Short Communications

Food of the Black-winged Stilt *Himantopus himantopus* in the Alligator Rivers Region, Northern Territory

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Introduction

The Black-winged Stilt *Himantopus himantopus* is a common and widespread bird found on shallow waterbodies throughout much of continental Australia. Despite its abundance, little has been recorded of its dietary habits in Australia beyond the fact that it subsists on molluscs, crustaceans, insects and perhaps diatoms (e.g. Blakers *et al.* 1984; Lane 1987). In particular, there are no records of diet from the tropical portions of the species' range. As part of our investigation of the foods of birds in the Alligator Rivers Region of the monsoonal Northern Territory (Dostine & Morton 1988, 1989, in press), small numbers of stomachs from Black-winged Stilts were examined and we present the results here.

Methods

Twenty-one Black-winged Stilts were collected by shooting on the freshwater Magela floodplain approximately 15 km north of Jabiru, N.T. Individuals were collected during the mid- to late-dry season because this species was virtually absent from the floodplain in the wet season and early-dry season (S.R. Morton, K.G. Brennan and M.D. Armstrong, unpubl. data). Specimens were collected on 10 November 1981 (1 bird), 25-28 July 1983 (10), 21-28 October 1983 (6), and 3 November 1983 (4). Following collection, individuals were measured and weighed, and stomach contents were removed and stored in 70% ethanol until analysis. Food items were sorted in a Petri dish using a Wild M3 binocular microscope and identified as completely as possible. Lengths of whole prey organisms were measured to the nearest 0.1 mm with vernier calipers. Dry weights of food items were calculated using one of the following methods: (i) using regression equations based on body dimensions (e.g. body length, head width); (ii) where variation in body size within prey types was insignificant, or where insufficient material was available for extrapolation, mean dry weights were assigned from measurements of reference specimens; and (iii) dry weights of seeds were calculated from mean values of five samples of 100 seeds for each plant species. The dry weight of some plant material (e.g. *Hydrilla verticillata* turions) was measured directly. Dry weights were obtained in most cases from fresh specimens oven-dried at 70°C for 24 hours. Dry weight of mollusc prey includes weight of shell. Items were weighed using a Cahn 29 Automatic Electrobalance.

Results

Composition of the diet

Aquatic invertebrates comprised 98% and 92% of the dry weight of prey and number of prey of Black-winged Stilts (Table 1). The remainder consisted largely of organisms either derived from aquatic larvae (e.g. adult Zygoptera) or which inhabited emergent macrophytes (e.g. cicadellid Hemiptera). Plant material constituted a minor percentage by dry weight (1.4%) of the organic material identified in stomachs. The food included prey from at least 33 invertebrate families. Mollusca were most important on a dry weight basis, and Mollusca and the insect orders Coleoptera, Trichoptera and Hemiptera were important on a numerical basis. The food was dominated by a small number of prey species. The mollusc species *Physastra* sp. (Planorbidae) and *Gabbia* cf. *smithii* (Bithyniidae) were important on a dry weight basis, and together comprised over 80% of the dry weight of food. Two species, *Gabbia* cf. *smithii* and *Oecetis* sp. (Leptoceridae) made major contributions to the number of prey. Adult and larval aquatic insects accounted for 62% of the number of prey. Fish remains were found in six stomachs, one of which contained a pectoral spine fragment from a small plotosid catfish. There were no clear differences between sexes in the types of food eaten.

Seasonal differences

Mollusca was the dominant taxon in both mid-dry and late-dry season samples, although the species appeared to change from *Gabbia* cf. *smithii* and *Amerianna carinata* in the mid-dry season to *Physastra* sp. and *Lymnaea lessoni* in the late-dry season. There were differences between samples in the representation of Coleoptera and Hemiptera in the diet. The percentage number of prey belonging to Coleoptera was 16.9% in the mid-dry season and 49.8% in the late-dry season; similarly, the percentage of hemipteran prey was 5.1% and 22.7% respectively.

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TABLE 1 Animal material identified in stomach contents of Black-winged Stilts (+ indicates taxa constituted < 0.1% dry weight, - indicates taxa recorded as present but not included in numerical tabulations).

