

NESTLING DIET IN FIVE SPECIES OF HERONS AND EGRETS IN BIRAMA SWAMP, CUBA

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Abstract: We used 78 boluses regurgitated by disturbed nestlings of five species of egrets and herons in a colony at Birama Swamp, western Cuba, to briefly describe dietary composition and prey sizes. The species included Cattle Egret (*Bubulcus ibis*), Snowy Egret (*Egretta thula*), Tricolored Heron (*Egretta tricolor*), Little Blue Heron (*Egretta caerulea*), and Green Heron (*Butorides virescens*). Overall we counted 1,887 items of 16 types of preys. Differences in dietary composition between nestlings and adults should reflect the structure of local prey populations. Cattle Egrets tend to consume more but smaller prey than the other species. A noteworthy find was small catfishes (*Claria* spp.), a recently introduced exotic species, among the prey consumed by three of the waders, which demonstrate an increase in the fish's population and disruption of the food web of this natural wetland.

Key words: Ardeidae, Birama swamp, Cuba, egrets, herons, nestling diet

Resumen: DIETA DE LOS PICHONES DE CINCO ESPECIES DE GARZAS EN LA CIÉNAGA DE BIRAMA, CUBA. Se describe la dieta y el tamaño de las presas de los pichones de cinco especies de garzas a partir de 78 regúrgitos espontáneamente liberados ante el disturbio humano en una colonia de la ciénaga de Birama, Cuba. Las especies estudiadas fueron la Garza Ganadera (*Bubulcus ibis*), la Garza de Rizos (*Egretta thula*), la Garza de Vientre Blanco (*E. tricolor*), la Garza Azul (*E. caerulea*) y el Aguaitacaimán (*Butorides virescens*). En total se contaron 1 887 artículos de 16 tipos de presas. Las diferencias en la composición de la dieta en relación a lo reportado para los adultos deben reflejar la estructura de las poblaciones locales de presas. La Garza Ganadera tiende a utilizar más presas diferentes pero de menor tamaño que el resto de las especies. Es notable el hallazgo de pequeños peces gato (*Claria* spp.), especie exótica de reciente introducción en el país, entre las presas consumidas en tres de las garzas lo que demuestra el aumento poblacional de este pez y su incorporación a la trama trófica del ecosistema no solamente como depredador.

Palabras clave: Ardeidae, ciénaga de Birama, Cuba, dieta de pichones, garzas

Résumé : RÉGIME ALIMENTAIRE DE CINQ ESPÈCES D'ARDEIDÉS DANS LE MARAIS DE BIRAMA, CUBA. Nous avons utilisé 78 régurgitats d'oisillons de cinq espèces d'ardéidés dans une colonie du marais de Birama, dans l'ouest de Cuba, afin de décrire brièvement la composition de l'alimentation et la taille des proies. Les espèces concernées étaient : le Héron garde-boeufs (*Bubulcus ibis*), l'Aigrette neigeuse (*Egretta thula*), l'Aigrette tricolore (*Egretta tricolor*), l'Aigrette bleue (*Egretta caerulea*), et le Héron vert (*Butorides virescens*). Nous avons recensé 1887 éléments de 16 types de proies. Les différences de composition de l'alimentation entre les oisillons et les adultes devraient refléter la structure des populations de proies locales. Le Héron garde-boeufs tend à consommer plus de proies mais de plus petite taille que les autres espèces. A noter parmi les proies consommées par trois de ces oiseaux, la découverte de petits poissons-chats (*Claria* spp.), une espèce exotique introduite récemment, découverte qui démontre un accroissement de la population de ce poisson et une perturbation de la chaîne alimentaire de cette zone humide naturelle.

Mots clés : aigrettes, alimentation des poussins, Ardeidae, Cuba, hérons, marais de Birama

Wading birds are widely recognized as flag species for wetland conservation. They are conspicuous predators, high in the food chain, and strongly dependent on the condition of wetlands (Hafner 1997). A great number of papers have been published to clarify the role of this guild in the structure and functioning of wetland ecosystems (Smith and Rotenberry 1990). The abundance of prey and their capture by predators is an important mechanism regulating populations and reflects the quality of a habitat's resources. An analysis of the dietary com-

position of wading birds provides important baseline data on the ecology of any wetland (Rosenberg and Cooper 1990).

