Late Summer Food Habits of Three Heron Species in Northeastern Louisiana

KENNETH R. NIETHAMMER AND MARK S. KAISER

School of Forestry, Fisheries and Wildlife
University of Missouri, Columbia, Missouri 65211, USA

Abstract.—Yellow-crowned Night-Herons (*Nycticorax violaceus*), Little Blue Herons (*Egretta caerulea*), and Green-backed Herons (*Butorides striatus*) collected in northeastern Louisiana from July-September 1980 exhibited different diets. Yellow-crowned Night-Herons fed mostly on crayfish (74% by weight) and Green-backed Herons fed primarily on fish (93% by weight). The diet of Little Blue Herons was diverse, including fish (61%), crustaceans (11%), insects (13%), and arachnids (14%). Yellow-crowned Night-Herons captured larger prey than did either of the smaller herons. Green-backed Herons took larger prey and a greater range of prey sizes than did the larger Little Blue Herons.

Key words: Yellow-crowned Night-Heron, Green-backed Heron, Little Blue Heron, Food habits.

North American herons take a wide variety of prey and use many foraging techniques (Kushlan 1978). Foraging behaviors of herons vary geographically and temporally, in response to many environmental factors (Kushlan 1981); but sympatric species often are assumed to be separated ecologically by selecting different types of prey. This paper describes quantitatively the late summer diets of the Yellow-Crowned Night-Heron (*Nycticorax violaceus*), Little Blue Heron (*Egretta caerulea*), and Green-backed Heron (*Butorides striatus*), and relates differences in their diets to their size.

STUDY AREA AND METHODS

Herons were collected between 15 July and 15 September 1980 in the Mississippi River lowlands of northeastern Louisiana. Collection sites included Lake Providence in East Carroll Parish, Lake Bruin in Tensas Parish, and Lake St. John in Concordia Parish. These sites are oxbow lakes formed by the Mississippi River and are from 8.5 to 18 km long and about 0.8 km wide. Maximum depths are 10.7 m for Lake Providence, 7.6 m for Lake St. John, and 16.8 m for Lake Bruin. Residences occupy about 75% of the shorelines and the remainder is a mixed bald cypress (*Taxodium distichum*)-tupelo (*Nyssa aquatica*) habitat. All of the lakes are surrounded by agricultural lands interspersed with stands of lowland hardwood forest.

Immediately after collection, bird carcasses were weighed, measured, and the esophagus, proventriculus, and gizzard were removed and stored in 70% ethyl alcohol. Later, prey items were removed, identified, and weighed. Wet weights were taken after the prey items were placed in water for 24 hours (Stanford 1973). Sources for prey identification and nomenclature were Pennak (1953), Borror and White (1970), Douglas (1974), and Hobbs (1976).

All prey items for which lengths could be determined were tallied in 5-mm categories. Prey items for which lengths and weights could not be determined were used only in computing frequency of occurrence and percent of diet based on number of prey items. Partially digested fish and crayfish were placed in length categories by comparing size with whole individuals, and weights were determined from published (Swingle 1965) or empirically derived length-weight curves. The contribution of a prey item may be measured, and thus interpreted, in several ways (Ashmole & Ashmole 1967, Siegfried 1971). For this reason we used several measures in this analysis: number, weight, frequency of occurrence, and size-frequency distribution.

RESULTS

Yellow-crowned Night-Heron

Seventy-four prey items were examined from the stomachs of 19 Yellow-crowned Night-Herons; of these 65 could be weighed and measured, yielding a total wet weight of 335.6 g. The diet consisted primarily of

crayfish (Table 1), the most common species being the red swamp crayfish (*Procambarus clarkii*). Fish made up 22% of the diet by weight, but occurred in only two of 19 birds; two largemouth bass (*Micropterus salmoides*) contributed most to the total weight of fish in the diet. Twenty-one percent of the food items were insects; however, insects contributed only 2% of the total diet by weight. Adult hydrophilid and scarab beetles constituted 54% and 31% of the insects taken, respectively. Yellow-crowned Night-Herons took prey that ranged from insects 10 mm long to fish and crayfish over 125 mm long (Fig. 1A). The bulk of the diet in both number and weight consisted of crayfish between 45 and 95 mm long. Mean lengths of prey in each taxon are shown in Table 2.