Prey category	Mid-dry Dry wt %	Mid-dry No. %	Late-dry Dry wt %	Late-dry No. %	Total Dry wt %	Total No. %
Mollusca						
F. Bithyniidae						
Gabbia cf. *smithii*	66.2	27.7	0.6	1.4	20.5	16.1
F. Lymnaeidae						
Lymnaea lessoni			1.7	3.7	1.2	1.6
F. Planorbidae						
Amerianna carinata	1.2	5.5	+	0.9	0.4	3.5
Physastra sp.			86.9	16.4	60.6	7.3
Total Mollusca	67.3	33.2	89.4	22.5	82.7	28.5
Odonata						
Anisoptera						
F. Libellulidae larvae	5.1	2.0	0.2	0.2	1.6	1.2
F. Gomphidae larvae	0.9	0.4	0.7	0.2	0.7	0.3
Zygoptera						
F. Coenagrionidae larvae	0.7	1.8	+	0.2	0.2	1.1
Unid. Zygoptera adults	0.5	0.5			0.2	0.3
Total Odonata	7.2	4.8	0.9	0.7	2.8	3.0
Trichoptera						
F. Leptoceridae						
Oecetis sp. larvae	1.2	25.3			0.4	14.2
Triplectides sp. larvae	1.7	10.1			0.5	5.6
Total Trichoptera	2.9	35.4			0.9	19.8
Hemiptera						
F. Belostomatidae	7.4	1.5	2.4	1.9	3.9	1.6
F. Naucoridae	0.7	1.5	1.4	5.6	1.2	3.3
F. Nepidae	1.2	0.5	0.3	0.7	0.6	0.6
F. Notonectidae	0.2	0.2	0.2	2.8	0.2	1.3
F. Corixidae	0.5	0.7	0.3	3.7	0.4	2.0
F. Gerridae	+	0.2			+	0.1
F. Pleidae			+	0.9	+	0.4
F. Cicadellidae	+	0.5	0.3	6.9	0.2	3.4
F. Fulgoridae			+	0.2	+	0.1
Total Hemiptera	10.2	5.1	4.9	22.7	6.5	12.9
Coleoptera						
F. Dytiscidae						
Laccophilinae			+	0.9	+	0.4
Hydroporinae						
Megaporus ruficeps	2.4	4.2	0.4	2.1	1.0	3.3
Others	+	0.2	0.1	4.4	0.1	2.0
Dytiscinae						
Unid. adult	1.4	0.2			0.4	0.1
Larvae	1.9	0.5			0.6	0.3
F. Hydrophilidae						
Hydrobiinae						
Berosus spp. larvae	0.6	1.7	0.7	19.4	0.7	9.5
Helochares sp.	+	0.2	0.4	3.5	0.3	1.6
Others	2.1	4.2	1.0	5.3	1.4	4.7
F. Haliplidae	0.7	3.5	0.2	2.5	0.3	3.1
F. Hydrochidae	+	1.1	+	3.9	+	2.4
F. Spercheidae			+	1.2	+	0.5
F. Curculionidae	0.2	0.7	+	1.6	+	1.1
F. Staphylinidae			+	0.5	+	0.2
F. Scarabaeidae	+	0.2	0.2	3.2	0.2	1.5
Unid. Coleoptera	+	0.2	+	1.2	+	0.6
Total Coleoptera	9.5	16.9	3.5	49.8	5.3	31.4
Diptera larvae and adults	+	0.4	+	0.7	+	0.5
Lepidoptera	0.4	1.7	+	0.2	0.1	1.0
Hymenoptera	0.2	0.9	0.1	1.4	0.1	1.1
Arachnida	0.2	0.2	+	0.9	+	0.5
Crustacea	+	1.1	+	0.7	+	0.9
Polyzoa (statoblasts)	+	-	+	-	+	-
Osteichthyes	2.2	0.2	1.2	0.2	1.5	0.2
Total dry weight (mg)	4363		10013		14376	
Total no. of items	546		432		978	
Sample size	10		11		21	

Forty-two taxa were identified in the mid-dry and 48 in the late-dry season samples. Eleven taxa were restricted to the mid-dry season sample, the most significant of these being trichopteran larvae. Taxa which were found mainly, though not exclusively, in the mid-dry season sample included *Gabbia* cf. *smithii*, coenagrionid larvae (Odonata), *Megaporus ruficeps* (Coleoptera) and Nymphulinae larvae (Lepidoptera). Eighteen taxa were restricted to the late-dry season samples; prominent amongst these were *Physastra* sp. and *Lymnaea lessoni*. Taxa which occurred mainly in the late-dry season included Cicadellidae and Naucoridae (both Hemiptera), and *Helochares* sp. and *Berosus* spp. larvae (both Coleoptera).