Descriptions of the diet of waders are concentrated primarily in the Everglades and Mississippi Valley of North America (Kushlan 1975, 1976, 1979, Smith 1997), Ebro Delta and Camargue in Europe (Ruiz 1985, Martinez *et al.* 1992, Fasola *et al.* 1993), and in Venezuelan floodplains (Morales and Pacheco 1986, Frederick and Bildstein 1992). However, little information is available in many

tropical regions where huge wetland areas exist. In Cuba, studies of diet in wading birds have been restricted mainly to anthropogenic habitats such as rice fields, grasslands, or artificial ponds (Torres *et al.* 1985, Acosta *et al.* 1990, 1994, 1996, Mugica 2000); thus, the sampled localities may not reflect the ecology of species in natural wetlands. They also rely exclusively on stomach content analyses, a method which is rather disruptive for natural populations. The analysis of prey in boluses regurgitated by nestlings when disturbed in colonies is a potentially valuable alternative. This sampling method also brings some biases and limitations (González-Solís *et al.* 1997) but it provides larger samples with less time and effort (Duffy and Jackson 1986, Suter and Morel 1996).

In this study we describe the diet in nestlings of five species of egrets and herons in Birama Swamp, western Cuba. The species included are Cattle Egret (*Bubulcus ibis*), Snowy Egrets (*Egretta thula*), Tri-

colored Heron (*E. tricolor*), Little Blue Heron (*E. caerulea*), and Green Heron (*Butorides virescens*).

METHODS

Diet samples of nestling wading birds were collected during studies of their reproduction in Birama Swamp, Cuba. Birama Swamp is the second largest wetland system in Cuba and the Caribbean, and its wading bird colonies have been monitored for a decade (e.g., Denis 2002). During June and July of 1998 and 1999, 55 boluses were collected: 19 of Cattle Egret nestlings, 25 of Snowy Egret, seven of Tricolored Heron, and four of Green Heron. An additional 23 boluses were collected during the 2005 breeding season: eight of Cattle Egret, eight of Tricolored Heron, six of Little Blue Heron, and one of Snowy Egret. All nestlings were between 1-2 wk old. Because marked between-year variation occurs in the diet of heron chicks (Fasola *et al.* 1993), samples from different years were not mixed. Boluses

Table 1. Prey consumed by heron and egret nestlings during 1998 and 1999 in Cayo Norte, Birama Swamp, Cuba.

Prey ^a	Cattle Egret (n=19)		Snowy Egret (n=25)		Tricolored Heron (n=7)		Green Heron (n=4)	
	Fre- quency	Percent Comp.	Fre- quency	Percent Comp.	Fre- quency	Percent Comp.	Fre- quency	Percent Comp.
Annelida	13.8	20.7	3.8	0.5	—	—	—	—
Mollusca	—	—	—	—	12.5	0.2	—	—
Arachnida	44.8	8.2	15.4	1.9	—	—	—	—
Decapoda	3.4	0.1	26.9	9.5	—	—	—	—
Orthoptera	72.4	16.2	7.7	2.2	—	—	—	—
Lepidoptera (A)	27.6	8.1	—	—	—	—	—	—
Lepidoptera (L)	72.4	36.4	7.7	3.0	—	—	—	—
Blattoptera	31.0	2.3	—	—	—	—	—	—
Coleoptera (A)	24.1	0.8	3.8	0.3	12.5	0.2	—	—
Coleoptera (L)	17.2	0.7	15.4	3.5	—	—	—	—
Diptera	10.3	0.3	3.8	0.3	—	—	—	—
Hemiptera	20.7	1.5	15.4	1.4	—	—	—	—
Homoptera	3.4	0.1	—	—	—	—	—	—
Dermaptera	3.4	0.2	—	—	—	—	—	—
Odonata (A)	20.7	1.5	3.8	0.3	—	—	—	—
Odonata (L)	10.3	0.7	34.6	6.0	—	—	—	—
Osteichthyes	—	—	80.8	66.0	100.0	99.5	60.0	80.0
Anura (A)	24.1	1.3	11.5	0.8	—	—	60.0	20.0
Anura (L)	—	—	3.8	3.0	—	—	—	—
Reptilia	10.3	0.8	3.9	1.4	—	—	—	—