Little Blue Heron

The stomachs of 17 Little Blue Herons yielded 442 prey items weighing 87.0 g. Individual lengths and weights were obtained for 395 items. Fish made up the largest part of the diet by weight and number of items (Table 1). Insects, spiders, and crustaceans each contributed about 10% of the total diet by weight. A variety of fishes was found; pirate perch (*Aphredoderus sayanus*), threadfin shad (*Dorosoma petenense*), and sunfish (*Lepomis* spp.) contributed 49% of the diet by weight. Little Blue Herons ate insects of six different orders, the majority being adult and larval aquatic beetles (Dytiscidae and Hydrophilidae) and immature dragnonflies (Libellulidae). Although no single order of

TABLE 1. Stomach contents of three heron species collected from northeastern Louisiana, 1980. (A = number of items, B = percentage of total individuals by number, C = percent frequency of herons with that particular prey items in stomach, and D = percentage of total diet by weight.)

Prey	Yellow-crowned Night-Heron				Little Blue Heron				Green-backed Heron			
	A	B	C	D	A	B	C	D	A	B	C	D
FISH	8	11	11	22	184	41	88	61	146	75	93	93
Mosquitofish (*Gambusia affinis*)	—	—	—	—	23	5	18	4	17	9	11	1
Shiners (*Notropis spp.*)	2	3	5	<1	1	<1	6	<1	2	1	7	2
Banded pigmy sunfish (*Elassoma zonatum*)	—	—	—	—	79	18	18	7	—	—	—	—
Sunfish (*Lepomis spp.*)	1	1	5	4	11	3	18	11	11	6	26	35
Pirate perch (*Aphredoderus sayanus*)	—	—	—	—	27	6	18	27	1	1	4	2
Threadfin shad (*Dorosoma petenense*)	—	—	—	—	19	4	29	11	88	45	48	53
Largemouth bass (*Micropterus salmoides*)	2	3	5	15	—	—	—	—	—	—	—	—
Catfish (*Ictalurus spp.*)	1	1	5	3	1	<1	6	1	—	—	—	—
Unidentified fish	2	3	11	*	23	5	53	*	27	14	48	*
CRUSTACEA	49	66	84	74	99	22	24	11	8	4	22	1
Crayfish (Cambarinae)	49	66	84	74	9	2	12	5	4	2	11	1
Prawns (*Palaemonetes kadiakensis*)	—	—	—	—	90	20	18	6	4	2	11	<1
AMPHIBIANS AND REPTILES	1	1	5	2	1	<1	6	2	—	—	—	—
Bullfrog tadpole (*Rana catesbeiana*)	—	—	—	—	1	<1	6	2	—	—	—	—
Stinkpot turtle (*Sternothoerus odoratus*)	1	1	5	2	—	—	—	—	—	—	—	—
INSECTA	16	21	26	2	97	23	100	13	34	18	63	6
Coleoptera	13	17	16	1	53	12	77	5	1	<1	4	<1
Hemiptera	1	1	5	<1	13	3	53	2	7	4	19	1
Odonata	—	—	—	—	27	6	77	3	18	9	48	2
Orthoptera	2	3	11	<1	2	<1	12	2	8	4	26	3
Diptera	—	—	—	—	1	<1	6	<1	—	—	—	—
Neuroptera	—	—	—	—	1	<1	6	<1	—	—	—	—
ARACHNIDA	—	—	—	—	61	14	59	14	5	3	22	1
Water spiders (*Dolomedes sp.*)	—	—	—	—	61	14	59	14	5	3	22	1

*Identified as trace amounts not included in weight calculations.