Plant material

Material from 15 species of plants was identified in stomachs. Species comprising greater than 1% of the dry weight of plant material are shown in Table 2. Seeds of *Heliotropium indicum* were the most important in both mid-dry and late-dry season samples. *H. indicum* colonises drying areas of the floodplain and produces seeds with a buoyant capsule. Seeds of the aquatic *Caldesia oligococca* were of some importance in samples from both seasons. No other plant species was found in both seasons or contributed greater than 5% of the dry weight of plant material, with the exception of unidentified seed type 1 represented

TABLE 2 Plant material in stomach contents of Black-winged Stilts.

Plant taxa	% Dry weight
F. Alismataceae	
Caldesia oligococca (seeds)	15.7
F. Boraginaceae	
Coldenia procumbens (seeds)	1.9
Heliotropium indicum (seeds)	47.7
F. Hydrocharitaceae	
Blyxa echinosperma (seeds)	2.5
Hydrilla verticillata (turions)	4.4
F. Polygonaceae	
Polygonum attenuatum (seeds)	2.0
Unidentified plant material	
Unid. material	3.4
Unid. seed type 1	16.0
Unid. seed type 2	3.2
Total dry weight (mg)	205
Sample size	21

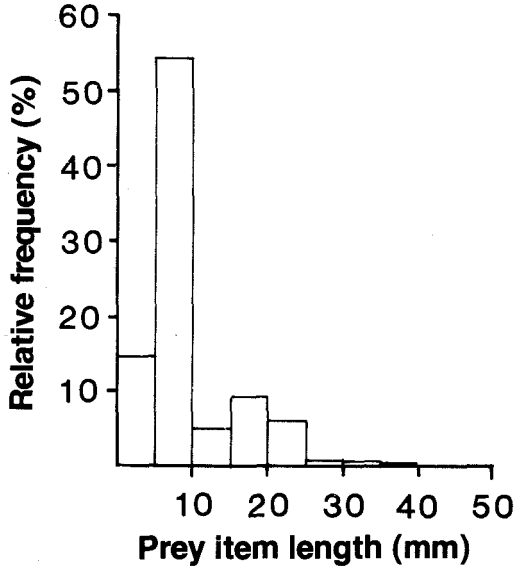

FIGURE 1 Length-frequency distribution of prey items (n = 977) from stomachs of Black-winged Stilts.

by a single large seed.

Seeds of five species of plants (including *H. indicum, C. oligococca, Coldenia procumbens* and *Blyxa echinosperma*) were identified in stomachs from the mid-dry season sample. In addition, stomachs contained small quantities of vegetable material probably derived from the cases of trichopteran larvae. The late-dry season samples contained seeds from ten plant species, including *H. indicum, C. oligococca, Polygonum attenuatum, Nymphoides* sp., *Eleocharis* sp., *Vallisneria* sp., *Najas tenuifolia* and *Ludwigia adscendens.* Stomachs also contained small quantities of *Hydrilla verticillata* turions and oogonia of Characeae.

Prey size

Most animal prey (78.9%) measured less than 10 mm in length (Fig. 1). The median value of prey lengths was 7.0 mm. The few items greater than 30 mm in length were principally dytiscine beetle larvae and small fish.

Body weight and culmen length

There was no significant difference in the body weight of male and female Black-winged Stilts ($P > 0.05$, t-test). Males averaged 164 g (139-208, *s.d.* = 21, n = 12) and females averaged 157 g (138-169, *s.d.* = 11, n = 8). There was also no significant difference in exposed culmen length of male and female Black-winged Stilts ($P > 0.05$, t-test). Males averaged 62 mm (56-65, *s.d.* = 2.7, n = 11), and females averaged 61 mm (58-65, *s.d.* = 2.6, n = 8).

Discussion

Small aquatic invertebrates comprised the main bulk of the food of Black-winged Stilts collected on the Magela floodplain, a result consistent with other studies of this species. In Australia, the Black-winged Stilt has been recorded feeding on brine shrimps (*Artemia*), brine fly larvae (Ephydridae), small molluscs, insects such as dragonflies and water beetles, and diatoms (Cleland 1911; Blakers *et al.* 1984; Lane 1987). In New Zealand, the species is known to eat amphipods, mayflies, chironomid larvae, caddis flies, brine flies, molluscs, oligochaete worms, crabs and small fish (Pierce 1985, 1986). North American birds eat brine shrimps, fish, brine flies and a variety of other insects (Wetmore 1925; Hamilton 1975). Records of taxa eaten by European and North African birds indicate a wide range of prey, though chiefly insect adults and larvae (Cramp & Simmons 1983).

