae. PROFADU (CONICET). 53 pp.

Ryder, R. R. and D. E. Manry. White-faced Ibis (Plegadis chihi). *In* The Birds of North America, No. 130 (A. Poole and F. Gill, Eds.). Philadelphia: Academy of Natural Sciences; Washington, D.C.

Schubart, O., A. C. Aguirre and H. Sick. 1965. Contribucao para o conhecimiento da alimentacao das aves brasileiras. Arquivos Zoologica. Sao Paulo 12: 95-249.

Zotta, A. 1934. Sobre el contenido estomacal de aves argentinas. Hornero 5: 376-383.

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Appendix. Frequency of occurrence of items prey found in the diet of White faced Ibis *Plegadis chihi* at Buenos Aires province, Argentina (N = 88).

	Spring	Summer	Autumn	Winter
INSECTA				
ODONATA				
Nymph	29.4	16.7		13.0
NEUROPTERA				
Nymph	11.8			
ORTHOPTERA				
Gryllidae				
Gryllodes laplatae			8.3	
Acridoidea				
Acridoidea sp.	5.9			4.3
Acrididae				
Melanophinae sp.		4.2		4.3
Gomphocerinae nymph				4.3
Acrididae nymph		4.2		
Acrididae sp.		8.3		
HEMIPTERA				
Belostomatidae				
Belostoma elegans	29.4	29.2	4.2	21.7
Belostoma elegans nymph	5.9			
Nepomorpha sp.			4.2	
COLEOPTERA				
Carabidae				
Scarites anthracinus			12.5	
Polpochila flavipes	5.9		4.2	
Paranortes cordicollis	11.8		8.3	13.0
Stenocrepis sp.				4.3
Argutoridius sp.				4.3
Carabidae sp.	17.6			8.7
Hydrophilidae				
Tropisternus setiger	35.3	33.3	12.5	47.8
Tropisternus lateralis	5.9	4.2		
Hydrobiomorpha sp.	5.9			13.0
Larva Hydrophilidae	5.9			
Hydrophilidae sp.	5.9			4.3
Dytiscidae				
Rhantus sp.				4.3
Tenebrionidae				
Larva Tenebrionidae	5.9			
Tenebrionidae sp.				4.3
Staphylinidae			8.3	
Scarabeidae				
Chalepides barbata	17.6			
Diloboderus abderus	11.8	20.8		
Lygirus sp.			12.5	
Dyscinetus gagates	11.8		12.5	
Dyscinetus rugifrons	17.6	16.7	12.5	
Dyscinetus sp.				13.0
Demodema bonariensis		4.2		13.0
Canthon sp.			4.2	
Scarabeidae sp.	5.9		4.2	
Dryopidae				
Pelomonus bergi	11.8			
Chrysomelidae			8.3	

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Appendix. (Continued) Frequency of occurrence of items prey found in the diet of White faced Ibis *Plegadis chihi* at Buenos Aires province, Argentina (N = 88).

Curculionidae				
Lamprocyphus sp.		4.2		
Calendrinae sp.		4.2	4.2	
Entiminae sp.			8.3	
Curculionidae sp.	23.5	4.2	8.3	4.3
Heteroceridae	5.9			
LEPIDOPTERA				
Heterocera sp. (larva)		12.5		
ARÁCNIDA				
OPILIONIDA				
Gonyleptidae				
Acanthopadylusculeatus		4.2		
SCORPIONIDA				
Bothriuridae				
Bothriurus bonariensis		4.2		
ARANEIDA				
Lycosidae	5.9	8.3		26.1
CRUSTACEA				
ISOPODA				
Porcellionidae				
Porcellio scaber	5.9		12.5	8.7
Armadillididae				
Armadillidium vulgare	23.5	8.3	87.5	13.5
DECAPODA				
Trychodactylidae				
Trichodactylus borellianus	5.9	20.8		
Palaemonidae				
Macrobrachium borelli	5.9			
AMPHIPODA				
Hyallelidae	5.9			
GASTROPODA				
MESOGASTROPODIDA				
Pilidae				
Pomacea canaliculata	58.8	79.2	66.7	82.6
BASOMMATHOPORIDA				
Planorbidae				
Biomphalaria cf. *straminia*	5.9			4.3
STYLOMATOPHORIDA				
Veronicellidae				
Veronicella sp. (juvenile)				4.3
HIRUDINEA				
Hirudinea (unidentified)				4.3
RHYNCHOBDELLIDA				
Glossiphoniidae	11.8			
ARHYNCOBDELLIDA				
Semiscolecidae	5.9			
AMPHIBIA	7.1			
VEGETABLE		7.7		

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