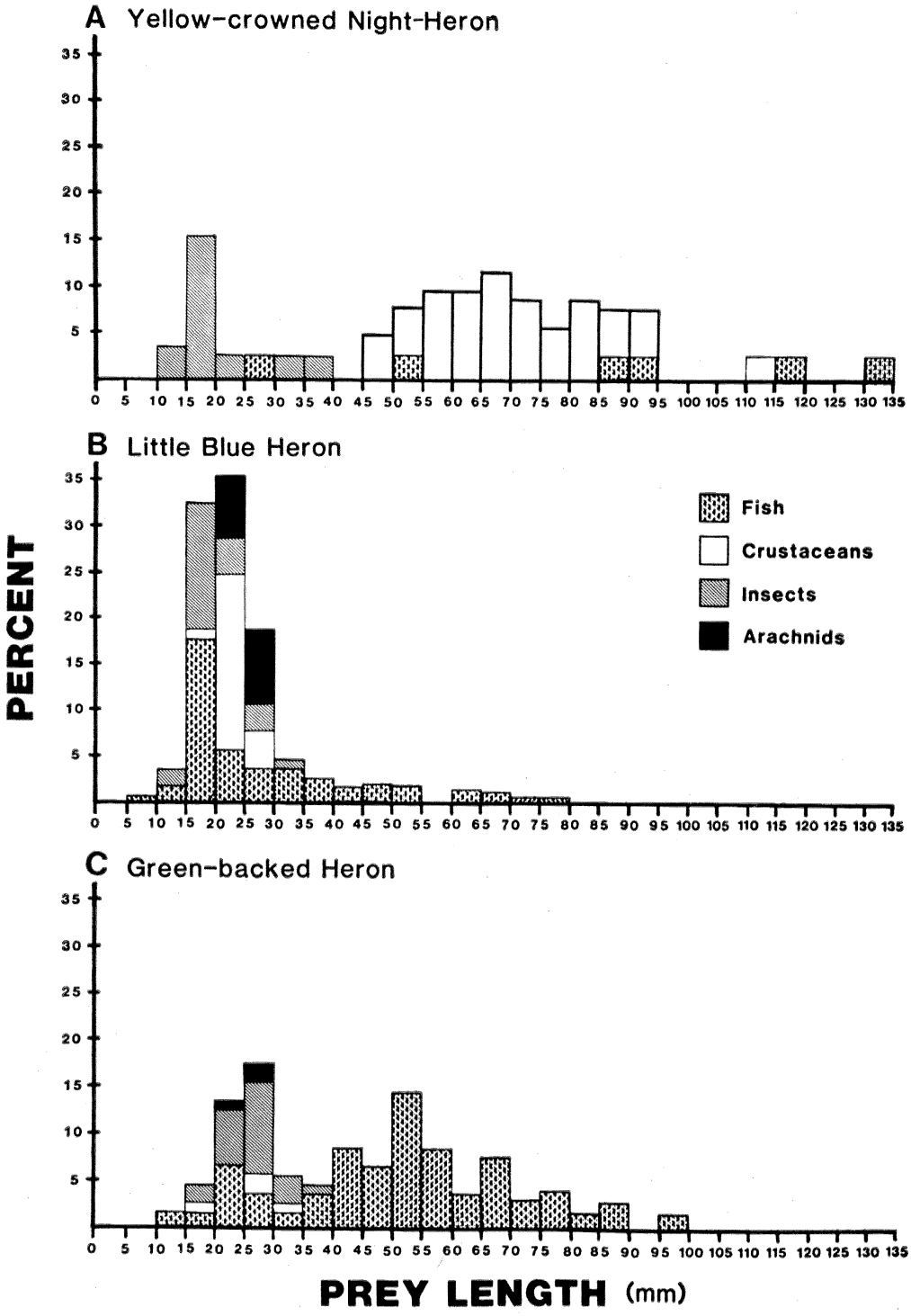

Fig. 1. Frequency distribution of prey length for three heron species collected in late summer in northeastern Louisiana, 1980.

insects made up more than 5% of the total diet by weight, most of the orders had a high frequency of occurrence. One genus of water spider (*Dolomedes*) comprised 14% of the diet by weight and occurred in 59% of the birds. Ninety-one percent of the prey were 35 mm or less in length (Fig. 1B). The remainder consisted of fish, the largest being 78 mm long. Mean lengths of prey in each taxon are shown in Table 2.