Although these previous records give an impression of a diverse assortment of food sources, few indicate the degree of dietary diversity revealed by our study. We found more than 50 taxa of animals from over 30 families, a considerable number in view of the fact that we sampled only 21 Black-winged Stilts from a relatively small area of one freshwater floodplain. Wetmore (1925) observed similar dietary diversity in a sample of 80 stilts from several localities in North America. One reason for such a wide range of prey could be the diversity and flexibility of feeding behaviour exhibited by Black-winged Stilts. Nine

methods of feeding have been identified, the most common of which are pecking, underwater plunging and snatching at flying insects (Hamilton 1975; Pierce 1985, 1986). Thus, Black-winged Stilts may obtain a wide range of prey at any one feeding site by changing their feeding style. A more important factor resulting in the observed variety of prey in this study could simply be that they seek small items of food (see Fig. 1), and that tropical freshwaters like the Magela floodplain provide a highly diverse fauna of such prey.

Despite the large number of prey types, relatively few species of aquatic snails, trichopteran larvae, and adult and larval beetles dominated the diet. This dominance is presumably real but some caution is necessary because differential digestion may lead to bias in the analysis of stomach contents of waterbirds (Swanson & Bartonek 1970; Briggs *et al.* 1985). Soft-bodied invertebrates can be under-estimated relative to harder invertebrates and seeds; consequently, the significance of some prey such as molluscs may be over-emphasised in our results.

The observed differences between samples in the food of Black-winged Stilts may result from a number of factors including seasonal variation in the composition of invertebrate prey (see Marchant 1982), differences in available foraging habitat as the floodplain dries (Morton & Brennan, unpubl. data) and changes in the selection of prey (Pierce 1985, 1986). Similarly, we noted substantial differences between samples in an analysis of the food of Whiskered Terns *Chlidonias hybrida* in the same geographical area as the present study (Dostine & Morton in press). Although Hamilton (1975) observed sexual dimorphism in morphology and feeding behaviour in Black-winged Stilts, our data revealed no indication of overall size differences between sexes nor obvious sexual disparity in diet.

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References

Blakers, M., Davies S.J.J.F. & Reilly, P.N. (1984). *The Atlas of Australian Birds.* RAOU and Melbourne University Press, Melbourne.

Briggs, S.V., Maher, M.T. & Palmer, R.P. (1985). Bias in food habits of Australian waterfowl. *Aust. Wildl. Res.* **12**, 507-514.

Cleland, J.B. (1911). Examination of contents of stomachs and crops of Australian birds. *Emu* **11**, 79-95.

Cramp, S. & Simmons, K.E.L. (eds) (1983). *Handbook of the Birds of Europe, the Middle East and North Africa: The Birds of the Western Palaearctic* Vol. 3. Oxford University Press, Oxford.

Dostine, P.L. & Morton, S.R. (1988). Notes on the food and feeding habits of cormorants on a tropical floodplain. *Emu* **88**, 263-266.

Dostine, P.L. & Morton, S.R. (1989). Food of the Darter *Anhinga melanogaster* in the Alligator Rivers Region, Northern Territory. *Emu* **89**, 53-54.

Dostine, P.L. & Morton, S.R. (in press). Feeding ecology of the Whiskered Tern, *Chlidonias hybrida*, in the Alligator Rivers Region, Northern Territory. *Aust. Wildl. Res.*

Hamilton, R.B. (1975). Comparative behaviour of the American Avocet and the Black-necked Stilt (Recurvirostridae). *Ornithol. Monogr.* **17**, 1-98.

Lane, B.A. (1987). *Shorebirds in Australia.* Nelson, Melbourne.

Marchant, R. (1982). Seasonal variation in the macroinvertebrate fauna of billabongs along Magela Creek, Northern Territory. *Aust. J. Mar. Freshw. Res.* **33**, 329-342.

Pierce, R.J. (1985). Feeding methods of stilts (*Himantopus* spp.) *N.Z. J. Zool.* **12**, 467-472.

Pierce, R.J. (1986). Foraging responses of stilts (*Himantopus* spp.: Aves) to changes in behaviour and abundance of their riverbed prey. *N.Z. J. Mar. Freshw. Res.* **20**, 17-28.

Swanson, G.A. & Bartonek, J.C. (1970). Bias associated with food analysis in gizzards of Blue-winged Teal. *J. Wildl. Mgmt.* **34**, 739-746.

Wetmore, A. (1925). Food of American phalaropes, avocets and stilts. *U.S. Dept. Agric. Bull.* **1359**, 1-20.