^aA = adult; L = larvae

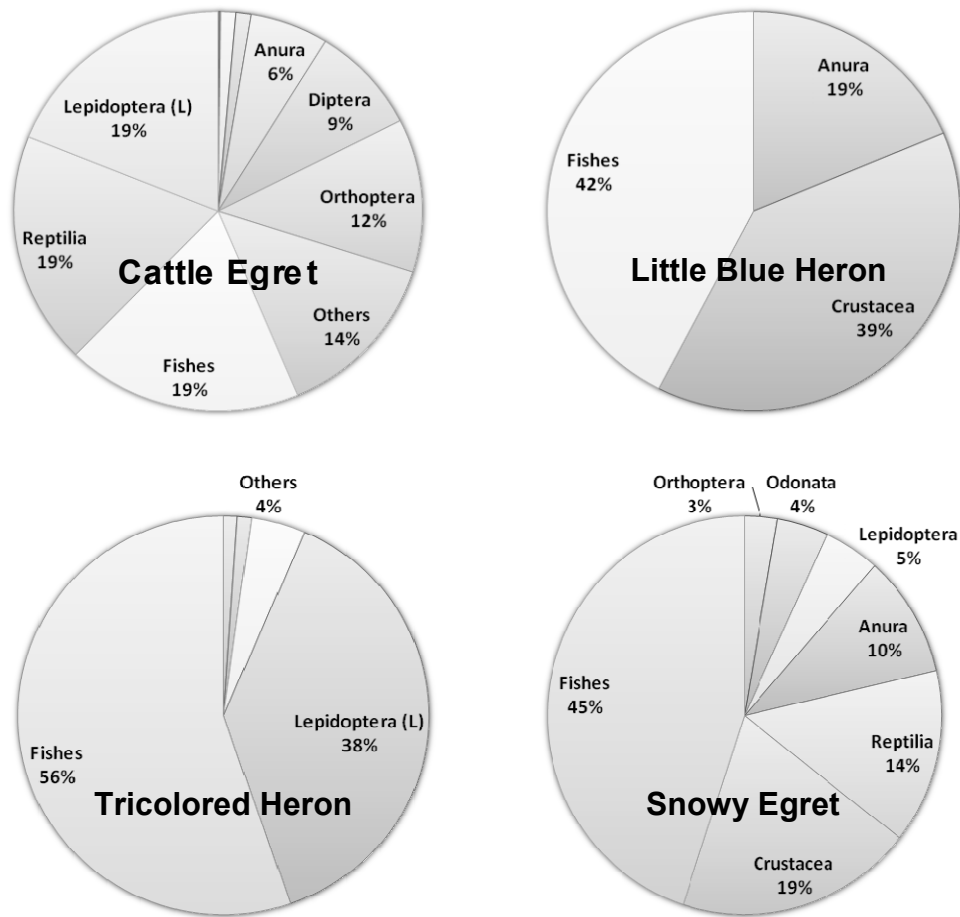


Figure 1. Proportion of biomass represented by each type of prey in the nestling diet of wading birds during the 2005 breeding season in Cayo Norte, Birama Swamp, Cuba.

were preserved in 70% alcohol during transport to the laboratory. For each bolus we counted the number of prey items using the minimum numbers principle (Martinez *et al.* 1992), and we identified each prey up to the taxonomic level of order or class. The frequency and percent composition of prey type relative to the total items identified were determined for each species of wader. The total biomass for each prey type was measured (nearest 0.1 g) with a balance for the 2005 samples. Total body length was measured (nearest 0.01 mm) for some well preserved individuals (except for Little Blue Heron samples) with a Vernier caliper.

RESULTS AND DISCUSSION

Overall we counted 1,887 items of 16 types of prey, with larval and adult stages considered sepa-

rately (Table 1). Terrestrial prey were more frequently represented than aquatic prey due to larger sample sizes from Cattle and Snowy Egrets. Higher numbers were found in the boluses of Cattle Egret nestlings, corresponding to the wider feeding niche described for adults (Jiménez 2000, Torres 2001).

The diet of Cattle Egret comprised mostly insects and other invertebrates (Table 1). Caterpillars (Lepidopteran larvae) and orthopteran insects were the most frequent prey items, with caterpillars accounting for the greatest biomass (18.9%) and highest rank in overall importance (Fig. 1). Similar results were published by Torres *et al.* (1985), who emphasized the importance of caterpillars for adults. Segmented worms (Annelida) appeared in only four samples, but in sufficient numbers to rank second in terms of numerical importance. In this locality the

prey of Cattle Egret had an average length of 20.8 mm and the larger items in the diet were frogs and tadpoles (Anura), caterpillars (Lepidoptera), and lizards (Reptilia) (Table 2).