Green-backed Heron

The stomachs of 27 Green-backed Herons contained 193 prey items, 143 of which could be weighed and measured. In total, 169.8 g of food were removed from the stomachs. Fish dominated the diet (Table 1). Threadfin shad and sunfish were the two major species taken, comprising 53% and 35% of the total diet by weight, respectively. Insects occurred in 63% of the stomachs but contributed little to the total diet by weight (6%). The major types of insects taken were adult dragonflies (Libellulidae), pygmy grasshoppers (Tetrigidae), and mole crickets (Gryllidae). Green-backed Herons used prey with a wide range of lengths (Fig. 1C). Insects, spiders, crustaceans, and small fish constituted the smaller items, while fish were the only prey items over 40 mm long. Mean lengths of prey in each taxon are shown in Table 2.

Interspecific Comparisons

The three heron species differ in size (Table 3). Yellow-crowned Night-Herons had the largest body weight and tarsus length, but bill length was less than that of Little Blue Herons. Little Blue Herons exceeded Green-backed Herons in all measurements. These interspecific differences were statistically significant (ANOVA and Duncan's Multiple Range Test, $P<0.05$).

Because Yellow-crowned Night-Herons were dependent on crayfish, their diet was significantly different in composition from

TABLE 2. Mean length (mm) of prey items for three heron species collected from northeastern Louisiana.[1]

Prey	Yellow-crowned Night-Heron N	Yellow-crowned Night-Heron Mean ± SD	Little Blue Heron N	Little Blue Heron Mean ± SD	Green-backed Heron N	Green-backed Heron Mean ± SD
Fish	6	85.5 ± 39.3[a]	147	27.2 ± 13.7[b]	101	51.1 ± 17.3[c]
Crustacea	43	71.6 ± 13.7[a]	96	24.3 ± 4.4[b]	6	28.0 ± 5.5[b]
Amphibians and reptiles	1	48.0 —	1	48.0 —	—	— —
Insects	15	20.0 ± 6.8[a]	90	20.0 ± 5.0[a]	31	26.8 ± 4.7[a]
Arachnida	—	— —	61	25.5 ± 2.5[a]	5	26.0 ± 2.7[a]
Totals	65	60.6 ± 28.0[a]	395	24.7 ± 9.5[b]	143	44.0 ± 18.4[c]

[1]ANOVA, horizontal values with identical superscripts are not significantly different at $\alpha = 0.05$.

TABLE 3. Physical characteristices of adult and fledged immature herons collected in northeastern Louisiana.[1]

Species	N	Body Weight (g)	Bill Length (mm)	Tarsus Length (mm)
Yellow-crowned Night-Heron				
adult	4	798 ± 35.0	73 ± 1.7	98 ± 2.2
immature	16	619 ± 109.1	66 ± 4.7	96 ± 4.6
Little Blue Heron				
adult	6	487 ± 64.7	76 ± 1.8	89 ± 1.2
immature	15	360 ± 60.9	72 ± 3.6	87 ± 2.6
Green-backed Heron				
adult	16	241 ± 28.5	63 ± 1.7	50 ± 1.8
immature	14	219 ± 35.4	59 ± 1.9	47 ± 2.9

[1]Values expressed as means ± SD.

those of the other two heron species. Chi-square tests detected differences both in the number of items in each prey category (YCNH vs. LBH, $\chi^2=57.14$, d.f.$=4$, $P<0.05$; YCNH vs. GH, $\chi^2=133.75$, d.f.$=4$, $P<0.05$) and the total weight of items in each prey category (YCNH vs. LBH, $\chi^2=86.03$, d.f.$=4$, $P<0.05$; YCNH vs. GH, $\chi^2=132.89$, d.f.$=4$, $P<0.05$). The foods of the Little Blue and Green-backed Herons differed significantly despite the fact that both species fed heavily on fish. Little Blue Herons had a more diverse diet than did Green-backed Herons, taking fewer fishes and more insects, crustaceans, and arachnids. Both numbers of items ($\chi^2=74.37$, d.f. $=4$, $P<0.05$) and total weight of items in each prey category ($\chi^2=32.38$, d.f.$=4$, $P<0.05$) differed significantly.