The diet of Snowy Egret nestlings included 12 types of prey. Fishes (Osteichthyes) were the most frequent prey, comprising 44.8% of the ingested biomass, and were the highest in numerical importance, followed by dragonfly larvae (Odonata) and crayfish (Decapoda). Prey averaged 26 mm in length, with the largest being caterpillars, crayfishes, and fishes. Terrestrial prey, including reptiles and orthopterans, comprised a small fraction of the samples. In the diet of adults, Jimenez (2000) reported crayfishes (Crustacea) as the most frequent prey during the non-reproductive season. With the exception of reptiles, which were uncommon in nestlings, other types of prey were common both in adults and nestlings.

The diet of Tricolored Heron nestlings was dominated by fishes (93.6% of prey), which were present

in all samples. Occasionally we found other prey types, but in very small numerical proportions yet accounting for a significant biomass. Total length of fishes averaged 19.7 mm. These results are similar to those of Frederick (1997) and Acosta *et al.* (1990), who reported that fishes were the dominant prey of adults, and they considered Tricolored as the most specialized of the guild. Only three types of prey were identified in the diet of Tricolored Heron nestlings: anurans, crayfishes and fishes (Table 1). Anurans were more frequent but fishes represent a higher proportion in biomass. All items were also well represented in the diet of adults during the reproductive season (Rodgers and Smith 1995).

We found only two types of vertebrate prey in the diet of Green Heron nestlings. Fishes and anurans occurred with equal frequency but fishes were numerically more important (Table 1). Anurans were the largest prey consumed. Graber *et al.* (1978) analyzed samples from two nestlings and found small fishes and crayfishes. Other types of prey reported

Table 2. Size of prey ingested by wading birds in Cayo Norte, Birama Swamp, Cuba.

Predator	Prey	Total Length (mm)				
		<i>n</i>	\bar{x}	Min	Max	CV
Cattle Egret	Reptilia	4	31.6	14.2	49.8	46.5
	Anura	4	39.6	29.9	50.1	22.1
	Araneae	26	12.0	6.1	22.4	28.5
	Hemiptera	5	17.2	13.3	20.5	20.8
	Lepidoptera (larvae)	66	32.1	14.1	81.4	40.4
	Orthoptera	49	21.3	8.5	38.2	30.5
	Osteichthyes	1	30.4	–	–	–
	All prey combined	53	20.8	9.9	49.8	31.2
Tricolored Heron	Osteichthyes	112	19.7	8.7	49.7	40.6
Snowy Egret	Anura (larvae)	7	9.8	8.1	11.1	9.1
	Coleoptera (larvae)	11	24.5	14.0	50.6	55.6
	Decapoda	23	30.5	11.5	70.7	41.9
	Lepidoptera (larvae)	6	40.2	29.6	71.1	38.3
	Odonata (larvae)	18	17.3	7.9	31.7	35.1
	Osteichthyes	124	25.4	10.1	56.0	35.7
	All prey combined	197	26.3	5.2	56.0	74.4
Little Blue Heron	Osteichthyes	1	54.7	–	–	–
	Anura	1	17.4	–	–	–
Green Heron	Anura	3	38.0	35.8	40.2	8.2
	Osteichthyes	2	27.1	25.6	28.5	7.5
	All prey combined	5	32.5	25.6	40.2	20.4

elsewhere include earthworms, spiders, reptiles, and small mice (Baynard 1912, Bent 1926, Palmer 1962).

Noteworthy was the discovery of several small catfishes of the genus *Claria* among the prey consumed by three species of wading birds. The catfish is an exotic species recently introduced in Cuba, and within a few years it has attracted the attention of conservationists for its negative effect on native faunal communities. Their presence in the diet of these birds provides evidence of its increasing population and the disruption of the food web in a natural wetland.

Because the diet of nestling herons and egrets may be expected to exhibit seasonal, geographical, and even long-term variation, monitoring diet could be an important tool to track ecosystems changes. Coexistence of several wading bird species in a colony results from the partitioning of resources such as nesting sites, nest materials, and food. Because the differential selection of prey could be important for reducing interspecific competition, further studies are needed to better understand the ecology of wading birds.

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