Green-backed Herons took significantly larger fish than did Little Blue Herons ($t=11.60$, $P<0.01$, Table 2). The range of fish sizes taken by these two heron species overlapped (Fig. 1), but the size-frequency distribution for Little Blue Herons was skewed to the right, while that for Green-backed Herons approached a symmetrical distribution about its mean. Therefore, differences between the two heron species in median fish size was even greater than the difference in means.

DISCUSSION

The three heron species considered in this study had distinctive diets. Yellow-crowned Night-Herons fed almost exclusively on crustaceans as also reported in previous studies (Wayne 1906, Price 1946, Palmer 1962, Riegner 1982). Little Blue Herons took a wide variety of prey types, but fish were the major food type, as measured by percent of individual prey items (41%). Similar findings were reported by Jenni (1969) in Florida (50%), Recher and Recher (1980) in both New Jersey (89%) and Florida (50%), and Domby and McFarlane (1978) in South Carolina (49%). Crustaceans appeared as the major prey type for Little Blue Herons in studies by Rodgers (1982) in Florida (67%) and Telfair (1981) in Texas (73%), while insects and arachnids were of primary importance in studies by Wetmore (1916) in Puerto Rico (40%) and Baynard (1912) in Florida (92%). All of these studies except Telfair (1981), Baynard (1912), and Recher and Recher (1980, New Jersey only) showed at least two prey types contributing over 25% of the diet by number. In this study, Green-backed Herons fed heavily on fish (75% by number and 93% by weight). Recher and Recher (1980) found that fish comprised 75%, 53%, and 45% of the diets of Green-backed Herons in Florida, New Jersey, and New York, respectively. Observations on Green-backed Heron food habits in Missouri also indicate that Green-backed Herons are primarily fish eaters (Kaiser 1982).

Kushlan (1978) states "A greater total range of prey size and a greater mean and median size of prey should be taken by larger birds." This statement was made, in part, on the basis of Willard's (1977) evidence that Great Blue Herons (*Ardea herodias*) and Great Egrets (*Casmerodius albus*) take larger fish than the smaller Snowy Egret (*Egretta thula*), Little Blue Heron, and Tricolored Heron (*Egretta tricolor*) and is an outgrowth of MacArthur's (1972) general foraging predications. The Yellow-crowned Night-Heron was the largest heron in our study and consumed the largest prey. Little Blue Herons have longer bills, tarsi, and larger bodies than Green-backed Herons, which might allow handling of larger prey. If body size is the major determinant of prey size selection, Little Blue Herons should take larger prey and a greater range of prey sizes than are taken by Green-backed Herons. However, in this study Green-backed Herons took larger fish and a greater range of prey sizes than did Little Blue Herons. Possibly one or both of these species is an exception to the expected pattern, or perhaps body size and prey size are correlated principally between sets of large and small herons rather than along a continuum. Although sizes of available prey may vary geographically and temporally, the size distribution of prey taken by Little Blue Herons in this study is similar to the size distribution of prey recorded in New Jersey (Willard 1977). Eels (150-250 mm) commonly taken by Little Blue Herons in Florida (Recher and Recher 1972) were considerably longer than the prey consumed in Louisiana.

Recher and Recher (1980) conclude

that there are different kinds of herons because there are different kinds of prey, and there are different sizes of herons because there are different sizes of prey. They argue that resource partitioning by herons results from the need to forage efficiently and that this is then "honed" by interspecific competition.

The need to forage efficiently, particularly during periods of low resource availability, is implicity related to the need to be different from other species. Body, bill, and tarsus size are important morphological characteristics in determining the types and sizes of prey that a heron may efficiently exploit. However, for at least the geographic location and time period covered in this study, size considerations did not explain differences in the food habits of Little Blue and Green-backed Herons. Instead, behavioral differences, habitat selection, or prey selection must have been responsible for the observed differences in prey sizes of these two species.

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